An empirical investigation of the impact of human capital efficiency on the financial and market performance of South African listed companies

by

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ABSTRACT

Human capital efficiency, as measured by Value-Added Human Capital (VAHU), refers to an employee's ability to create value-added for his employer. As a key resource which is not captured by conventional accounting, human capital and its value-creating ability may contribute to the premium to book value at which many companies trade. This study, therefore, sought to investigate trends in the divergence between book value and market value in South Africa, by analysing the median market-to-book ratios of companies listed on the Johannesburg Stock Exchange over time. The primary research objectives, however, were to empirically confirm whether corporate financial and market performance in South Africa can be explained as a contemporaneous and future outcome of human capital efficiency, and whether human capital efficiency is improving. In a largely industrialised emerging market, such as South Africa, there is some concern that companies which concentrate on efficient and productive management of their tangible assets may neglect the effective skills development and training of their human capital assets.

Time-series cross-sectional multiple regressions were used to analyse the intra-industry and inter-industry relationships between VAHU and financial performance (as measured by return on assets, revenue growth and headline earnings per share) and market performance (as measured by market-to-book ratios and total share return) in companies listed on the Johannesburg Stock Exchange. Of the financial year-ends falling in the period 31 December 2001 to 30 June 2011, 1765 company years were covered, relating to 390 companies listed on the Main Board and ALT-X. Company size, leverage, industry and return on equity were held as control factors. The same financial data was used to assess the median growth in VAHU over the period under review.

The market value-book value gap of listed companies in South Africa was found to have increased from 2001 to 2011, while human capital efficiency declined. Human capital efficiency has almost no effect on current or future market performance in South Africa. Higher human capital efficiency has a positive effect on current returns generated by any asset – tangible or intangible. Higher headline

earnings per share is concurrently associated with higher human capital efficiency in almost every industry. Higher revenue growth is contemporaneously associated with higher human capital efficiency in all industries, except those which are consumer-driven. In consumer-driven industries, human capital efficiency is not a driver for revenue growth, but is still associated with higher profitability. The longer-term effect of human capital efficiency on corporate performance in South Africa is more unclear than its immediate effect.

The findings of the study highlight the commercial implications of the degree of industrial action and poor basic education in South Africa – a working population that is poorly educated, with the paradox of wages that are low in relation to the cost of living, yet which are becoming too high in relation to the level of output the workers produce. The results pose a compelling argument for improving the quality of education in South Africa, as well as for employer-driven skills development and employee training.

OPSOMMING

Menslike kapitaaldoeltreffendheid, soos gemeet deur Toegevoegde Waarde Menslike Kapitaal (TWMK), verwys na 'n werknemer se vermoë om toegevoegde waarde vir sy werkgewer te skep. As 'n sleutel-hulpbron wat nie deur konvensionele rekeningkunde vasgelê word nie, dra menslike kapitaal en die waardeskeppingsvermoë daarvan, dalk by tot die premie op boekwaarde waarteen baie maatskappye verhandel. Hierdie studie het dus nagestreef om tendense in die afwyking tussen boekwaarde en markwaarde in Suid-Afrika te ondersoek, deur die mediaan mark-tot-boekverhoudings van maatskappye genoteer op die Johannesburgse Effektebeurs met tydverloop, te ontleed. Die hoof-navorsingsdoelwitte was egter om empiries te bevestig of korporatiewe finansiële en markprestasie in Suid-Afrika beskryf kan word as 'n gelyktydige en toekomstige gevolg van menslike kapitaaldoeltreffendheid en of daardie menslike kapitaaldoeltreffendheid verbeter. In 'n grootliks geïndustrialiseerde ontwikkelende mark, soos Suid-Afrika, is daar 'n mate van kommer dat die maatskappye wat konsentreer op die doeltreffende en produktiewe bestuur van hul tasbare bates, die doelmatige ontwikkeling van vaardighede en opleiding van hul menslike kapitaalbates mag verwaarloos.

Tydreekse dwarsdeursnee meervoudige regressies is gebruik om die intra-industrie en inter-industrie verhoudings tussen TWMK en finansiële prestasie (soos gemeet deur die opbrengs op bates, inkomstegroei en wesensverdienste per aandeel) en markprestasie (soos gemeet deur mark-tot-boekverhoudings en die totale opbrengs op aandele) in maatskappye wat op die Johannesburgse Effektebeurs genoteer is, te ontleed. Van die finansiële jaareindes in die tydperk 31 Desember 2001 tot 30 Junie 2011, is 1765 maatskappyjare gedek, rakende 390 maatskappye wat op die Hoofbord en Alt-X genoteer is. Die grootte van die maatskappye, hefboomfinansiering, industrie en opbrengs op ekwiteit dien as kontrolefaktore. Dieselfde finansiële data is gebruik om die mediaangroei in TWMK oor die tydperk onder oorsig te bepaal.

Dit is bevind dat die markwaarde-boekwaardegaping van genoteerde maatskappye in Suid-Afrika vanaf 2001 tot 2011 toegeneem het, terwyl menslike kapitaaldoeltreffendheid gedaal het. Menslike

kapitaaldoeltreffendheid het byna geen effek op die huidige of toekomstige markprestasies in Suid-Afrika nie. Hoër menslike kapitaaldoeltreffendheid het 'n positiewe uitwerking op die huidige opbrengste wat gegenereer word deur enige bate – tasbaar of ontasbaar. Hoër wesensverdienste per aandeel is samelopend met hoër menslike kapitaaldoeltreffendheid in byna elke industrie. Hoër groei in inkomste is gelyktydig geassosieer met hoër menslike kapitaaldoeltreffendheid in alle industrieë, behalwe dié wat verbruiker-gedrewe is. In verbruiker-gedrewe industrieë, is menslike kapitaaldoeltreffendheid nie 'n aandrywer van inkomstegroei nie, maar is nog steeds gelyktydig geassosieer met hoër winsgewendheid. Die langer-termyn uitwerking van menslike kapitaaldoeltreffendheid op korporatiewe prestasie in Suid-Afrika, is meer onduidelik as sy onmiddellike effek.

Die bevindinge van die studie beklemtoon die kommersiële implikasies van die omvang van industriële aksie en swak basiese onderwys in Suid-Afrika – 'n werkende bevolking met swak opleiding, tesame met die paradoks van lone wat laag in vergelyking met bestaankoste is, maar wat te hoog styg met betrekking tot die vlak van uitset wat die werkers produseer. Die resultate bied 'n oortuigende argument vir die verbetering van die gehalte van onderwys in Suid-Afrika, sowel as vir werkgewer-gedrewe ontwikkeling van vaardighede en werknemersopleiding.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

9/11	Terrorist attacks on the United States on 11 September 2001
BFA	McGregor Bureau of Financial Analysis
CAGV	Compound annual growth rate of VAHU
CSC	Centre for Statistical Consultation
DR	Debt ratio
EBITDA	Earnings before interest paid, tax, depreciation and amortisation
EPS	Earnings per share
EVHC	Excess value of human capital
GAAP	Generally accepted accounting practice
GCI	Global Competitiveness Index
GDP	Gross domestic product
GR	Revenue growth
HEPS	Headline earnings per share
IFRS	International Financial Reporting Standards
IND	Industry
JSE	Johannesburg Stock Exchange
LMC	Natural log of total market capitalisation
M/B	Market-to-book ratio
MGV	Median growth in human capital efficiency
NUM	National Union of Mineworkers
NUMSA	National Union of Metalworkers of South Africa
OBE	Outcomes-based education
ROA	Return on assets
ROE	Return on equity
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SATAWU	South African Transport and Allied Workers Union
TSR	Total share return
UK	United Kingdom
US	United States of America
VAHU	Value-Added Human Capital
VAIC™	Value-Added Intellectual Coefficient
VT	Human capital training value

CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION

In the resource-based theory of the firm, competitive strength is derived from the optimal utilisation of all the assets of the firm (Wernerfelt, 1984:178) - both tangible, physical assets and intangible assets. Expressed in terms of this resource-based theory, the emergence of the knowledge economy was prompted by a shift in strategy focus over time from tangible resources to intangible resources. The emphasis in many industries has moved from managing physical assets to produce goods as the main driver of economic wealth, to seeing knowledge-based intangible assets as the primary source of competitive advantage (Chen, Cheng & Hwang, 2005:174; Lev & Radhakrishnan, 2003:6; Luthy, 1998).

Unfortunately, the value of these knowledge-based intangible assets is often not captured by traditional financial accounting. Human capital is an excellent example. IAS 38 Intangible Assets (2010:941) defines an intangible asset as an identifiable, non-monetary asset without physical substance. However, paragraph 15 of the accounting standard explicitly excludes skilled and trained staff from intangible assets. The entities employing such staff cannot recognise them as assets in the balance sheet as they do not have sufficient control over the future economic benefits the staff are expected to generate. Although not disclosed as an asset, human capital clearly has value as it contributes to a company's operational capabilities. Human capital may, therefore, be viewed as a key resource in the creation of company value as it enables a company to increase its earnings potential.

According to Lev (2001:9), the average market value of the companies on the Standard & Poor 500 in the United States of America (US) grew from close to book value in the mid-1970's to more than seven times book value in the early 2000's. It is important to note the distinction between the individual share prices of the listed companies and the average share price of the *group* of listed companies. The former could be volatile and fluctuate daily, while the latter could remain fairly

stable over time. Although the phenomenon of market value-book value divergence has been the subject of many studies internationally (Barth, Beaver & Landsman, 2001; Frankel & Lee, 1998:316; Lakonishok, Shleifer & Vishny, 1994:1574), limited research has been performed locally to investigate whether South African companies experience the same growing disconnect between their book values and market values.

It is now widely accepted that differences between a company's market value and its book value are *inter alia* due to uncapitalised, intangible, intellectual capital assets (Brennan & Connell, 2000:206; Edvinsson & Malone, 1997:12; Lev & Radhakrishnan, 2003:31; Mavridis, 2004:93). Three common categories within intellectual capital have emerged: structural capital, relational capital (sometimes called customer capital) and human capital (Bontis, 1998:66; Bornemann, Knapp, Schneider & Sizl, 1999:8; Edvinsson & Malone, 1997:34; Stewart, 1998:75). Structural capital may be described briefly as the organisational structure, processes and culture within a company and the results of its innovation; while relational capital constitutes those external relationships which hold competitive advantage (*e.g.* with customers and suppliers).

Therefore, in addition to being a key resource in the creation of company value, human capital can also be considered to contribute to the market value-book value gap.

1.2. DEFINING HUMAN CAPITAL

Despite its importance in the business context, there is no clear consensus on the definition of human capital. The Meritum Project, a consortium of European researchers on intellectual capital, defines human capital as

> the knowledge that employees take with them when they leave the firm. It includes the knowledge, skills, experiences and abilities of people. Some of this knowledge is unique to the individual, some may be generic. Examples are innovation capacity, creativity, know-how and previous experience, teamwork capacity, employee flexibility, tolerance for ambiguity, motivation, satisfaction, learning capacity, loyalty, formal training and education (Project Meritum, 2002:13).

According to Bozbura (2004:358), human capital is composed of "a mixture of employees' occupational or general knowledge accumulation, the leadership abilities, risk-taking and problem-solving capabilities". Human capital has also been described as

> the collection of intangible resources that are implanted in the members of the organization. These resources can be of three main types: competencies (including skills and know-how), attitude (motivation, leadership qualities of the top management) and intellectual agility (the ability of organizational members to be 'quick on their intellectual feet': innovation and entrepreneurship, the ability to adapt and cross-fertilize, *etc*.) (Bontis, Dragonetti, Jacobsen & Roos, 1999:397).

For the purposes of this study, a combination of the characteristics identified by Tseng and Goo (2005:194) and Pantzalis and Park (2009:1610) will be used: Human capital comprises the physical and intellectual capabilities acquired through education and training that enable an employee to perform tasks effectively and productively. It is a direct consequence of employee knowledge, attitude and skill.

1.3. THE RESEARCH PROBLEM

1.3.1. Divergence between book value and market value of companies

The apparent inadequacy of traditional financial accounting with respect to knowledge-based intangible assets (and consequently, human capital) is considered to be one of the contributing factors to the increasing divergence between the market value and book value of companies (Lev, 2001:8; Lev & Radhakrishnan, 2003:31; Lev & Zarowin, 1999:383).

Another root cause may be the contrast between the “backward-looking” nature of financial statements and the “forward-looking” nature of company market value. Financial statements which comply with International Financial Reporting Standards (IFRS) are prepared primarily on the historic cost basis (with the fair value model being applied in certain instances). After initial recognition in the accounting records, assets and liabilities either continue to be carried at that amount or are written down over time. On the other hand, the market value of ordinary shares is influenced by past performance, *current* market conditions (*e.g.* inflation and interest rates) and investors' expectations of *future* company prospects and market conditions.

As previously discussed, limited research has been performed locally to empirically confirm whether South Africa is also subject to the growing divergence between market value and book value of companies identified in foreign share markets.

1.3.2. The impact of human capital on corporate performance

South Africa is largely an industrialised country – over 45% of the companies listed on the Johannesburg Stock Exchange (JSE) fall in the industrials and basic materials industry categories. The rest are spread fairly evenly across the financial, consumer goods and consumer services sectors. There is some concern that in this type of industrialised business environment, the emphasis placed on effective use of physical assets to produce goods and services may come at the cost of the development of human capital (Firer & Williams, 2003:357). This implies that

companies which concentrate on the efficient and productive management of their tangible assets may tend to neglect the effective management of their human capital assets.

Globalisation and the boom of the knowledge economy will eventually compel South African businesses to develop their knowledge-based intangible assets (including human capital) in order to be competitive in the long run – locally and internationally. While training programmes and secondary or tertiary education opportunities offered to employees will accomplish this commercial objective, these endeavours will also serve the greater aspirations for socio-economic growth within the country itself. Section 29 of the South African constitution enshrines the right to basic and further education for all (Republic of South Africa, 1996). However, due to the trade-off between tangible and human capital assets, the current business culture in South Africa tends to view further expenditure on human capital development as an opportunity cost, because those funds could have been spent on physical assets which produce goods and services.

Human capital and its development are difficult to measure and quantify on a large scale. In this study, human capital is measured by the efficiency with which it creates value for a company. This value-creating efficiency (hereafter known as “human capital efficiency”) should not be confused with the physical efficiency of a workforce. The physical efficiency of an employee refers to his ability to produce his required output to the highest quality, in the shortest possible time, using the least amount of resources. While physical efficiency may not necessarily lead to value creation, it may be argued that value creation is more easily achieved through appropriately trained and skilled individuals who perform their jobs effectively. This argument is supported by Judson (2002:229) who analysed data on educational spending, enrolment and educational attainment to confirm a positive relationship between economic growth and human capital accumulation.

If empirical research can strengthen the concept that human capital efficiency is important in the South African business arena, this research will hopefully change the perception of education, training and skills development in South Africa to that of a necessary investment rather than a grudge expense.

1.4. THE OBJECTIVES OF THE RESEARCH

1.4.1. Investigation of the divergence between book value and market value of companies

As discussed in sub-section 1.3.1., human capital assets are thought to be incorporated in the market valuation of companies, yet are not recognised in their net book value. Before examining the effect of human capital efficiency on the market value-book value gap, this study will first seek to empirically confirm whether there *is* a difference between the book value and market value of companies listed on the JSE in South Africa and whether this difference has been increasing over time.

The first research hypothesis therefore posits that:

H1: The market value-book value gap of South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

1.4.2. Investigation of the human capital impact on corporate performance

As very few of the impact studies performed in South Africa focused specifically on human capital, there is little empirical evidence tracking the progress of human capital efficiency in South Africa over any period of time. The second objective of this study is to empirically confirm whether human capital efficiency in South Africa is improving. The second research hypothesis therefore posits that:

H2: Human capital efficiency in South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

The third and most important objective of this research study, is to empirically confirm whether the financial and market performance of listed companies in South Africa can be partly explained as an outcome of human capital efficiency.

Feng and Lev (2001:23) suggested that contemporaneous correlation and regression are only indicative of the *relevance* of the independent variable to the dependent variable. To investigate the true explanatory power of the independent variable, they suggest the use of a "multi-period predictive test" – implying that correlation and regression analyses should be performed using future values of the dependent variable. Lev and Radhakrishnan's (2003:24) findings also suggest that the market effect of organisational capital is expected to be felt for several years (*i.e.* up to ten years later). The use of future values of financial and market performance in this study is further supported by the inherent time lag between the investment made in human capital and experiencing benefits derived from it (Joia, 2000:82).

Therefore, to fully meet the third research objective, the following two hypotheses will be tested:

H3: Higher human capital efficiency is associated with higher financial and market performance contemporaneously, in South African listed companies for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

H4: Higher human capital efficiency is associated with higher financial and market performance in the future, in South African listed companies for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

1.5. THE SIGNIFICANCE OF THE STUDY

According to the Global Competitiveness Reports issued by the World Economic Forum annually, South Africa's Global Competitiveness Index (GCI) ranking fell from 36th to 54th in the world since 2006 (GCR 2007-2008, 2007:10; GCR 2008-2009, 2008:10; GCR 2009-2010, 2009:13; GCR 2010-2011, 2010:15). It is no coincidence that there was a corresponding decline in GCI scores in the areas of Higher Education and Training, as well as Labour Market Efficiency. Human capital is important for the improvement and development of business products and processes as it drives innovation and renewal (Stewart, 1998:76; Sullivan, 2000:9). If greater effort is focused on education and skills development by the South African government and businesses, the resultant

workforce will be better equipped to drive economic growth in South Africa in this era of global competition.

It is hoped that providing further empirical evidence of the positive impact of human capital efficiency on companies in South Africa and consequently the South African economy, will spark a change in the collective mindset towards investments in education, training and skills development by the South African government, businesses and individuals.

Various methodological shortcomings and limitations were identified during the literature review of prior research studies about human capital and its relationship with corporate performance (discussed in Chapter 2). This study will also be of value to human capital research in South Africa because the research methodology was specifically designed to overcome these shortcomings:

- It focuses solely on human capital, rather than the broader spectrum of intellectual capital components. A limited number of intellectual capital impact studies have been performed in South Africa and amongst those, even fewer concentrate on human capital.
- Rather than focusing only on knowledge-based industries, this is a cross-sectional study covering all industries of the JSE.
- Time-series analysis was used over a period of ten and a half years and not only single period data, as had been the trend in prior research. An investigation across time may give stronger evidence of the true explanatory power of human capital efficiency.
- The future impact of human capital efficiency on corporate performance was investigated, in addition to the contemporaneous impact.
- Potential statistical challenges highlighted by previous researchers were explicitly addressed in this study.
- Lastly, the research design of the study remedied the problem posed by potential delays in the distribution of financial statements after year-end.

1.6. OUTLINE OF THE THESIS

The structure of the remainder of the study is illustrated in the chapter outline below.

Chapter 2: Literature review

The literature review begins with an overview of prior studies on the divergence between the accounting book value and market valuations of companies (locally and internationally). The primary focus of the chapter, however, is providing summaries of the existing research on the relationship between human capital and corporate performance. Particular emphasis is placed on literature relevant to the research problem in South Africa and other emerging economies. Where prior research is relevant to a topic discussed in another chapter, the literature may be outlined within that specific chapter instead.

Chapter 3: Research design and methodology

This chapter commences with the restatement of the research hypotheses presented in Chapter 1. The research methodology followed in the study to investigate these hypotheses is then described and motivated. This includes the reasoning behind the selection of variables and proxies, as well as a brief description of the statistical techniques utilised in the study. Improvements which were made to the research methodology, based on the limitations and recommendations identified in prior studies, are also discussed.

Chapter 4: Developments in the market value-book value gap and in human capital efficiency

This chapter presents the statistical results of, and discusses the findings of the empirical study on the market value-book value gap, referred to in H1 and described in sub-section 1.4.1., and the study on the growth in human capital efficiency, referred to in H2 and described in sub-section 1.4.2.

Chapter 5: The impact of human capital efficiency on corporate performance

Chapter 5 presents the statistical results of, and discusses the findings of the empirical study on the impact of human capital efficiency on financial and market performance as described, referred to in H3 and H4 and described in sub-section 1.4.2. First, the descriptive statistics of the dependent and independent variables are presented. This is followed by the regression results for each regression performed. These results are then analysed within each industry (intra-industry analysis) and between the various industries (inter-industry analysis), and interpreted in the context of the conclusions reached in Chapter 4 and the literature reviewed in Chapter 2.

Chapter 6: Conclusion and recommendations

The results of the study, initially presented in Chapters 4 and 5, are drawn together to formulate conclusions on the impact of human capital efficiency on financial and market performance of listed companies in South Africa. Limitations and shortcomings identified in the study are discussed, as well as gaps and uncertainties that require further clarification. The chapter concludes with recommendations posed for further research.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

The first section of the literature review briefly establishes the prevalence of a market value-book value gap internationally and discusses potential causes for such a gap. The second section of the literature review deals specifically with measures of human capital and studies on the impact of human capital on the financial and market performance of companies, including those which treat human capital as a sub-category of intellectual capital.

2.2. BOOK VALUE *VERSUS* MARKET VALUE OF COMPANIES

Lev and Zarowin (1999:383) documented a weakening association between share market values and key accounting variables in earnings, cash flow and book value in the US from 1978 to 1996 – they identified a steady decline in the usefulness of financial information to investors. Similarly, Brown, Lo and Lys (1999:1047) also found a weakening of the relationship between equity values and accounting earnings and book value from 1958 to 1996 in the US after controlling for scale effects. Although the market-to-book ratio (M/B) was used as a variable in numerous South African studies, it appears that no local research has been performed to monitor the movement in M/B itself over time in the South African equity market.

Countless studies have been performed to explain what drives the market value of a company and many of these studies also raise potential reasons for the market value-book value gap. Barth *et al*. (2001:95) reviewed various value relevance studies which examine the association between accounting amounts and equity market values. They identified measurement errors in accounting amounts, the pricing of business risk in market value, and the effect of accounting estimates on market returns as three primary explanations for the differences between market and book values of companies. The inconsistencies in capitalising and the exclusion of many intangible assets (including human capital) from the balance sheet are two examples of measurement errors in

accounting amounts. Lev and Radhakrishnan (2003:25) confirmed that organisational capital (which may also be defined as structural capital) adds further explanatory power for equity values, than just book value and growth potential. Therefore, intangible assets such as human capital and structural capital also contribute to the market value-book value gap.

2.3. MEASURING HUMAN CAPITAL

Research on human capital in the business context is often connected to research on intellectual assets. Numerous attempts were made to measure intellectual capital, with varying degrees of success. In their overviews of relevant literature surrounding intellectual capital, Bontis (2001:44-54), De Beer and Barnes (2003:18), Firer (2005:6-8) and Petty and Guthrie (2000:159) provide non-exhaustive lists of financial and non-financial intellectual capital models and indicators that have been developed – for example: Tobin's q, Skandia Navigator, Intangible Asset Monitor, and Calculated Intangible Value. Each measure of intellectual capital poses its own shortcomings and no single measure of intellectual capital has been confirmed to be the most superior. Sullivan (2000:95), however, proposed that using indicators for the individual components of intellectual capital (structural, relational and human capital), would avoid the problems experienced when attempting to measure intellectual capital directly as a whole. In accordance with this view, a number of indicators have been developed to measure the value of human capital separately.

Excess value of human capital (EVHC) is a ratio of the natural logarithm of the market value of equity per employee, to the natural logarithm of the industry median market value of equity per employee (Pantzalis & Park, 2009:1611). Consistency between companies in the understanding of what constitutes an ‘employee’ is crucial to the accurate calculation and comparison of this indicator. Pantzalis and Park (2009:1621) concluded that instead of being interpreted as a measure of human capital, EVHC should rather be interpreted as a measure of the market's inability to assign a value to human capital or as a measure of the business risk associated with excessive reliance on human capital.

Lajili and Zeghal (2006:179) formulated human capital training value (VT) as a measure of a company's return on investment in training its human capital. It is calculated as the difference between the marginal product of labour and average labour cost per employee. The marginal product of labour is a measure of the incremental productivity of each additional employee added to the workforce. Deriving VT is a complicated calculation incorporating direct training costs, the opportunity costs relating to the provision of training, and the assumption of a market discount rate. In addition, a serious shortcoming is the assumption that staff training is only given in the first time period - *i.e.* the year in which the employee was initially appointed (Lajili & Zeghal, 2006:179). It therefore does not take the time effect and ongoing nature of on-the-job training into account.

Bontis and Fitz-enz (2002:229) designed four human capital constructs measuring effectiveness, valuation, investment and depletion, using empirical data obtained from company surveys. Their human capital effectiveness construct encompassed metrics for revenue, expenses, income and return on investment. The human capital valuation construct had metrics for compensation revenue, compensation expense, compensation, executive compensation and supervisor compensation. The human capital investment construct measured development rate, training rate and training cost. The human capital depletion construct involved voluntary turnover, involuntary turnover and total separation rate. The financial and human resource-related data used to calculate these metrics was volunteered by the 25 companies that participated in the survey and is not freely available. Consequently, these indicators lack ease of replication. In addition, as the survey participants were all financial services companies, certain metrics used in the human capital constructs may not be universally applicable to non-financial businesses.

Bontis and Fitz-enz's (2002) human capital constructs, EVHC, and VT are impractical and costly to implement on a large scale in South Africa due to lack of public access to the necessary company information. For example, neither training costs, remuneration by staff seniority level, nor number of employees are required to be separately disclosed in company financial statements prepared according to IFRS, or in terms of the Companies Act, No. 71 of 2008 (Republic of South Africa, 2008a). Even in those instances where the number of employees *is* disclosed in the financial

statements, the presentation may be inconsistent between companies – for example, showing the average staff count for the year *versus* the year-end staff count or showing only full-time employees *versus* total employees (full-time and part-time).

Pulic (2000:706) proposed that intellectual capital be measured in terms of the efficiency with which value is added by it. He categorised the components of his Value-Added Intellectual Coefficient (VAIC™) according to capital employed (tangible assets), structural capital and human capital. Pulic's measure of human capital efficiency – Value-Added Human Capital (VAHU), is calculated as value-added divided by total payroll costs and is best described as the value-added per unit of input cost relating to human capital.

VAHU will be used as the measure of human capital in this study for the following reasons:

- As cited in Maditinos, Chatzoudes, Tsairidis and Theriou (2011:135), Schneider (1998) suggested that complex data collection and manipulation processes may lead to a "danger in losing track of the main objective of a study". In addition, both researchers and companies are less likely to use a financial indicator if the cost of calculation is too high in relation to the benefit obtained. VAHU (as a component coefficient of VAIC™) has proved to be a popular measure of human capital, as it is relatively easy to calculate.
- The calculation uses financial statement information which is readily available to the public, as the financial statements of JSE-listed companies are required to be made available periodically to its shareholders in hard copy or electronically. All stakeholders would therefore be able to calculate VAHU.
- The annual financial statements of all JSE-listed companies are required to be audited by independent, external auditors. This affords the calculation of VAHU a considerable degree of reliability as the underlying financial information is deemed to have been prepared objectively and free of material error.
- The uniformity of the VAHU calculation allows for ease of comparison between companies, regardless of industry, size or location. Alternative indicators of human capital may be less

standardised if they combine non-financial information, use share price data which is influenced by market forces or are tailored to suit a specific company.

- The calculation of VAHU itself draws a clear relationship between corporate performance (in the numerator) and human capital (in the denominator).

Similar reasons were also offered by Firer and Stainbank (2003:32), Firer and Williams (2003:353) and Swartz, Swartz and Firer (2006:74) for their choice of VAIC™ as a measure of intellectual capital.

2.4. HUMAN CAPITAL AND CORPORATE PERFORMANCE

2.4.1. Research focused on intellectual capital

Like other emerging economies, research on intellectual capital and its components is still in the early stages in South Africa. Although various international and local studies examined the relationship between corporate performance and intellectual capital as a whole, few studies focused specifically on the individual relationship between corporate performance and human capital. The individual sub-categories of intellectual capital are considerably easier to measure than intellectual capital as a whole (Sullivan, 2000:95), possibly because of the difficulty caused by combining their dissimilar natures into a single metric. Consequently, analysing the sub-categories individually may yield higher explanatory power with respect to corporate performance than analysing intellectual capital as a whole. Research isolating the impact of human capital on corporate performance may deliver valuable insights.

Ho and Williams (2003) performed an international comparative analysis between South African, Swedish and United Kingdom (UK) companies of the association between four aspects of board structure (composition, size, inside director ownership and leadership duality) and efficiency of value added by physical and intellectual capital. Although their results yielded no clear conclusions on the explanatory power of board structure in South Africa (Ho & Williams, 2003:486), they found

that the 84 South African companies tested were considerably more effective at generating value from their intellectual capital than their physical capital (Ho & Williams, 2003:480).

Using a sample of 65 listed companies from heavily knowledge-based industries over the 2001 financial year, Firer and Stainbank (2003:25) investigated the relationship between intellectual capital performance, (as measured by VAIC™) and three popular measures of corporate performance in South Africa – profitability, productivity and market valuation. Return on assets (ROA), asset turnover and M/B are used as proxies for profitability, productivity and market valuation respectively. The study covered the sub-sectors of business services, pharmaceuticals, communications, electronics, finance, insurance, real estate and health services – all of which are traditionally considered to be heavily reliant on intellectual capital. However, intellectual capital performance was only found to have a significantly positive influence on profitability. A significantly negative relationship was found between VAIC™ and productivity, and no statistical evidence was found to reject or confirm the assumption that intellectual capital efficiency influences market valuation. Firer and Stainbank (2003) identified a potential trade-off in South Africa between productivity from tangible assets and intellectual capital performance. They hypothesised that the South African emphasis on tangible *versus* intangible assets may be due to the high cost of maintaining intellectual capital and the related risk of investment in intellectual assets being higher than investment in tangibles. They also suggested that the perceived inability to quantify benefits of intellectual capital investment may be due to the general unfamiliarity of South African businesses to the concept of intellectual capital and, consequently, the potentially high costs involved in training management to deal with such assets. This may be problematic for South African companies, given the value-creation power of intellectual capital, identified by Ho and Williams (2003:480).

Tan, Plowman and Hancock (2007:91) also used the VAIC™ model to identify a positive relationship between intellectual capital and corporate performance in 150 companies listed on the Singapore Exchange between 2000 and 2002 [as measured by earnings per share (EPS), return on equity (ROE) and annual share return]. Their findings indicated that both current and future

financial performance can be explained by intellectual capital and its rate of growth. However, this relationship is stronger in the property and services sectors than in the manufacturing and trading sectors. The researchers also analysed the VAIC™–corporate performance relationship by categorising the sample companies as high, moderate and low VAIC™ – they concluded that the higher the intellectual capital efficiency, the stronger the relationship to corporate performance. This empirically confirmed the intuitive logic that companies which are more reliant on intellectual capital would benefit more from its value-creating efficiency than companies which are intrinsically low in intellectual capital.

A study on 81 US multinationals, conducted by Riahi-Belkaoui (2003:224), confirmed the relevance of net value-added as a measure of wealth created by a company's resources and found that intellectual capital positively affects future financial performance. It should be noted that the sample was obtained from Forbes magazine's "most international" 100 US companies from the period 1991 to 1996 – it is not known how the magazine measured this "multinationality" and subsequent ranking. While the study was focused on the internationalisation of intellectual capital, the results may still hold some relevance for domestic companies.

Williams (2001:192) surveyed 31 annual reports of listed companies in the UK from 1995 to 1999 to examine the relationship between intellectual capital performance (measured by VAIC™) and the extent of intellectual capital disclosures in financial reporting. He discovered that companies with higher levels of intellectual capital performance tend to reduce the amount of disclosure on their intellectual capital, for fear of losing their competitive advantage (Williams, 2001:201). Although this study did not explicitly examine the effect of intellectual capital on corporate performance, the results provide evidence of management's perceptions of the competitive value of intellectual capital and its implied positive effect on corporate performance.

2.4.2. Research focused on human capital

Although the studies mentioned in sub-section 2.4.1. offered valuable insights regarding intellectual capital as a whole, they made no attempt to examine human capital as a separate component

thereof. Those empirical studies which *do* consider the relationship between corporate performance and human capital as an independent factor, deliver somewhat limited evidence, with mixed conclusions. It is interesting to note that most of these studies were conducted in emerging economies and almost all of the studies used VAHU or a modification thereof, as the proxy for human capital.

For the sake of clarity, no discussion was included in the remainder of the literature review on those aspects of research which do *not* relate directly to the investigation of human capital. For example, any conclusions reached regarding structural capital and capital employed were excluded if they did not add value to the investigation of the impact of human capital efficiency on corporate performance.

A pioneering South African study by Firer and Williams (2003:348) used the VAIC™ approach to measure the relationship between intellectual capital and its components and corporate performance in JSE-listed companies. The study covered the 2001 financial results of 75 companies in the banking, electronic, information technology and services sub-sectors. Due to the exploratory nature of the study, no formal hypothesis was stated and the sample was restricted to business sub-sectors which are inherently heavily reliant on intellectual capital in order to maintain a homogeneous sample. They suggested that more conclusive results might be achieved using a sample more representative of the JSE, by also including sub-sectors *not* intensive in intellectual capital. Firer and Williams (2003) used ROA, asset turnover and M/B to measure corporate performance and included leverage, company size and ROE as industry-level control factors. As part of their research on the components of VAIC™, they concluded that human capital efficiency (as measured by VAHU) is negatively associated with corporate productivity (as measured by asset turnover) in South Africa – *i.e.* companies that focus on developing their human capital assets appeared to do so at the expense of making effective use of their physical assets. Conversely, companies trying to improve their corporate productivity tended to do so by focusing on their tangible resource base and placed less emphasis on enhancing the efficiency of their workforce. This is in line with the intellectual capital/tangible assets trade-off identified by Firer and

Stainbank (2003:36). Although they could not confirm any clear association between VAHU and profitability, Firer and Williams (2003:357) found that investors react negatively to excessive emphasis on human capital *versus* physical capital - with negative consequences for market valuation. The desire to further develop the methodology and improve on the research outcomes achieved by the exploratory work of Firer and Williams, are in part the inspiration for this research study.

Another South African study performed by Swartz *et al.* (2006:78) used a valuation model developed by Ohlson (1995) to empirically confirm the value relevance of human capital (measured by VAHU) to share prices on the JSE. The original valuation model identified the roles of accrual earnings, book value and dividends in equity valuation and used an estimate of cost of capital. Human capital efficiency was found to have a significant and robust positive effect on share prices. Share prices three months after each company's year-end were used to allow time for dissemination of annual financial reports by the company and analysis thereof, and response thereto, by investors. Although conservative, this approach is considered appropriate in the South African context where annual reports are very seldom released to the public on the actual financial year-end date. Due to the unique nature of the model and the degree of estimation of risk required, this model was not deemed suitable for use in this research study.

Although different dependent variables were tested, the results achieved by Firer and Williams (2003) and Swartz *et al.* (2006) are somewhat contradictory. These two studies therefore presented no clear consensus on the impact of human capital on the different spheres of corporate performance in South Africa.

Chen *et al*. (2005:159) used the VAIC^{TM} model to examine the consequences of human capital for the financial and market performance of all companies listed on the Taiwan Stock Exchange from 1992 to 2002. Positive associations were found between VAHU and all five indicators investigated – namely M/B, ROE, ROA, revenue growth (GR) and employee productivity. Although these associations were considered statistically significant, the strength of the positive association was

low – indicating that Taiwanese companies that display higher human capital efficiency perform only somewhat better in terms of profitability and market valuation. Chen *et al*. (2005) also performed one-year, two-year and three-year lagged regressions to investigate the future impact of human capital efficiency, but could not confirm any significant association between human capital and future corporate performance. It could be argued that further analysis and comparison at industry or sector level might have yielded more useful research results for both the contemporaneous and future regressions than only studying the impact on the overall market.

Similar mixed results were achieved by Shiu (2006:363) who applied the methodology of Firer and Williams (2003:348) to the 2003 annual reports of 80 listed technological companies in Taiwan. Human capital efficiency was found to have a positive effect on asset turnover in Taiwan, but offered no explanatory power for ROA and M/B. A criticism of the methodology applied in Shiu's study is the restriction of negative company VAHU to zero, which was motivated as being necessary for accurate correlation calculations (Shiu, 2006:359). This thinking is incorrect, as correlation analysis describes the linear relationship between variables, *i.e.* whether one variable increases or decreases when the other increases or decreases, but it does not specify that both variables have to be positive or negative. In this research study, any negative VAHU calculated was utilised as is and was not restricted to zero.

Using the VAIC^{TM} component approach, Gan and Saleh (2008:113) examined the value-creating ability of 89 technology-intensive companies listed on the Bursa Malaysia Berhad in 2004 and 2005. A positive relationship was found between VAHU and ROA and asset turnover, implying that the efficiency of a company's human capital resource base is an important determinant of its profitability and productivity in the Malaysian context. They found no relationship between VAHU and M/B and attributed it to Malaysia's young, emerging market. It was suggested that market valuation on the Bursa Malaysia Berhad may be driven more by fundamental theory than a more mature stock market would be (Gan & Saleh, 2008:127). They also cautioned that the results may not be representative of the entire Malaysian market because only companies listed on the

MESDAQ of the Bursa Malaysia Berhad were tested. The MESDAQ is a division of the stock exchange, intended to promote the development of high growth technology-based companies. The limited scope and function of the MESDAQ are somewhat similar in nature to that of the ALT-X of the JSE, which was introduced in 2003 to raise development funding for high growth, small market capitalisation companies to encourage entrepreneurship and black economic empowerment in South Africa. As at 30 June 2011, 70 companies were listed on the ALT-X. It can be argued that research which includes both the Main Board and the ALT-X of the JSE may be a better reflection of the true South African market.

Muhammad and Ismail (2009:2010) also attempted to investigate the relationship between VAHU and ROA and net profit in the Malaysian financial sector using multivariate regression, but could not establish any significant relationship. This is contradictory to the knowledge-rich nature of financial services and points to the failure of the Ninth Malaysia Plan in achieving its desired outcomes. The Ninth Malaysia Plan was introduced in 2006 to promote economic growth by improving the quality of the country's human capital, thereby raising its capacity for knowledge, creativity and innovation (Malaysia, 2006:9). Muhammad and Ismail (2009:10) proposed that their inconclusive regression results might be due to the fact that the study was limited to only 18 financial companies listed on the Bursa Malaysia Berhad in only one year (2007).

A study by Appuhami (2007:24) of 33 companies listed in 2005 in the banking, finance and insurance sectors of the Thai stock exchange confirmed a strong positive relationship between human capital efficiency (measured by VAHU) and investors' capital gains on listed companies. He also found that these companies displayed considerably higher efficiency in human capital than in other types of intellectual capital. As these financial industries tend to declare minimal dividends (Appuhami, 2007:14), Appuhami chose to focus on capital gains as his measure of market performance. It would be more suitable to use market return as a measure of market performance when studying numerous market sectors with differing dividend policies, because it encompasses both aspects of shareholder return, *i.e.* capital gain and dividend yield.

The study by Kamath (2008:700) evaluated the intellectual capital efficiency and corporate performance of the top 25 companies in the drug and pharmaceutical industries listed on the Bangladesh Stock Exchange from 1996 to 2006. Although VAHU in this industry is positively correlated with profitability and productivity (as measured by ROA and asset turnover) and negatively correlated with M/B, he could not reach a conclusion on the predictive power of human capital efficiency on these measures of corporate performance. Kamath (2008:694) found that heavy investments in human resources in the Indian pharmaceutical industry did not yield an immediate return. His findings support the argument for research into the impact of existing human capital efficiency on future corporate performance, in addition to studies on the contemporaneous impact.

An empirical study of four sectors of the Athens Stock Exchange by Maditinos *et al.* (2011:146) confirmed that human capital development is important for economic success in the Greek business environment. Their findings indicated that (1) human capital is a factor in the investment decision when pricing listed stocks and (2) there is a statistically significant positive relationship between human capital and ROE. However, they found no association between human capital and other measures of financial performance (*i.e.* GR and ROA). Maditinos *et al*. (2011) tested 96 companies across the construction and materials, industrial goods and services, food and beverage, and personal and household goods sectors for the period 2006 to 2008. They cautioned that broadening the time frame and scope of the study to include companies of varying knowledge-intensity may yield different research results. They also suggested using earnings before interest, tax, depreciation and amortisation (EBITDA) when calculating returns, to partially eliminate the effect of financial leverage when analysing VAIC™ and its components and corporate performance.

Puntillo (2009:112) studied 21 banks listed on the Milan Stock Exchange from 2005 to 2007 and concluded that intellectual capital and its components did not influence return on investment, ROA and M/B. Although Puntillo cited the use of VAIC™ as the measure of intellectual capital, upon closer inspection it was noted that the personnel costs used in the calculation of VAHU included

occasional, project-based, once-off and non-recurring costs which were extrapolated by the researcher from historical information (Puntillo, 2009:105). The extent of this estimation may have rendered the VAHU calculation inaccurate as a true reflection of human capital efficiency. It creates a strong argument for using the employee costs as disclosed in audited financial statements in the calculation of VAHU, rather than deriving staff costs through other means which involve estimation, approximation or conjecture.

Although he did not use VAIC™ or its components, Bozbura (2004:366) found a strong positive association between the human capital and M/B of Turkish companies. A private online survey on the descriptive factors of human capital (and the other components of intellectual capital) was sent to 280 companies listed on the Istanbul Stock Exchange. No indication is given of which year was covered in the study. The results were used to determine a proxy for human capital and then applied in a multivariate regression against M/B. A key shortcoming identified during the review of this research is the apparent incompatibility of the time frames used in the calculation of M/B in the study. The numerator (market value) was calculated using listed share prices on one specific day - 2 August. The denominator (book value) would have been derived from annual financial statements, which are presumably prepared as at the various company financial year-end dates and not as at 2 August. It was noted, however, that Bozbura (2004:365) intended his calculation to be merely an *estimate* of M/B.

Several studies were also performed internationally to measure and rank the intellectual capital performance of companies in the banking sector using VAIC™ and its components.

Mohiuddin, Najibullah and Shahid (2006:52) ranked the three VAIC™ components of 17 banks in Bangladesh from 2002 to 2004, while Goh (2005:391) tested 16 Malaysian banks from 2001 to 2003. Mavridis and Kyrmizoglou (2005:57) compared the efficiency of human capital and physical capital of 17 Greek banks from 1996 to 1999, while Mavridis (2004:110) tested 141 Japanese banks in 2001. All four studies of the banking sectors in Malaysia, Japan, Greece and India indicated that more value-added is generated from investment in human capital than from

investment in any other component of intellectual capital. This is not surprising, as the type of consumer services offered in financial industries is largely dependent on employee expertise and skill. Although these studies are limited to the banking sector and do not directly test whether the higher VAHU is associated with higher corporate performance, the results *do* highlight the relative importance of human capital efficiency and motivate the need for research attention on human capital efficiency as a separate factor.

Muhammad and Ismail (2009:212) also attempted to comparatively rank the VAIC™ components in the three sub-sectors of the Malaysian financial sector. The results indicate that banks, brokerage firms and insurance companies place higher reliance on human capital efficiency than on the efficiency of structural capital or capital employed. In terms of ranking VAHU between the sub-sectors, banks display the highest human capital efficiency, followed by brokerage firms and then insurance companies. What is interesting to note from this study is that the order of human capital efficiency directly corresponds to the order of company size, as measured by assets, net profit and number of employees. It may, therefore, be prudent to control for company size in any comparative examination of human capital efficiency between individual companies or sectors.

Bontis, Keow and Richardson (2000:85) studied the interrelationship between human capital, relational capital and structural capital within service and non-service industries in Malaysia. Their conclusions indicate that regardless of the industry, in order to identify and meet customer needs and gain their loyalty, a business must utilise the full potential of its human capital (Bontis *et al*., 2000:91). They also found that service industries are less capable than non-service industries of transforming employee knowledge into structural capital – this implies that service industries struggle more to externalise the knowledge held within their human capital. Their study supports the traditional logic that the human capital element is of greater importance to service delivery than to production.

The studies mentioned in this literature review provide a potential starting point and valuable insight for further research in the topics of human capital, corporate performance or the relationship between the two.

2.5. SHORTCOMINGS AND LIMITATIONS IDENTIFIED IN PRIOR RESEARCH

Ioannidis (2005:0696) argued that the strength of a research finding is based on the perceived likelihood (before attempting the study) of getting such a result, the statistical power of the study, the extent of replication of the study by independent teams to confirm that result, and the balance of positive and negative conclusions reached in the entire body of similar research. Within that framework of the characteristics of strong research findings, the results of the body of prior research on the impact of both intellectual capital and human capital on corporate performance (in South Africa and internationally) can at best be described as mixed or inconclusive.

The research previously performed on the impact of both intellectual capital and human capital on corporate performance offers contradictory results with no clear trend of positive or negative conclusions. Overall, it appears that differing conclusions on the effect of human capital and intellectual capital are reached depending on the year examined, the countries examined, and the intellectual and physical capital intensity of the industries examined. Furthermore, there is a significant lack of replication of studies, due to the fact that research into human capital and intellectual capital performance is still in its early stages – this is particularly true in the South African research context.

Most of the prior research used cross-sectional analysis across multiple companies with single-period data, while a study across time may yield deeper insights (Firer & Stainbank, 2003:41; Firer & Williams, 2003:358; Maditinos *et al*., 2011:146; Tseng & Goo, 2005:199). Much of the prior research was also targeted at industries with high intellectual capital intensity. There is a risk of "sampling within a sample" if research is limited to certain sectors of the share market and an even greater risk if those sectors are all heavily intellectual capital-based (Firer & Williams, 2003:358;

Maditinos *et al*., 2011:146). Further research across all sectors, including non-knowledge based business sectors, is suggested to improve the explanatory power.

The suggested increase in time depth and study breadth in research on the impact of human and intellectual capital on corporate performance, is echoed by Ioannidis (2005:0700). Although he admits that 100 percent certainty is unattainable in research, he recommends that the strength of research conclusions may at least be improved by gathering large-scale evidence (Ioannidis, 2005:0700) – *i.e.* studies completed over longer time periods, over a wider cross-section of companies, and having the research methodology repeated closely by other researchers.

In addition, the use of VAIC™ as a measure of intellectual capital may pose its own limitations, as it "cannot prescribe in precise terms the actions that management or regulators should take in a company, business sector or economy to strengthen value creation" (Firer & Stainbank, 2003:41). Consequently, as a sub-component of VAIC™, it is implied that using VAHU as a measure of human capital may have similar limitations. Despite suggesting the use of VAIC™ as a potential shortcoming in their study, none of the prior researchers suggest an alternative measure which they consider to be more appropriate.

It was noted that most of the prior research reviewed only considered those companies which were still listed at the end of the time period covered by the particular research study. Companies which had delisted during the research period were usually excluded from the research samples. No reasons were offered to support their exclusion. It may be argued that including only 'currently' listed companies creates the potential for survivorship bias.

While the existing body of research examining the connection between human capital and corporate performance using the VAIC™ methodology is valuable due to its exploratory and pioneering nature, this study will attempt to address the potential shortcomings and limitations identified in the prior research.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1. INTRODUCTION

The research design implemented in this study constitutes empirical quantitative research using secondary numeric data to test the following hypotheses:

H1: The market value-book value gap of South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

H2: Human capital efficiency in South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

H3: Higher human capital efficiency is associated with higher financial and market performance contemporaneously, in South African listed companies for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

H4: Higher human capital efficiency is associated with higher financial and market performance in the future, in South African listed companies for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

3.2. INVESTIGATION OF THE DIVERGENCE BETWEEN BOOK VALUE AND MARKET VALUE OF COMPANIES

A growing divergence between the book value and market value of companies can be confirmed by a rising M/B, as the ratio is calculated by dividing the equity market values of a company by the book value of its equity. H1 was tested by examining the movement of the median annual M/B of all companies listed on the Main Board and ALT-X of the JSE for the financial year-ends falling in the period 31 December 2001 to 30 June 2011. Trends in the calculated annual median M/B were

deduced from descriptive statistics. Motivation for the use of medians is provided in sub-section 3.4.5.4.

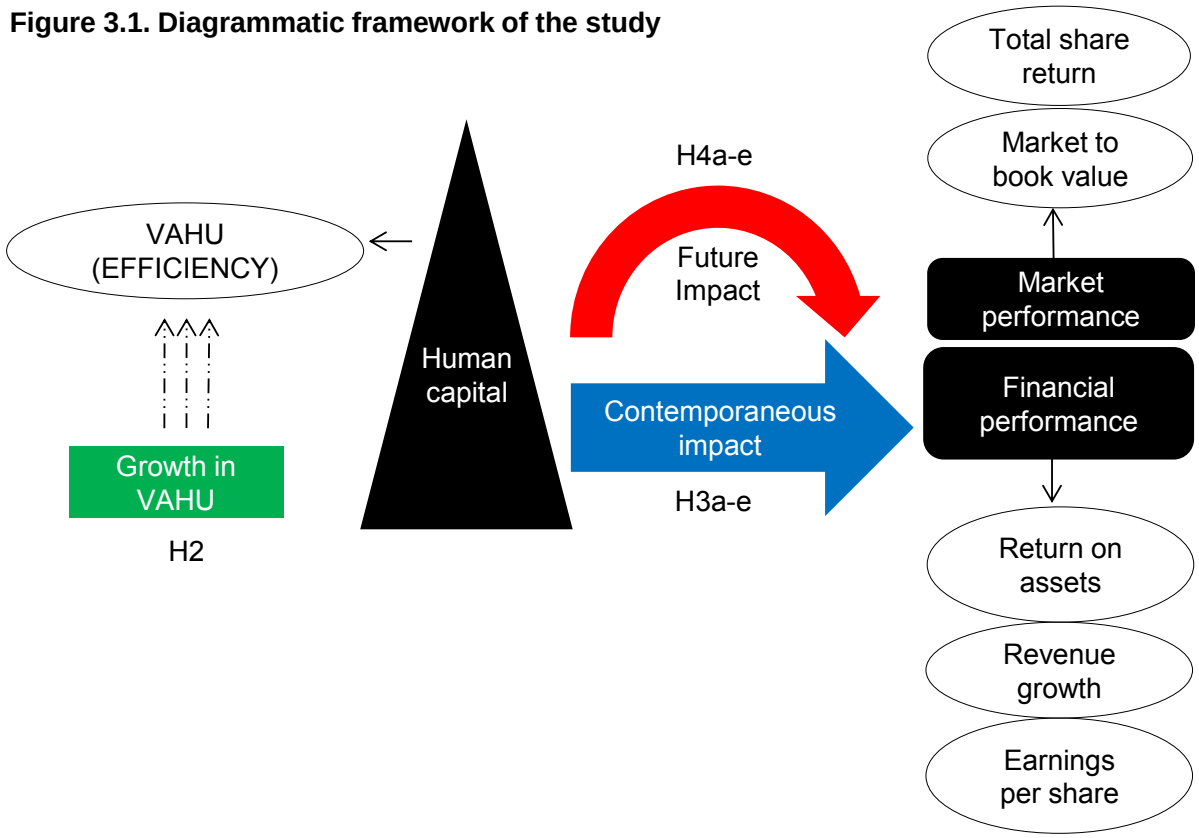
The calculation of the M/B is discussed in sub-section 3.3.4. The time period used in the testing of H1 is motivated in sub-section 3.3.1. This time period is considered lengthy enough to clearly illustrate visible trends. To further supplement the analysis of the results obtained from H1, the same methodology was applied to investigate the market value-book value gap within each industry. The aggregation of industries is discussed in sub-section 3.4.5.1.

3.3. INVESTIGATION OF THE HUMAN CAPITAL IMPACT ON CORPORATE PERFORMANCE

3.3.1. Time period of the study

Figure 3.1. presents the theoretical framework for formulating the research hypotheses of the study.

Figure 3.1. Diagrammatic framework of the study



Based on the recommendations highlighted in previous studies, this study covered multiple consecutive years rather than a single year. A time-series test of financial data may be considered statistically sound, as long as the underlying basis of preparation of the financial data is reasonably consistent over the period.

The adoption of IFRS became mandatory for all South African companies listed on the JSE for the financial years starting after 1 January 2005 (JSE Limited Listing Requirements - Service Issue 13, 2010:8-19). Prior to this, all South African companies had the option of either using South African generally accepted accounting practice (GAAP) or complying with IFRS. A survey benchmarking national accounting rules against IFRS was performed by a consortium of audit firms in 2001. This survey (known as GAAP 2001) found that, as at the end of 2001, South African GAAP differed from IFRS only in terms of certain requirements for financial instruments and investment properties (Nobes, 2001:122).

The research performed by Street (2002a) formed the basis for the follow-up survey of 2002, known as GAAP Convergence 2002 (Street, 2002b). The country comparisons in these studies found that, at that stage, South Africa GAAP was the country accounting standard which most closely resembled IFRS, with only five minimal differences identified (Street, 2002a:81). It was further confirmed that, subject to differences in the dates when the standards became effective, compliance with the revised South African GAAP standards of 2001 would ensure compliance with IFRS (Street, 2002b:9). All South African GAAP standards issued thereafter would be harmonised with IFRS.

The effective dates of the South African GAAP standards of 2001 (SAIGR Handleiding - Rekeningkunde 2000/2001, 2000) were reviewed and it was established that the latest effective date was financial years beginning on 1 January 2001. Therefore, all the revised South African GAAP standards were in full effect for financial year-ends on and after 31 December 2001. The financial statements for all financial year-ends on and after 31 December 2001 may be considered reasonably consistent, as the accounting basis of

preparation is compliance with IFRS. Therefore, this study covered the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

3.3.2. Measurement of movement in VAHU

H2 was investigated by examining the median growth in human capital efficiency (MGV):

$$MGV > 0\%$$

MGV represents the median growth rate in VAHU for all companies over the period under review. It is calculated as the median of the compound annual growth rate of VAHU (CAGV) of all the companies listed on the JSE Main Board and ALT-X over the period under review. Refer to sub-section 3.4.5.4. motivating the use of medians. The MGV was also calculated for each industry to facilitate industry comparisons.

CAGV was calculated as the geometric mean of the annual rate of growth in VAHU over the period under review and was calculated per company:

$$CAGV = \sqrt{\frac{\text{End VAHU}_1}{\text{Start VAHU}_1} \times \frac{\text{End VAHU}_2}{\text{Start VAHU}_2} \times \ldots \frac{\text{End VAHU}_n}{\text{Start VAHU}_n}} - 1$$

where

End VAHU = VAHU at the n^{th} financial year-end falling in the period 31 December 2001 to 30 June 2011

Start VAHU = VAHU at the start of the year of the n^{th} financial year-end falling in the period 31 December 2001 to 30 June 2011

n = number of financial year-ends falling in the period 31 December 2001 to 30 June 2011

The annual growth rates of VAHU may be expressed either as decimals or as decimal multiplier equivalents. If VAHU increased from 40 to 50 in a year, for example, the decimal multiplier would be 1.25 and the decimal growth rate would be 0.25. If VAHU decreased from 50 to 40 in a year, the

decimal multiplier would be 0.8 and the decimal growth rate would be -0.2. The even root of a negative number is not real – *i.e.* using decimal growth rates in the calculation of CAGV could lead to a result which is not real. Therefore, the decimal multiplier equivalents of the annual growth rates were used, to avoid this problem of negative growth rates in the root calculation of the CAGV.

3.3.3. Development of regression models

Time-series cross-sectional multiple regressions of all companies across all the years under review was used to analyse the relationship between the human capital and the financial and market performance variables over the period under review. The format of financial data investigated across multiple companies, and across consecutive years, is known as panel data. To further explain the multi-year panel linear regression results, cross-sectional regression analyses was performed using all JSE-listed companies for each individual year under review. In addition, the regressions were run separately for each industry in order to gain potential insight into the industry-specific relationships between the variables in those industries which are considered highly knowledge-based and those which are not.

Human capital is only one of the numerous determinants of a company's financial and market performance. The statistical regressions performed on corporate performance should clearly distinguish human capital efficiency, the determinant under investigation, from these other factors. Therefore, company size, financial leverage and industry were included as company-level control factors, while the epsilon (ε) encompassed all the other factors:

i. *Size:* natural log of total market capitalisation (calculated by multiplying share price by number of ordinary shares in issue).
ii. *Leverage*: debt ratio, calculated by dividing book value of total debt by book value of total assets.
iii. *Industry*: dummy variables representing the industries as categorised on the JSE Main Board or ALT-X. Effectively, each of the individual regressions in H3a-e and H4a-e were run separately for each industry as well as for the JSE as a whole. A clear comparison could be made between

the impact of human capital on those industries which are traditionally considered to be highly knowledge-based and those which are not.

H3 examined the relationship between current human capital efficiency and the various proxies for current financial and market performance through the following regression models:

$$ROA^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \varepsilon \quad (H3\text{-}a)$$

$$GR^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \varepsilon \quad (H3\text{-}b)$$

$$HEPS^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \varepsilon \quad (H3\text{-}c)$$

$$M/B^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \beta_5(ROE^{t}) + \varepsilon \quad (H3\text{-}d)$$

$$TSR^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \beta_5(ROE^{t}) + \varepsilon \quad (H3\text{-}e)$$

Where

DR = Debt ratio

GR = Revenue growth

HEPS = Headline earnings per share

IND = Industry

LMC = Natural log of total market capitalisation

M/B = Market-to-book ratio

ROA = Return on assets

ROE = Return on equity

TSR = Total share return

VAHU = Value-Added Human Capital

α = Intercept

H4 examined the relationship between current human capital efficiency and the various proxies for future financial and market performance through the following regression models:

$$ROA^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \varepsilon \quad (H4\text{-}a)$$

$$GR^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \varepsilon \quad (H4\text{-}b)$$

$$HEPS^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \varepsilon \quad (H4\text{-}c)$$

$$M/B^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \beta_5(ROE^{t+1}) + \varepsilon \quad (H4\text{-}d)$$

$$TSR^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \beta_5(ROE^{t+1}) + \varepsilon \quad (H4\text{-}e)$$

The selection of control variables follows Kamath (2008:692), Riahi-Belkaoui (2003:221) and Shiu (2006:360) who use size and leverage as control factors. In addition to size and leverage, Firer and Stainbank (2003:32) and Firer and Williams (2003:354) also use an industry variable in their statistical analyses.

A fourth company-level control factor was added to the regressions where the dependent variable is calculated using share price (H3-d, H3-e, H4-d and H4-e), in order to encapsulate the effect of a company's financial performance on its market performance:

iv. *Financial performance*: ROE, calculated by dividing EBITDA by average book value of equity. The book value of equity is calculated as the difference between book value of total assets and book value of total liabilities.

3.3.4. Measures of dependent variables

The proxies for financial and market performance in this study were selected from the collection of similar, relevant prior research studies (Appuhami, 2007:21; Chen *et al*., 2005:165; Firer & Stainbank, 2003:30; Firer & Williams, 2003:352; Gan & Saleh, 2008:121; Shiu, 2006:360; Tan *et al*., 2007:77). Firer and Stainbank (2003:30) also acknowledge that the use of one proxy for financial and market performance over another, could not be motivated by previous empirical studies.

The following three variables were chosen to represent financial performance:

i. Return on assets:

$$ROA = \frac{EBITDA}{\text{Average Total Assets for the year}}$$

ROA is a measure of the profit of a company relative to its total assets and is indicative of the efficiency, effectiveness and economy with which the company utilises its assets to generate such profits. As leverage is included as a control factor in the multiple regressions and net profit is influenced by the degree of financial leverage, ROA was calculated using EBITDA. As suggested by Maditinos *et al*. (2011:147), using EBITDA is a more suitable measure of a company's financial performance, regardless of its degree of leverage. Total assets, inclusive of intangible assets, may be used in the calculation of ROA as human capital is not recognised as an intangible asset in terms of IAS 38 Intangible Assets (2010:943). Total assets include cash and the other investments which generate interest income – therefore, in this study, EBITDA was calculated inclusive of interest income.

ii. Revenue growth:

$$GR = \left(\frac{\text{Current year revenue}}{\text{Prior year revenue}} - 1 \right)$$

GR is a measure of the growth potential of a company. Unlike the calculation of CAGV, which is calculated over multiple financial years, GR represents growth over a single financial year. GR is not transformed through root calculations and, therefore, need not be expressed as a decimal multiplier.

iii. Headline earnings per share:

HEPS was used in this study, as it is a required disclosure item in the annual financial statements of all publicly traded companies (JSE Limited Listing Requirements – Service Issue

13, 2010:8-20) and it is also commonly used in analyst reports to assess company performance, as it allows for more sophisticated comparability than basic EPS. According to SAICA Circular 08/07 Headline earnings (2010:4), headline earnings is derived by adjusting basic earnings for certain separately identifiable re-measurements specific to the operating or trading activities and capital base of the company. The use of HEPS as a supplementary EPS figure, is allowed under paragraphs 73 and 73A of IAS 33 Earnings per share (2010:825). As it is mandatorily disclosable, HEPS was used as presented in the financial statements (in South African cents) and was not independently recalculated.

The following two variables were chosen to represent market performance:

i. *Market-to-book ratio:*

$$M/B = \frac{\text{Share price x Number of shares in issue}}{\text{Book value of total assets} - \text{Book value of total liabilities}}$$

M/B is a measure of the worth of a company's ordinary shares in an active market (its market capitalisation) relative to its balance sheet value. It is indicative of a company's performance in the stock market as the higher the M/B, the better the company's ability to create value from its net assets.

ii. *Total share return:*

$$TSR = \frac{(\text{End share price} - \text{Start share price}) + \text{Annual dividend per share}}{\text{Start share price}}$$

TSR incorporates the capital gain on an ordinary share (measured by the movement in share price over a year) and the annual dividend declared per ordinary share (Tan *et al.*, 2007:82). It represents the total market return earned by the shareholder of an ordinary share in a year.

3.3.5. Measure of independent variable

Pulic's (2000:707) measure of human capital efficiency, VAHU, was used as the measure of the independent variable in this study. The reasons motivating this choice were presented in Chapter 2.

Pulic (2000:706) defined value-added as OUTPUTS less INPUTS, where OUTPUTS represent total income from goods and services sold in the market and INPUTS represent all expenses relating to everything that comes into the company. VAHU represents the value-added per unit of human capital input and is expressed as:

$$VAHU = VA \div HC \qquad (1)$$

where

VAHU = Value-Added Human Capital

VA = value-added

HC = salaries and wages

In contrast to the resource-based theory, which considers the firm to be the product of its assets, the stakeholder theory argues that a firm is accountable to multiple stakeholders who are the source of the firm's resources and who hold an interest in it (Donaldson & Preston, 1995:67). These stakeholders include shareholders, employees, customers, suppliers, credit providers, the government and general society. When expressed in terms of the resource-based and stakeholder theories, value-added in the new knowledge economy may be considered to be the value created from the optimal use of a firm's tangible and intangible intellectual capital resources before distribution to its various stakeholders.

Refining Pulic's concept, Riahi-Belkaoui (2003:220) proposed that value-added be calculated by rearranging the following equation:

$$R = S – B – DP – W – I – DD – T \quad (2)$$

where

R = retained earnings for the year

S = net sales revenue

B = bought-in materials and services (cost of goods sold and other expenses)

DP = depreciation

W = salaries and wages

I = interest expense

DD = dividends declared

T = total of all taxes

$$S - B - DP = W + I + DD + T + R \quad (3)$$

Equation (2) can be rearranged to derive Equation (3), which reflects the net value-added approach. The left hand side of the equation represents the value created in the business through the use of its resources (resource-based theory of the firm) and the right hand side represents the stakeholders to whom the value will be distributed (stakeholder theory). Wages are due to employees, interest expenses are due to lenders, dividends are due to shareholders, taxes are due to the government and retained earnings are accumulated and not distributed.

The sum of retained earnings for the year and dividends declared should equal profits after tax earned in the year. Therefore, Equation (4) can be derived by replacing DD plus R in Equation (3) with NP.

$$S - B - DP = W + I + T + NP \quad (4)$$

Where NP = net profit after tax

As the left hand side of Equation (4) represents net value-added, it can be rewritten as

$$VA = W + I + T + NP \quad (5)$$

Therefore, VAHU introduced in Equation (1) will be calculated in this study as

$$VAHU = \frac{W + I + T + NP}{HC} \qquad (6)$$

where

W = salaries and wages

I = interest expense

T = total of all taxes

NP = net profit after tax

HC = salaries and wages

(Note that salaries and wages are denoted by both W and HC – two separate symbols were deliberately used to draw a clear distinction between the VAHU numerator and denominator.)

This format of the calculation of VA is consistent with that used by Chen *et al*. (2005:166) and Riahi-Belkaoui (2003:219). Hansson (1997), as cited in Lajili & Zeghal (2006:176), found that equity investors are unable to distinguish between expenses (*e.g.* salaries) and investments (*e.g.* training costs) relating to human resources. This supports the use of both salaries and wages and training costs as a measure of human capital investment. However, it is highly unlikely that sufficient data on training costs could be obtained, as it is not required to be separately disclosed in financial statements prepared according to IFRS. The use of only salaries and wages in the calculation of VAHU, was further supported by Pantzalis and Park's (2009:1610) assertion that the labour market value of human capital is reflected in the compensation amounts received by employees, due to the competition involved in the labour market in attracting the employees.

In South Africa, the Basic Conditions of Employment Act permits the Minister of Labour to set minimum terms and conditions of employment (including minimum wages). These minimum wage levels are only determined for certain labour-intensive sectors and informal employment sectors where workers are considered vulnerable, and are determined on a regional, sectoral and occupational/skill level. It creates a remuneration floor in those sectors which are traditionally low-

paying. The issue of minimum wages is not unique to South Africa – the International Labour Organization (2006) lists over 100 countries which practise some form of minimum wage fixing. In addition, research by the South African Department of Labour (Republic of South Africa, 2008b:25) confirmed that of the entire South African workforce, only 34% were subject to the minimum wage restriction and in 40% to 60% of these cases, the actual wages were below the legal minimum wage. Therefore, the minimum wage restriction had only been successfully implemented in approximately 17% of the South African workforce. The existence of a minimum wage policy was considered unlikely to affect the calculation of VAHU materially and consequently, neither the results of this study.

It is of great importance to note that the salaries and wages used in the calculation of VAHU excluded all directors' emoluments. Compensation paid to directors are usually significantly higher than that of management and other employees, in addition to being perceived as less market-related and more subjective. It was thought that including directors' remuneration in salaries and wages would obscure the meaning of the variable and skew the statistical results. The potential concerns posed by directors' remuneration do not seem to have been identified in prior research, as it could not be ascertained whether directors' emoluments were included in prior studies. Directors' remuneration is easily attainable as it is required disclosure in company financial statements in terms of paragraph 17 of IAS 24 Related Party Disclosures (2010:669) and Companies Act, No. 71 of 2008 (Republic of South Africa, 2008a).

The use of VAHU as a measure of the value of human capital was further supported by its similarity to the measure of wealth creation efficiency, P_2, used by the UK Department for Business Innovation and Skills in their annual Value-Added Scoreboard report. P_2 measures the wealth creation efficiency of UK and European companies as the ratio of value-added to the major input costs (employee costs for labour and depreciation for fixed assets) needed to transform bought-in goods and services into products and services for customers (United Kingdom, 2009:55). This calculation implies that BIS would calculate the separate wealth creation efficiency of labour as the ratio of value-added to employee costs – a ratio similar to VAHU.

3.4. DATA AND THE MANAGEMENT THEREOF

3.4.1. Statistical regression using panel data

The statistical techniques utilised in the study and the appropriateness thereof, were discussed in detail with the Centre for Statistical Consultation (CSC) at the University of Stellenbosch. Due to the degree of difficulty in performing the necessary types of statistical regression, the CSC was consulted periodically during the research process to provide specialist expertise.

Due to the accounting and financial reporting restrictions discussed in sub-section 3.3.1., the study only covered financial year-ends falling in the period 31 December 2001 to 30 June 2011. However, the period covered by the final data was effectively one year shorter due to the use of GR, TSR and average assets and equity in the calculation of ROA and ROE. The use of panel data in the study is considered appropriate as it can decrease regression errors in samples where time-series depth is lacking (De Jager, 2008:56), because:

- it allows for less collinearity, more efficient testing, more freedom in test design and testing of more complex behavioural models than purely cross-sectional or time-series data;
- biases caused by pure time-series data or aggregation of companies in one period may be eliminated;
- it allows for better investigation of the dynamics of adjustment in the relationships between variables; and
- purely cross-sectional or time-series data are simply unable to detect certain effects which the combination of the two might be able to identify.

In addition to the actual regression analyses, other statistical tests first needed to be performed. Firstly, a regression is only helpful if the independent variables display some association with the dependent variable. Therefore, bivariate pairwise correlation analyses were performed prior to undertaking the regression analyses to determine whether there was a linear relationship between the different variables. If the variables' correlation with each other was too low (*i.e.* correlation coefficient was too close to 0), the regression would not yield any useful results.

Problems may also occur in a regression if the correlation analysis reveals that the independent variables are highly correlated with each other (*i.e.* correlation coefficient is close to 1 or -1). This phenomenon is known as multicollinearity. In these instances, it becomes difficult to estimate *how much* of the behaviour of the dependent variable is attributable to each independent variable. It does not, however, compromise the accuracy in determining the *direction* of the relationship between the dependent and independent variable. A Breusch-Pagan test was performed to identify heteroskedasticity in the data, as the presence thereof implies bias in the standard error and reduces the reliability of the regression results. De Jager (2008:66) suggested that such tests of serial correlation or multicollinearity and heteroskedasticity would improve the results of regressions using panel data.

The CSC estimates that for a time-series regression to be statistically sound, research data should be available for each company for at least four consecutive years during the period under review. They find no statistical reason to exclude companies which listed partway through and remained listed until the end of the period (late listers) or companies which delisted during the period (delisters), as long as they were listed for at least five consecutive years during the period (to allow for a minimum of four consecutive years of research data). Where a company was missing *any* of the financial information and share price data needed to calculate a research variable during a specific year in the period under review, the company was excluded from the regression for *that* specific financial year. However, if such exclusions resulted in fewer than four consecutive years of complete research data, the company was excluded from the regression *entirely*. For example: If Company A was missing salaries data needed to calculate VAHU in 2005, the regression population included all Company A data for the periods 2001 to 2004 and 2006 to 2011. If Company A was missing salaries data in 2004, the regression population included all Company A data for the period 2005 to 2011. If Company A was missing salaries data in 2004 and 2008, Company A was excluded from the regression entirely.

3.4.2. Survivorship bias

Survivorship bias is a common risk in econometrics where the sample includes only currently listed companies because, by definition, it excludes delisters ("bad" companies which previously delisted due to business failure or other reasons) and only includes "good" companies. To avoid survivorship bias, this research study initially included companies which delisted during the period under review. Control regressions were performed parallel to the primary research regressions for the entire JSE (however, using only currently listed companies) to determine whether the exclusion of delisters would have affected the overall regression results – thereby confirming or rejecting the existence of survivorship bias when using only listed companies.

3.4.3. Quality of the original data

All annual financial statements and monthly market data for all the companies listed on the Main Board and ALT-X of the JSE during the period under review (financial year-ends falling in the period 31 December 2001 to 30 June 2011) were drawn from the McGregor Bureau of Financial Analysis (BFA) database. A simple statistical sampling test was performed to test the integrity of the company data extracted. A sample of 20 financial statements was drawn from the BFA database, each from a different randomly selected company and spread evenly over the period under review. The line items applied in the calculation of the variables utilised in the study were then selected from this sample of BFA financial statements and compared to the published annual financial statements of those companies to identify potential errors in transcription in the BFA database.

The time and company spread of the sample ensured coverage of the various data capturers BFA may have used over the period under review. The final sample consisted of 300 financial statement items. Errors identified in the sample were extrapolated to estimate the error rate in the full population of companies in the BFA database. The results of these data integrity tests are discussed in sub-section 5.2.1.

3.4.4. The use of listed share prices

Although the studies which attest to the inefficiency of the JSE outnumber those which attest to its efficiency, it has been proven that the informational efficiency of the JSE improved over time (Mabhunu, 2004:85). JSE-listed companies are allowed three months after financial year-end to distribute their audited annual financial statements to their shareholders. If this deadline is not met, the listed companies are still required to distribute unaudited provisional financial statements to their shareholders, within the three months after year-end (JSE Limited Listing Requirements - Service Issue 13, 2010:3-7). Therefore, share price data as at three months after each year-end, was used in this study to calculate TSR, M/B and LMC to allow for the time taken for companies to publish and for users to analyse the financial statements. This approach to share price data was also employed in Swartz *et al.* (2006:76).

3.4.5. Data aggregation and transformation

3.4.5.1. Industry aggregation

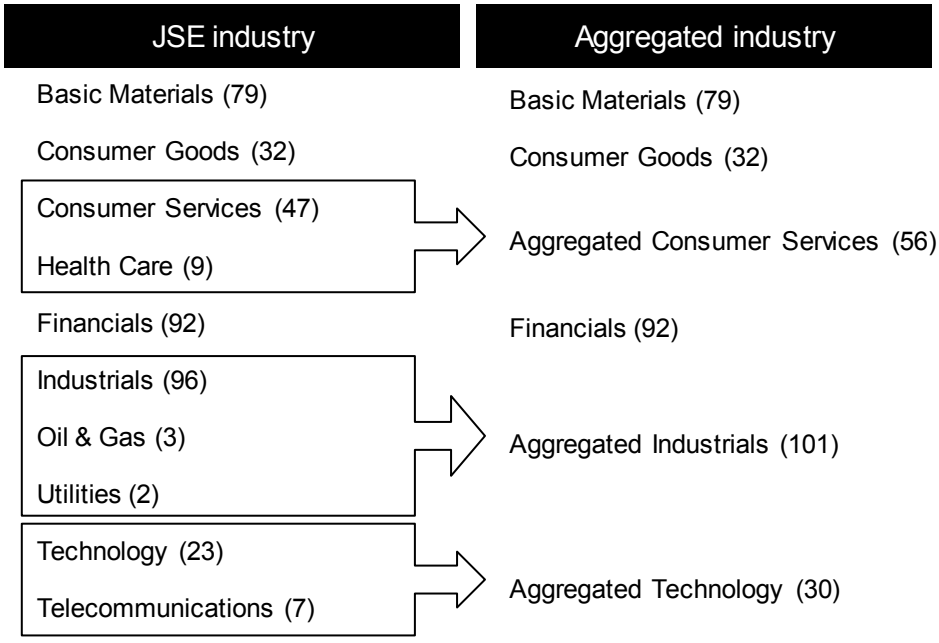
Although the JSE has 10 industry categories, some categories contain very few companies. To improve the reliability of the "per industry" statistical tests to be performed, all categories containing fewer than 20 companies as at 30 June 2011, were aggregated with another category of a similar nature to ensure that industry regression populations of a sufficient size were obtained. Over the course of their listing, the industry categorisation of some companies may have changed. The final industry categorisation of each company – *i.e.* as at 30 June 2011 or as at the date of delisting – was applied throughout the time period under review. Therefore, it is assumed that companies did not change industry categories during the period under review.

The industry, super-sector and sector classifications of the JSE follow the Industry Classification Benchmark (FTSE, 2012), a globally-accepted classification system used by most stock exchanges around the world. For the sake of validity, comparability and objectivity, it was deemed most appropriate to use the JSE industry classifications in this study.

The industry sizes (based on the number of listed companies over the period under review) and aggregation applied in this study are illustrated in Figure 3.2. The Health Care industry is comprised of healthcare service providers and pharmaceutical companies. It was aggregated with Consumer Services because this industry already contained other personal service providers and drug retailers. The Utilities industry was grouped with Industrials as it consisted only of electricity providers.

In larger international stock exchanges, petroleum companies are grouped in one industry and then categorised into sectors based on their upstream, midstream or downstream operational nature (FTSE, 2012:1). On the JSE, the Oil and Gas industry is comprised of a single downstream petroleum company. In this study, the Oil and Gas industry was aggregated with Industrials to reflect its downstream nature.

Figure 3.2. Industry size and aggregation



The nature of the companies included in the different aggregated industries may be described as follows:

- Basic Materials is comprised primarily of companies involved in the mining of metals and diamonds, upstream petroleum companies; and a small number of companies involved with forestry; paper; and speciality chemicals.
- Consumer Goods consists mostly of food and beverage manufacturers (including tobacco and brewery houses); the fishing and farming sectors; and a few motor manufacturers.
- Aggregated Consumer Services is a misnomer, as it consists equally of retailers and service providers (such as healthcare and pharmaceuticals; travel and leisure; and media firms).
- Financials includes financial services; banks; insurance houses; and real estate.
- Aggregated Industrials includes industrial goods and services; construction and materials; transport; downstream petroleum companies (oil and gas); and electricity providers.
- Aggregated Technology consists half of computer service providers and the rest are hardware and telecommunication equipment manufacturers, software developers, and telecommunication providers.

Intuitive logic based on the nature of each industry would lead one to expect that, in those industries where the quality, expertise, training and skill of their human capital are considered to be better, the value-generating ability of the human capital would be higher. Therefore, the average VAHU would be expected to be higher in Financials, Aggregated Technology and perhaps Aggregated Consumer Services. Conversely, the average VAHU in Aggregated Industrials, Consumer Goods and Basic Materials would intuitively be expected to be lower.

3.4.5.2. Share splits and consolidations

The number of shares of the companies in the research population was adjusted for share splits and consolidations, to ensure consistency throughout the time period under review. For example, the number of shares was halved after the occurrence of a two-for-one share split. No further adjustment is needed for share prices, as the historical share prices obtained from BFA were already adjusted for these share actions. Published HEPS did not need to be adjusted, as the impact of the share split or consolidation was already taken into account in determining the weighted average number of shares at year-end used in the calculation of the HEPS. However,

even without making any of the aforementioned adjustments for these share actions, the effect on the study would be expected to be minimal, as the research population only included eight companies which had experienced a share split or consolidation during the period under review.

3.4.5.3. Outliers

Outliers are a common and expected occurrence in the large data sets found in multivariate panel data and, unless addressed, they could result in biased estimation and misspecification of regression models. Winsorising is a long-accepted remedy built into most statistical packages, which limits the effect of outliers by reducing the offending extreme values to fall within the range of a normal distribution. This method is preferred over marginal models that tend to over-specify outliers when used with multivariate time series (Tsay, Pena & Pankratz, 2000:803). In this study, the problem of outliers was addressed conservatively by winsorising all raw data to three standard deviations from the mean of the overall JSE. The use of three standard deviations means that 99.87% of the data points are considered to fall within a 'normal' or non-outlier range. The remaining 0.13% of the data points – the extreme values – are lower than the minimum or greater than the maximum of this 'normal range' and are capped to reflect the minimum or maximum value. Thus, only the effect of the *outlier portion* of the extreme values is removed by the winsorising process. As the extreme values amount to 0.13% of the data set and only the outlier portion thereof is removed, mathematically the adjustment due to winsorising cannot represent more than 0.13% of the entire data set. Winsorising the data, therefore, improves the reliability of the regression, with minimal adjustment to the underlying data.

3.4.5.4. Non-normal distribution of financial data

Table 3.1. reflects the results of the tests for skewness and kurtosis to ascertain whether the research variables are normally distributed.

Table 3.1. Test for normality

	Valid N	Skewness	Standard error of skewness	Kurtosis	Standard error of kurtosis
VAHU	1765	8.6049	0.0583	278.2759	0.1164
ROA	1765	0.2614	0.0583	3.5260	0.1164
GR	1765	28.7041	0.0583	995.4410	0.1164
HEPS	1765	37.8265	0.0583	1 518.4150	0.1164
M/B	1765	25.3001	0.0583	763.8630	0.1164
TSR	1765	13.1320	0.0583	262.5310	0.1164
LMC	1765	-0.1316	0.0583	-0.1440	0.1164
DR	1765	0.1603	0.0583	-0.9330	0.1164
ROE	1765	2.1077	0.0583	12.2760	0.1164

Most of the dependent variables (M/B, TSR, GR and HEPS) and independent variable (VAHU) are positively skewed and display leptokurtosis (*i.e.* strong positive kurtosis). The positive skewness means that the majority of the values are lower than the mean and the most extreme values tend to be higher than the mean, rather than lower. The positive kurtosis implies that the majority of the values are clustered very close to the mean (rather than being reasonably dispersed) and the research population has a higher probability of having extreme values. It may, therefore, be concluded that M/B, TSR, GR, HEPS and VAHU are non-normally distributed. The control variables (ROE, LMC and DR) and ROA do not exhibit any significant skewness or kurtosis and may be normally distributed.

Regression assumes that the variables involved have a normal distribution. Unfortunately, research has proven that the *absence* of normality in financial ratios is actually the norm (Barnes, 1982:51; Deakin, 1976:95; So, 1987:488). Horrigan (1983:687) explained that the distribution of financial ratios should rather be interpreted in terms of corporate behaviour – *i.e.* a normal distribution would only be found where all companies perceive one certain ratio level to be optimal and strive toward that level.

Instead of a symmetrical normal distribution, research has pointed to the prevalence of positive skewness in financial ratios (Ezzamel, Mar-Molinero & Beecher, 1987:466). This non-normality

was attributed *inter alia* to the simple fact that many financial ratios have a lower limit of zero and effectively no upper limit (Ezzamel *et al*., 1987:466); the nature of the interrelationship between the components of the ratios (Barnes, 1982:51); and to the existence of outliers (Ezzamel *et al*., 1987:466; So, 1987:491).

Removing the outliers does not guarantee normality (Ezzamel *et al*., 1987:479; So, 1987:491), nor does the presence of outliers necessarily reduce the usefulness of a data sample. On the contrary, outlying companies may be valuable as they might exhibit otherwise unquantifiable features (*e.g.* monopoly power) (Horrigan, 1983:687).

While the transformation of raw data (through square roots or natural logarithms, *etc)* may somewhat reduce skewness and kurtosis, it does not guarantee normality either (Ezzamel *et al.*, 1987:479). Statistical models would first need to be tested for robustness towards data transformation before they could be run with transformed data (Ezzamel *et al*., 1987:479) – this creates additional risk for unreliable statistical results. More importantly, the transformation of data risks changing the interrelationships between the variables (Barnes, 1982:57) and, in so doing, losing the essence of the original data.

In a market environment where there are few companies, most of which differ widely in size (such as in South Africa), outliers are difficult to identify and skewness is unavoidable (Cahan, Courtenay, Gronewoller & Upton, 2000:1296). The non-normal distribution of the research variables observed in Table 3.1. is to be expected. The consequences of this non-normality which was observed (albeit as expected), were addressed conservatively by using a combination of the aforementioned techniques:

- The median was used to discuss central tendencies, rather than the mean (refer to section 3.2. and sub-section 3.3.2.)
- The size variable, market capitalisation, was transformed using natural logarithms (refer to sub-section 3.3.3.)

- The data was winsorised to reduce the effect of outliers (refer to sub-section 3.4.5.3.)
- The statistical results were adjusted for multicollinearity and heteroskedasticity to further reduce the effect of non-normality (refer to sub-section 5.2.3. and 5.2.4.)

These techniques were expected to significantly improve the statistical integrity of the regression results, without any excessive manipulation of the underlying data.

CHAPTER 4: DEVELOPMENTS IN THE MARKET VALUE-BOOK VALUE GAP AND IN HUMAN CAPITAL EFFICIENCY

4.1. H1: MARKET VALUE-BOOK VALUE GAP

The concept that most companies experience a difference between the book value of their net assets and their market values has been researched in great depth internationally. Locally, however, the existence of a South African market value-book value gap has largely been accepted as fact, without the same degree of verification through empirical research.

One of the research objectives of this study was to empirically confirm whether there is actually a growing disparity between the book value and market value of JSE listed companies listed in South Africa:

H1: The market value-book value gap of South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

The examination of H1 is intended as a high level analysis only, explored only as an introduction to the study of the association between human capital efficiency and corporate performance. M/B of each company was calculated as the product of the listed share price and the number of shares in issue, divided by the difference between the book value of total assets and total liabilities. The median M/B of each industry was then analysed over the period. The results of the investigation into H1 are presented in Figure 4.1. and Table 4.1.

Figure 4.1. Movement in M/B

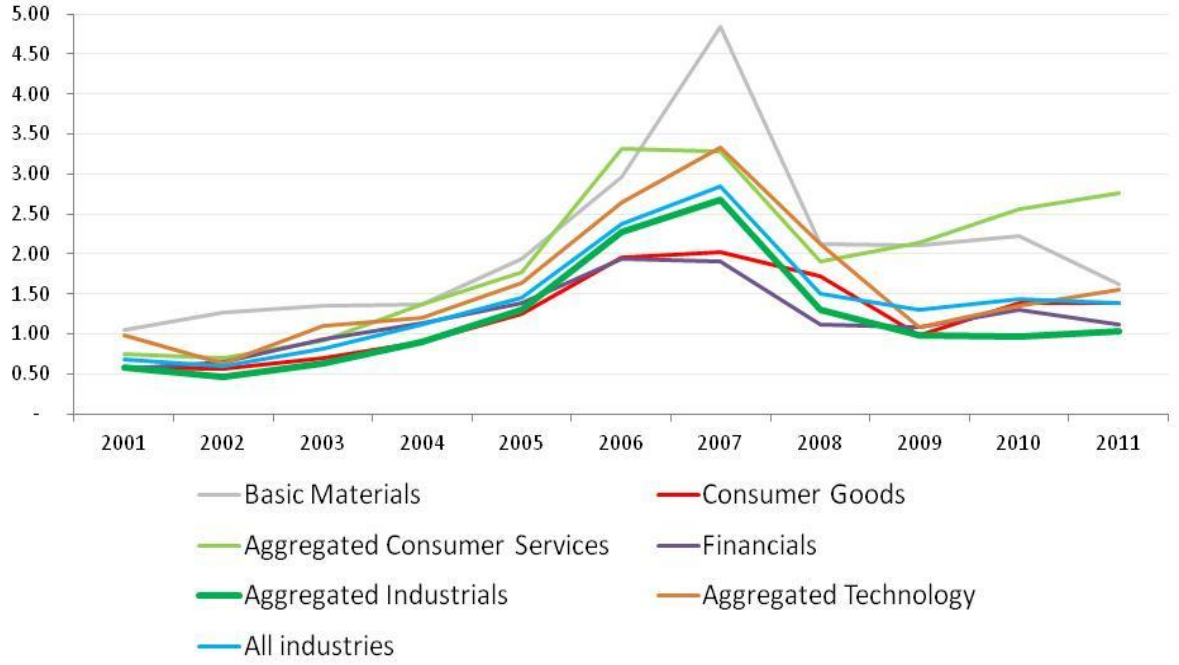


Table 4.1. Median industry M/B

	All industries	Basic Materials	Consumer Goods	Aggregated Consumer Services	Financials	Aggregated Industrials	Aggregated Technology
2001	0.68	1.05	0.57	0.76	0.56	0.57	0.98
2002	0.60	1.26	0.56	0.70	0.65	0.47	0.64
2003	0.81	1.36	0.70	0.91	0.93	0.63	1.10
2004	1.12	1.36	0.91	1.38	1.14	0.91	1.21
2005	1.46	1.94	1.26	1.77	1.39	1.30	1.64
2006	2.38	2.96	1.96	3.32	1.95	2.27	2.65
2007	2.85	4.85	2.02	3.28	1.90	2.67	3.33
2008	1.50	2.12	1.71	1.91	1.12	1.30	2.12
2009	1.30	2.11	0.98	2.15	1.09	0.98	1.09
2010	1.44	2.23	1.39	2.56	1.30	0.97	1.36
2011	1.39	1.62	1.38	2.76	1.13	1.04	1.55

The M/B of the overall JSE doubled from 0.68 in 2001 to 1.39 in 2011. The M/B of all six industries increased since 2001, with a marked jump from 2006 to 2007 and a dramatic drop from 2007 to 2008. Thereafter, M/B appears to have held steady, with only Aggregated Consumer Services showing a moderate increase after 2008. The M/B of Basic Materials appears to be the most volatile, showing the steepest growth in the period leading up to 2007 and the steepest decline in

M/B in the years thereafter. The increase in M/B in South Africa over time echoes the results of earlier US studies (Brown *et al*., 1999:1047; Lev, 2001:9; Lev & Zarowin, 1999:383).

Macroeconomic statistics for South Africa – the quarterly growth in gross domestic product (GDP) (Statistics South Africa, 2012a:9); Rand/US dollar exchange rates (South African Reserve Bank, n.d.) and gold prices per ounce (obtained from Bloomberg financial database) – are presented in Figure 4.2. to Figure 4.4.

Figure 4.2. Quarterly GDP growth rate

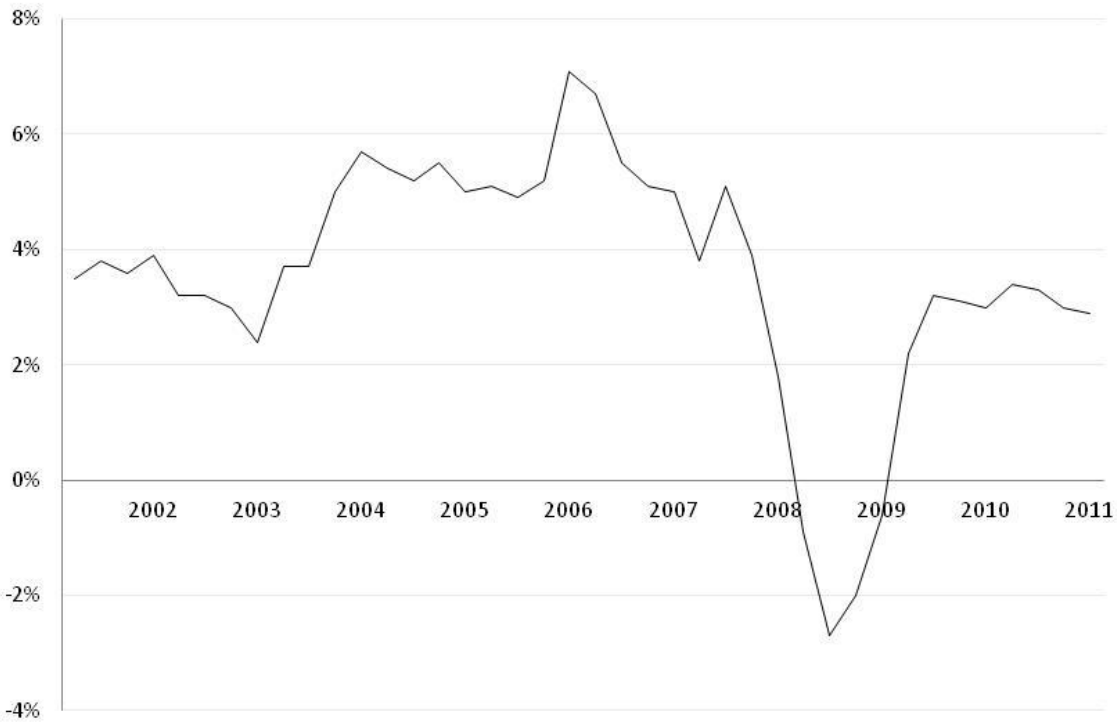


Figure 4.3. Average Rand/US dollar exchange rate

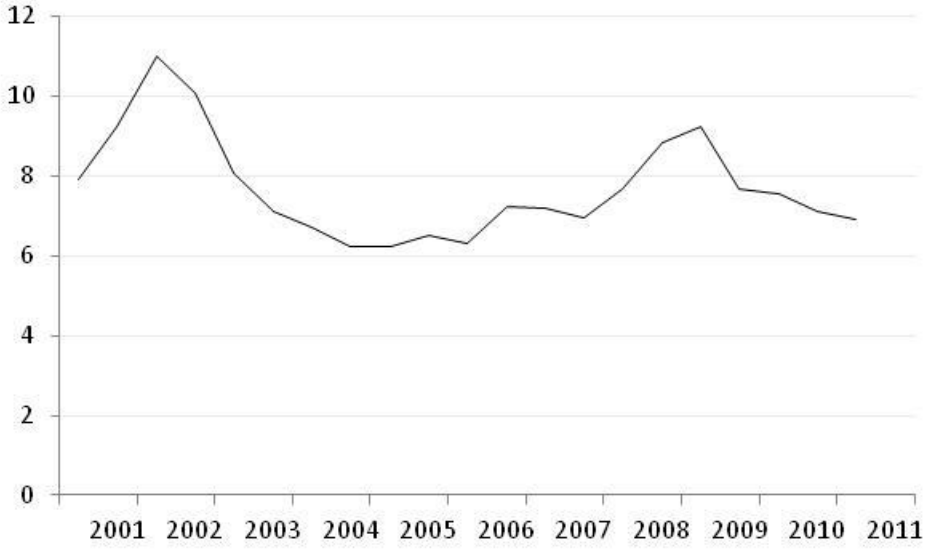
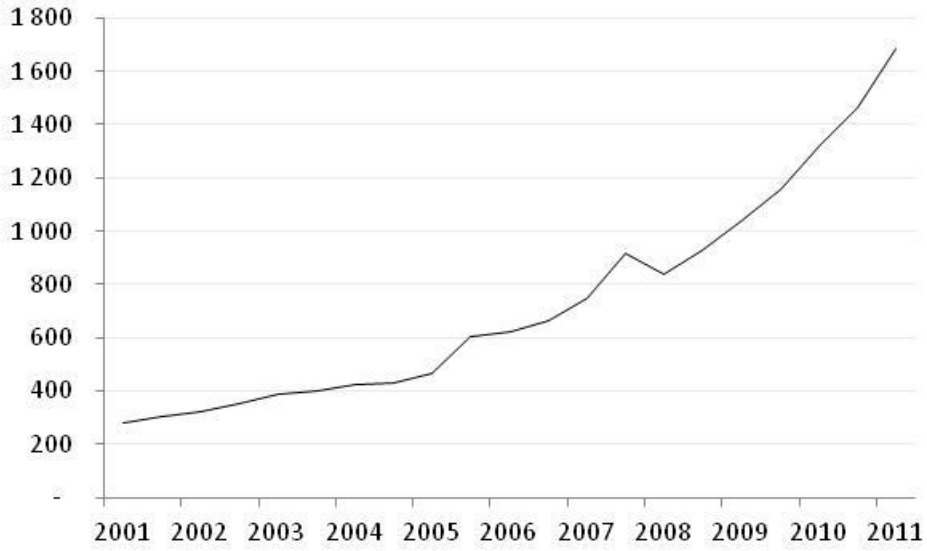


Figure 4.4. US dollar price of gold per ounce



The decrease in M/B observed from 2007 until 2009 is most likely attributable to the global financial crisis of 2007. Prior to the global financial crisis, quarterly GDP growth had increased steadily before peaking at 7.1% in the fourth quarter of 2006 (refer to Figure 4.2.). Market values had risen as interest rates fell over the previous years (South African Reserve Bank, n.d.), resulting in the rise in M/B.

After the crisis hit, South Africa experienced a period of general economic slowdown in 2007 and 2008, as international trade declined and credit availability tightened. Like other stock exchanges, the JSE was hit hard. Share prices began to fall steadily, as the uncertainty of turnaround destroyed already shaky investor confidence.

Eventually the GDP began to decline, with negative GDP growth experienced in 2009 - refer to Figure 4.2., derived from Statistics South Africa (2012a:9). Although the recession lasted only one year (2009), the South African economy had been in a state of contraction for three years (from 2007 until 2009). The South African Rand depreciated from 2008 until midway through 2009, with the US dollar costing R10.59 at the height of the recession (refer to Figure 4.3.). Market values of companies fell dramatically in comparison to their book values, resulting in the decline in M/B from 2007 to 2009.

A third of the Basic Materials industry is comprised of companies that specialise in the mining of gold, platinum and other precious metals. The remaining two thirds focus on chemicals and other mining activities. The extraordinary peak in M/B observed in Basic Materials in 2007 and subsequent decline 2008 are attributable to the sensitivity of the industry to the gold price and the Rand/US dollar exchange rate. The US dollar price per ounce of gold increased almost steadily from 2001 until 2011 (refer to Figure 4.4.). When combined with rising Rands earned per US dollar, the rising US dollar gold price resulted in M/B increasing from 2002 to 2007. Coupled with the temporary drop in the US dollar gold price in 2008, the sharp fall in the Rand/US dollar exchange rate in 2008 resulted in the steep decline in M/B observed in Basic Materials in 2008.

After 2009, the decline in the M/B of most industries stabilised – with the exception of Aggregated Consumer Services, whose M/B actually increased. While the distinctive growth in M/B experienced after 2009 in the Retail sector is most likely due to the effect of the steady appreciation of the Rand on imports (refer to Figure 4.3.), the growth of M/B in the Tourism sector is attributed to the effect of the build-up to, and finally hosting of, the Soccer World Cup in June

2010. The Tourism sector and Retail sector constitute approximately 25% and 45% of the Aggregated Consumer Services industry respectively.

The annual median M/B of all companies listed on the JSE fluctuated between 0.60 and 2.85 (refer to Table 4.1.) from 2001 to 2011. This is low in comparison with the US, where market value was approximately seven times book value in the early 2000's (Lev, 2001:9). The relatively small difference between market valuation and book value of South African companies was found to be easily attributable to macroeconomic determinants, leaving little room for the market value-book value gap to be explained by other factors – such as human capital efficiency. Therefore, it was considered highly probable that the multiple regressions performed for H3 and H4 would expose a weak relationship between VAHU and market performance.

In conclusion, the hypothesis H1 may be accepted – with a limited qualification. Other than a temporary narrowing of the gap due to the global financial crisis in 2007 (and subsequent recession in South Africa), the market value-book value gap of South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

4.2. H2: GROWTH IN VAHU

As previously mentioned, minimal research has been done to monitor the progress of human capital efficiency in South Africa over time. Therefore, the second objective of this study was to empirically confirm whether human capital efficiency in South Africa is improving. The following hypothesis was tested:

H2: Human capital efficiency in South African listed companies increased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

The results of the investigation into H2 are presented in Table 4.2.

Table 4.2. Median growth in VAHU (MGV)

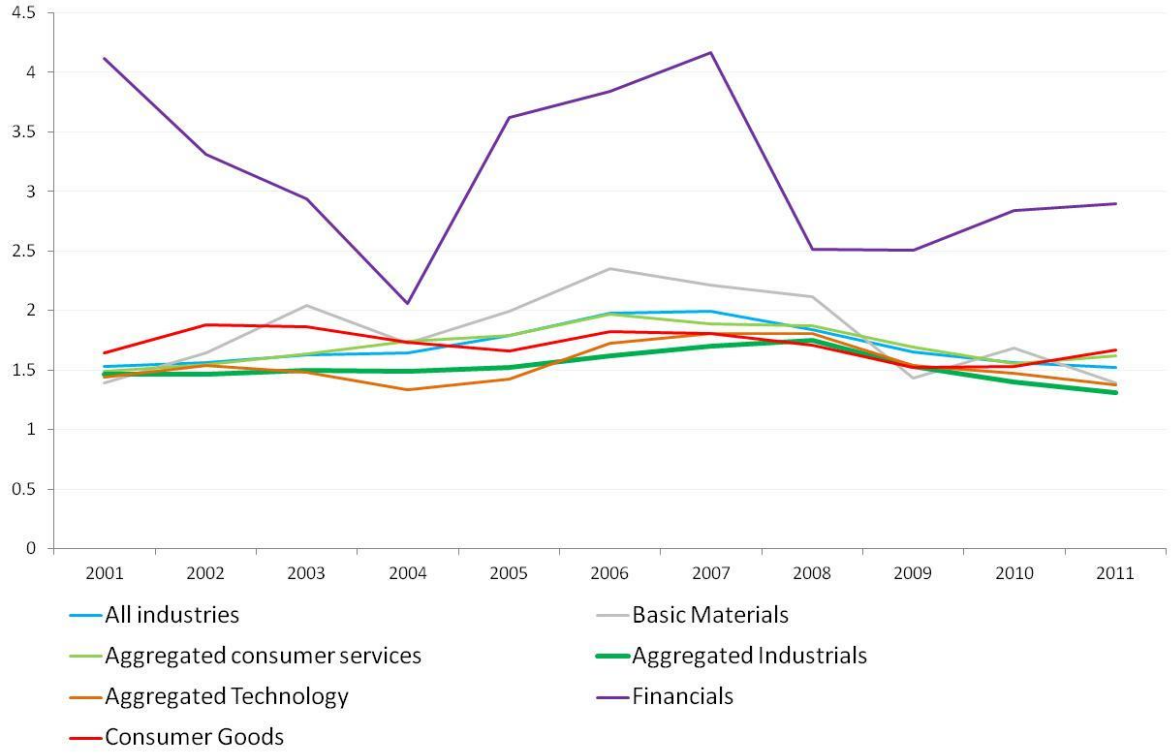
	2001 to 2011
All industries	-1.822%
Basic Materials	-1.523%
Consumer Goods	-0.354%
Aggregated Consumer Services	0.331%
Financials	-5.341%
Aggregated Industrials	-2.993%
Aggregated Technology	-1.165%

For the period under review (financial year-ends falling in the period 31 December 2001 to 30 June 2011), the MGV was negative for the JSE as a whole and for all industries – with the exception of Aggregated Consumer Services which reflected a negligibly positive MGV of 0.331% . This disproves H2 – for the financial year-ends falling in the period 31 December 2001 to 30 June 2011, VAHU declined in almost all industries in South Africa. It is interesting to note that the industry which is traditionally expected to have the heaviest reliance on human capital to generate value-added (*i.e.* Financials), showed the steepest decline in VAHU over time, with a MGV of -5.341%.

In an ideal world, it is expected that the human capital efficiency in a developing country would show steady improvement as the government's investment in better education improves year-on-year. A better educated, trained and skilled workforce could command higher compensation, while at the same time delivering higher quality and quantity of output and thereby generating more value-added. Ultimately, improvements in these factors are expected to result in improved human capital efficiency. This may not be the case in the South African context, unfortunately, where human capital efficiency is instead decreasing over time.

To further pinpoint reasons for South Africa's declining VAHU, graphs were prepared showing the movement in median VAHU per industry over time. Refer to Figure 4.5.

Figure 4.5. Movement in industry VAHU



Two periods of deeper decline were apparent – 2002 to 2004 and 2007 to 2009. These periods of decline roughly coincided with the aftermath of the terrorist attack on the United States on 11 September 2001 (9/11) and the global financial crisis in 2007. It was also clear that although Financials showed the greatest variability in VAHU (with the sharpest periods of growth and decline) over the entire period, it was also the industry with the highest level of human capital efficiency.

The negative MGV for the overall JSE supports Firer and Williams' (2003:357) suggestion, that, due to the South African preoccupation with exploiting physical assets, further investments in technological advances were simply favoured by companies instead of further investment in their human capital. This study, however, proposes three additional factors which may have contributed to South Africa's falling human capital efficiency:

- South African companies are unable to generate value-added effectively from their available resources.

- The compensation paid to the South African workforce is too high in relation to the level of output delivered.
- The South African workforce is not sufficiently educated, trained and skilled.

Inability to generate value-added

Human capital efficiency is the ability of human capital to generate value. In times of extreme unpredictability and market instability when all resources struggle to generate value, human capital efficiency would naturally also be negatively affected. However, human capital efficiency would be most adversely impacted in those industries which rely more heavily on their human capital to generate value than other resources. It is not surprising that in the post-2007 and post-9/11 time periods which were plagued with market instability, all industries experienced some decline in VAHU – with Financials being the industry most sensitive to the market unpredictability, followed by Basic Materials. Although the variability in VAHU in these industries may be partially explained by the inability of those companies to effectively translate their pool of resources into value-added, it is unlikely to be the root cause for human capital efficiency decreasing overall in South Africa over the time period. This is highlighted by reports from Statistics South Africa that, after adjusting for inflation, the value-added in the South African economy (a sub-component of GDP) more than doubled from 2002 until 2011 (Statistics South Africa, 2012a:12).

Compensation is too high in relation to level of output delivered

The appropriateness of employee remuneration levels, given their level of output, is difficult to measure, yet it remains a very important indicator to consider in the South African economy. The GDP in South Africa increased by 253% from December 2002 until December 2011 (Statistics South Africa, 2012a:12). This is incommensurate with the growth in annual earnings of 385% over the same period (Statistics South Africa, 2002a:10; Statistics South Africa 2012b:7). Comparable data was not available prior to 2002. These statistics were not adjusted for inflation and serve only as a rough, high-level comparison. Even so, the difference between nominal GDP growth and nominal earnings growth is alarming. At the very least, it lends credibility to the assertion that the

compensation levels paid to South African employees are becoming too high in relation to the level of output delivered.

The significantly higher growth in employee compensation may be partly attributed to the 'strike' culture' in South Africa's heavily unionised labour force. Section 23 of the South African constitution (Republic of South Africa, 1996) grants every employee the right to strike, albeit under the principle of 'no work, no pay' (Republic of South Africa, 1995). Even though striking workers are not paid for the duration of the strike, the impact on a business can be far-reaching as the cost of downtime (*i.e.* lost income and consequent future delays) can outweigh the cost savings made by not paying strikers. The number of working days lost due to industrial action increased from 953 610 in 2001 (Republic of South Africa, 2003:12) to 2 806 656 in 2011 (Republic of South Africa, 2011:14).

The long-term consequences of industrial action are the wage settlements that are reached with workers in order to end the strikes. The collective bargaining power of South African trade unions is strong with respect to concluding favourable wage agreements, as 29% of the formally employed labour force is affiliated with a trade union (Statistics South Africa, 2012c:30). By 2011, 99.6% of all industrial action in South Africa was sanctioned and co-ordinated by trade unions (Republic of South Africa, 2011:53). Wage settlements concluded in 2011 ranged from annual increases of 6% to 14%, with a median of 8% (Republic of South Africa, 2011:24). Comparative data on wage settlements prior to 2005 was not available. These wage agreements are sometimes binding for several years, regardless of what is happening in the South African economy. South Africa practises inflation targeting, with the annual inflation rate held between approximately 3% and 6%, by manipulating interest rates (South African Reserve Bank, 2000). It is clear that the increase in compensation levels forced through industrial action always exceeded inflation. The cash flow pressure resulting from this disparity contributed to the comparatively lower growth in GDP by eroding the value that could have been generated from other resources. Lower value-added, with rising wages, has negative implications for human capital efficiency.

Workforce is not sufficiently educated, trained and skilled

The education statistics for the South African labour force employed as at the end of December 2001 and 2011, were obtained from the Labour Force Survey prepared by Statistics South Africa (Statistics South Africa, 2002b; Statistics South Africa, 2012c) and are presented in Figures 4.6., 4.7. and 4.8.

Figure 4.6. Labour force by age

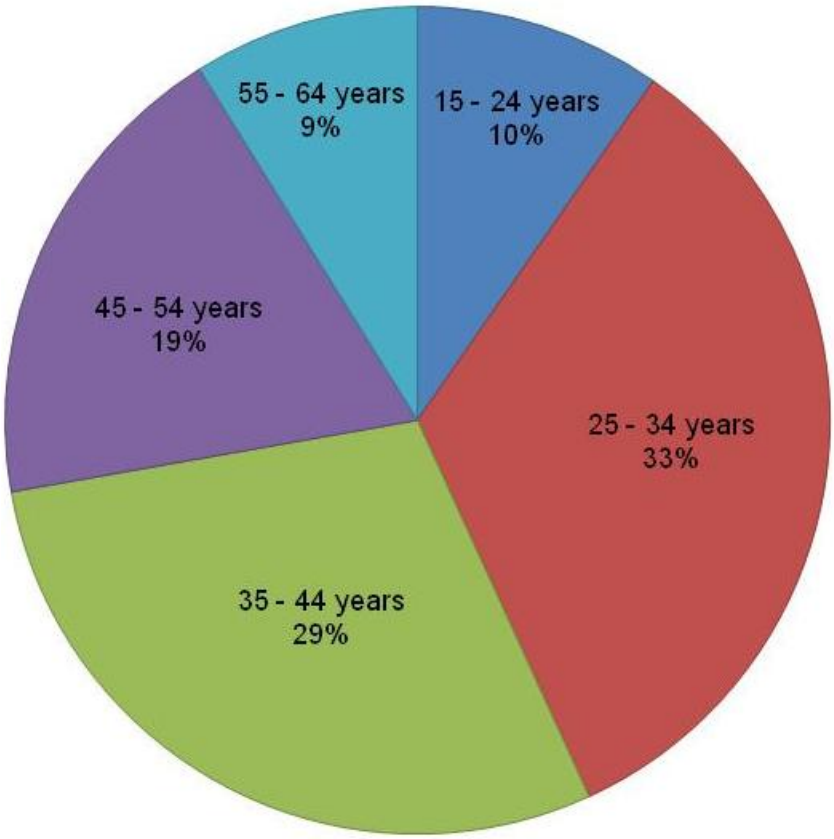
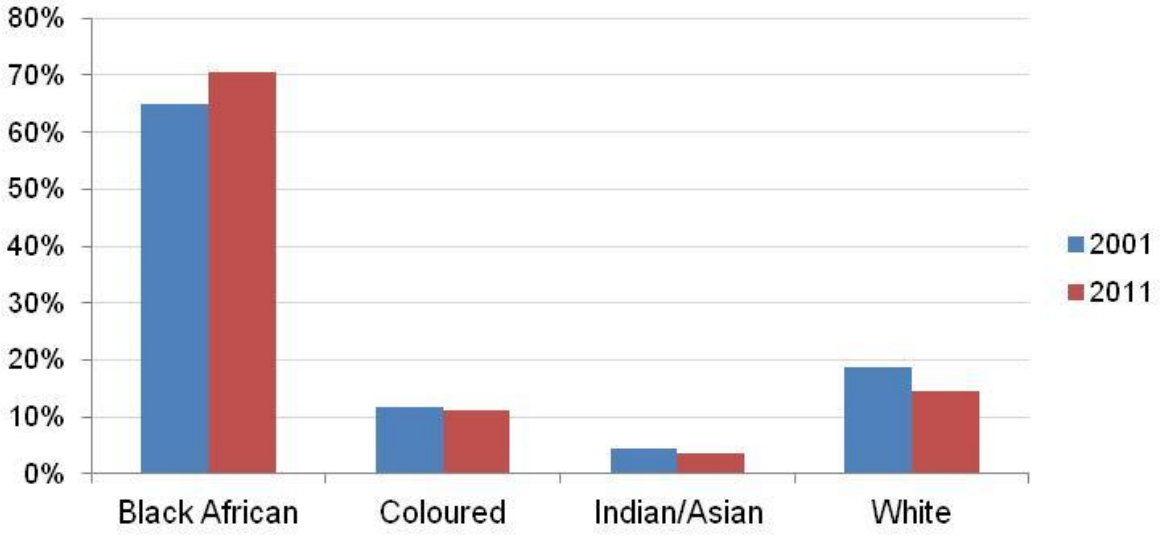


Figure 4.7. Labour force by population group



Much negativity surrounds outcomes-based education (OBE) in South Africa. The somewhat 'new' education system focused on student-centred learning, with performance measured in terms of expected proficiencies and was first implemented in Grade R to Grade 9 in 2002, then rolled out to Grades 10 to 12 in 2004 (Republic of South Africa, 2002:2-3). It has been blamed for many of the problems experienced in the South African school system. However, it is clear from the ages of the labour force in 2011 (refer to Figure 4.6.) that, at most, only 10% of the workforce employed during the period under review could ever have been exposed to OBE. The chronology dictates that most of the workforce employed during the period under review in this study is the product of the earlier education environment which existed under Apartheid. The effect of Apartheid on the labour market is further amplified by the fact that previously disadvantaged population groups constitute approximately 81% (in 2001) to 85% (in 2011) of the workforce under review (refer to Figure 4.7.).

Identifying the reasons which lead to the South African workforce being inadequately educated, is not the matter under investigation in this study. It is proposed that poorly skilled and trained workers may contribute to the decline in human capital efficiency. These findings were presented merely to demonstrate *why* it can reasonably be concluded that the South African workforce is inadequately educated and poorly skilled.

Figure 4.8. Labour force by education level completed

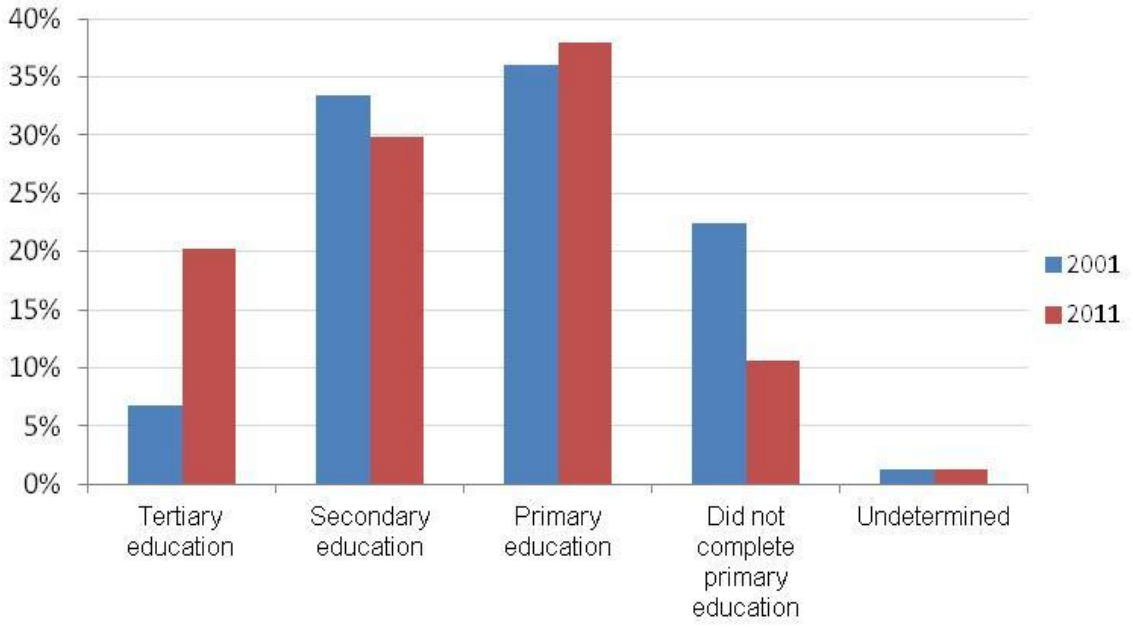


Figure 4.8. depicts the proportion of South African employees who completed primary, secondary or tertiary education. The number of workers with a college diploma or university degree increased dramatically from 6.8% to 20.2%. This was naturally coupled with a decrease in workers with their highest education at secondary level (from 33.5% to 29.9%). Together, these factors point to a greater portion of the working population having a tertiary education in 2011 than in 2001. Similarly, a greater portion of the workforce was found to have a primary education in 2011 than in 2001. The increase in primary level educated workers is directly related to the decline in those who did not complete primary education. Overall, it appears that the *level* of education achieved by the South African workforce increased.

Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) measures the quality of education using four basic indicators - basic learning materials, mathematics textbooks, learner-teacher ratios and class size (SACMEQ, 2011:1). The national benchmarks determined (SACMEQ, 2011:3); the results for South Africa in the SACMEQ II report conducted in 2000 (Moloi & Strauss, 2005) and in the SACMEQ III report conducted in 2007 (Moloi & Chetty, 2010), are presented in Table 4.3. South Africa did not participate in SACMEQ I and comparable data does not appear to be available prior to 2000.

Table 4.3. SACMEQ Quality of education indicators

	Benchmark	2000	2007
% of learners with basic learning materials	100.0%	68.0%	82.0%
% of learners with mathematics textbooks	100.0%	41.0%	36.0%
Learner-teacher ratios	<40	37	37
Class size	<40	42	44

According to the results in Table 4.3., the South African education system consistently fell short of almost all targets regarding the quality of education. Although more students were provided with a ruler and something to write with (and write on), the learner-teacher ratio, class sizes and provision of mathematics textbooks worsened from 2000 to 2007. Therefore, it appears that, although the overall levels of education achieved by the South African labour force appear to have increased, the *quality* of education actually weakened.

South Africa's GCI ranking in the Global Competitiveness Reports, issued annually by the World Economic Forum, fell from 57th in 2008 to 75th in 2011 (GCR 2008-2009, 2008:302; GCR 2010-2011, 2010:302) in the area of Higher Education and Training. This serves as further proof of the deterioration of the quality of education of South African employees.

It is expected that the implications of poor basic education for the South African workforce and human capital efficiency, will continue to be felt for many years, because in 2010, 40.2% of students were considered non-numerate and 27.2% were considered to be non-readers (Moloi & Chetty, 2010:56). Our future workforce might not be able to interpret meaning in a short and simple text, and might only be able to perform basic calculations and simple shape recognition.

In conclusion, H2 was disproved – the human capital efficiency of South African companies decreased for the financial year-ends falling in the period 31 December 2001 to 30 June 2011. This decline might be attributable to the trade-off between tangible and human capital experienced in South Africa; excessive compensation levels imposed by the ‘strike’ culture in South Africa; poor

education and possibly the overall economic declines post-9/11 and post-2007. Ultimately, it is not clear where the problem in the growth of human capital efficiency lies, but the lack thereof creates new avenues for further research into reasons for the decline – *i.e*. the determinants of human capital efficiency.

CHAPTER 5: THE IMPACT OF HUMAN CAPITAL EFFICIENCY ON CORPORATE PERFORMANCE

5.1. INTERPRETING REGRESSION OUTPUTS

The goal of a regression analysis is to produce an equation that explains the behaviour of a variable (the dependent variable), using the behaviour of at least one other variable (the independent variables). Mathematically, the desired outcome looks like this:

$$DEPENDENT = \alpha + \beta_1(INDEPENDENT1) + \beta_2(INDEPENDENT2) + \beta_3(INDEPENDENT3) + \varepsilon$$

Because the dependent variable may be a product of countless other factors besides just *that* specific independent variable being tested, the effect of these other unnamed factors is encompassed in the error term, ε. Each independent variable has its own β, which should range from -1 to 1 – this is the standardised beta coefficient and represents the strength and direction of the relationship between the independent and dependent variables. Standardisation allows for comparison of explanatory power between the independent variables (VAHU and the control factors) within a *single* regression. Due to the existence of the error term, the strength measured by β refers to the *extent of the influence* which the independent variable has over the dependent variable's behaviour and not to *quantification* of the impact.

A β of 0.8 for *INDEPENDENT1* and -0.2 for *INDEPENDENT2,* means that an increase in *DEPENDENT* is more likely to be related to an increase in *INDEPENDENT1* than a decrease in *INDEPENDENT2*. It does not mean that *DEPENDENT* will increase by 0.8 units and decrease by 0.2 units if *INDEPENDENT1* and *INDEPENDENT2* increase by one unit respectively. Note that the β of an independent variable in one regression and the β of the same independent variable in another regression, cannot be used to compare the explanatory power of that independent variable with respect to the dependent variable across two regressions.

The purpose of this study is limited to confirming the existence of a relationship between higher VAHU and higher measures of financial and corporate performance. The goal is neither to confirm that VAHU has a *substantial* impact, nor to confirm that VAHU is the *most* influential variable. Given the research objectives of this study, the direction of the β coefficients is what matters most – the magnitude of the β coefficients is irrelevant for the purposes of this study.

The nature of econometrics is such that any one variable may be influenced by countless factors in combination. It is also important to understand that the regressions performed in this study do not attempt to establish a *causal* relationship between VAHU and corporate performance, but to confirm whether VAHU is, in fact, a contributing factor to corporate performance. A positive β coefficient for VAHU does not mean that higher VAHU necessarily results in good corporate performance – it means that companies with higher VAHU are more likely to display higher corporate performance than lower corporate performance.

β is clearly the key regression output for an investigation into the relationship between one variable and another and, therefore, it is important that β be reliably estimated. The t statistic represents the degree of precision with which β has been measured. However, the t statistic is difficult to interpret in isolation as it is a relative value. Instead, the t statistic is used to determine its p value, which is easier to interpret and gives a clearer indication of the significance of the β estimation. Stated simplistically, the p value relating to an independent variable represents the probability that the behaviour of the dependent variable is due to random effects and not due to the independent variable. The lower the p value, the more significant the estimation of β. $(1 - p)$ represents the confidence interval for the β estimation. For example, if the p value is 0.048, the β estimation is significant at $p<0.05$ and one can be 95% confident in its reliability.

For the purposes of this study, the statistical results were considered reliable when a confidence level of at least 90% was observed. Therefore, results may be significant at $p<0.10$, $p<0.05$ or $p<0.01$. When interpreted in the context of this study, a regression which produces β coefficients which are not statistically significant (*i.e.* p value is 0.10 or higher) implies that the independent

variable (VAHU) has little explanatory power with respect to the dependent variable and the hypothesis (H3 or H4) is rejected.

The R-squared of the regression represents the proportion of the dependent variable's behaviour which is explained by all the independent variables collectively. The *β* coefficients of individual variables may be low, while their combined explanatory power (R-squared) may be greater. Loosely explained, the *F* value represents the degree of precision with which the entire regression model was measured and is also difficult to interpret in isolation. The *F* value has its own *p* value, which is easier to interpret and paints a clearer picture of the significance of the regression model as a whole. Consequently, R-squared and the *F* value (and the significance thereof) are less important in an investigation focused on the impact of one *individual* independent variable on the dependent variable.

Finally, the intercept (*α*) is not of great importance *per se* in defining the relationship between the variables and is usually not discussed in the interpretation of the regression results. In summary, the *β* coefficients of the independent variables reflect the strength and direction of their relationship with the dependent variable and the *p* value is an indication of confidence in the reliability of the *β* coefficients (*i.e.* their statistical significance).

5.2. ADDRESSING POTENTIAL CONCERNS AND STATISTICAL LIMITATIONS

5.2.1. Data integrity tests

As discussed in Chapter 3 (refer to sub-section 3.4.3.), the integrity of company data obtained from BFA and used in the calculation of the research variables, was tested by comparing a sample of data points to the published financial statements. All differences of 5% or less between the individual items in the BFA and the published financial statements, were noted as being due to rounding differences and were considered immaterial to the calculation of the overall error rate. All differences greater than 5% were classified as genuine errors. Eighteen errors were identified in the sample of 300 financial statement data points. The overall error rate of 6% is not considered

significant and it was positively concluded that the research data obtained from BFA is valid, accurate and complete. The sampling method used and interpretation of the error rate was discussed with the CSC.

5.2.2. Survivorship bias

The control regressions performed to identify potential survivorship bias are described in sub-section 3.4.2. Only minimal differences in the R-squared were identified when the control regressions were run using only companies listed as at 30 June 2011 (*i.e.* currently listed companies). The largest differences identified were increases of 4.3 percentage points and 1.9 percentage points respectively, when testing the contemporaneous (H3-c) and future impact (H4-c) of VAHU on HEPS in Aggregated Technology (refer to Appendix A). This implies that if only the currently listed companies had been tested, it would have resulted in minimal survivorship bias. It also indicates that, overall, including delisters did not adversely affect the explanatory power of the regression models. It may be argued that while limiting the study to currently listed companies would not result in any survivorship bias, including delisters would not harm the study and could, in fact, strengthen the outcome of the study by increasing the size of the research population and scope of testing. Therefore, the remainder of the study was completed using both listed companies and delisters.

5.2.3. Multicollinearity

As discussed with the CSC, there is no consensus on the degree of correlation between predicator variables which indicates the existence of multicollinearity in panel data, nor is there a best measure of multicollinearity in panel data. Tabachnick and Fidell (1996:86), however, suggest that the *problems* in estimating the standard error caused by multicollinearity are only experienced at correlations of 0.9 and higher or -0.9 and lower. Therefore, for the purposes of this study, pairs of variables with correlation coefficients within this problematic range were deemed to be risky for use (due to multicollinearity). The results of the bivariate pairwise correlation analyses performed on the data used in the H3 and H4 regressions are presented in Table 5.4. and Table 5.8. respectively.

The correlation coefficients between the independent variables (*i.e.* VAHU and the control factors) ranged from 0.128 to 0.445 in the H3 data and from 0.139 to 0.424 in the H4 data. These correlation coefficients do not fall in the identified range of risk relating to multicollinearity. Although some of the correlation coefficients are not significant at $p<0.05$, this does not affect the validity of those correlation coefficients. When used to detect multicollinearity in time series data, the key factor is the *strength* of the dependencies identified in the bivariate correlation matrix and not the statistical significance thereof (Pitard & Viel, 1997:529). Therefore, multicollinearity does not appear to be a concern in the data used in the H3 and H4 regressions.

5.2.4. Heteroskedasticity

The results of the Breusch-Pagan test for heteroskedasticity are presented in Appendix B. The bias in the standard error caused by heteroskedasticity is easily remedied through robust covariance matrix estimation (Hayes & Cai, 2007:714). The regression results presented for H3 in Figure 5.1 and Appendix F, and for H4 in Figure 5.2 and Appendix G, were obtained after correcting for heteroskedasticity in this manner – thereby removing any related bias. The conclusions of the Breusch-Pagan test are therefore rendered extraneous and do not need to be discussed in the analysis of the regression results. For the sake of completeness, however, the results of the test have been presented in Appendix B.

5.2.5. Outliers

The descriptive statistics for the winsorised data used in H3 and H4 are presented in Table 5.2. in sub-section 5.3.1. and Table 5.6. in sub-section 5.4.1. Note that the minimum values and maximum values of each industry never exceed those of the overall JSE – this is due to the process of capping outliers to three standard deviations from the overall JSE mean (*i.e.* winsorising). Comparative descriptive statistics are presented for the raw, unadjusted data of H3 and H4 in Appendix C, in order to visibly comprehend the positive and reductive effect of this winsorising process on the standard deviations of the variables.

5.3. H3: CONTEMPORANEOUS IMPACT OF HUMAN CAPITAL EFFICIENCY

As mentioned previously, the primary objective of this study is to empirically confirm whether the financial and market performance of listed companies in South Africa can be explained as an outcome of human capital efficiency, by researching the following hypothesis:

H3: Higher human capital efficiency is associated with higher financial and market performance contemporaneously, in South African listed companies for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

This hypothesis was tested using the following regression models:

$$ROA^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \varepsilon \quad (H3\text{-}a)$$

$$GR^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \varepsilon \quad (H3\text{-}b)$$

$$HEPS^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \varepsilon \quad (H3\text{-}c)$$

$$M/B^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \beta_5(ROE^{t}) + \varepsilon \quad (H3\text{-}d)$$

$$TSR^{t} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t}) + \beta_3(DR^{t}) + \beta_4(IND) + \beta_5(ROE^{t}) + \varepsilon \quad (H3\text{-}e)$$

5.3.1. Descriptive statistics

The number of companies in the research population for H3 and H4 are presented in Figure 3.2. Company years per industry are shown in Table 5.1. Aggregated Industrials is the largest industry on the JSE, measured by the number of companies listed over the research period and by company years included in the research population. Aggregated Technology is the smallest industry, using both measures of size.

Table 5.1. Company years used in H3

	ROA	GR	HEPS	M/B	TSR
All industries	1507	1507	1507	1506	1506
Basic Materials	251	251	251	211	250
Consumer Goods	193	169	193	168	192
Aggregated Consumer Services	307	353	353	306	352
Financials	254	302	302	253	301
Aggregated Industrials	419	419	419	418	418
Aggregated Technology	131	154	131	130	153

The descriptive statistics for the research population used in H3 for the overall JSE are presented in Table 5.2.

Table 5.2. Descriptive statistics for H3

	H3 - All industries			
	Median	Minimum	Maximum	Std Dev
VAHU	1.724	-0.325	4.434	1.190
ROA	0.175	-0.483	0.959	0.139
GR	0.129	-0.306	0.601	0.227
HEPS	71.300	-250.786	570.392	205.295
M/B	1.441	0.000	5.135	1.589
TSR	0.168	-0.772	1.191	0.491
LMC	14.076	4.564	20.285	2.438
DR	0.407	0.000	0.978	0.253
ROE	0.299	-1.152	3.440	0.340

The median VAHU in the JSE implies that overall, South African companies are able to generate value from their human capital. The median TSR of 16.8% is far higher than the prime rate in South Africa over the period under review. The average annual growth in revenue of 12.9% is considerably higher than the target inflation rate in South Africa of 3% to 6%. In addition, the median ROA of the overall JSE was reasonably high at 17.5%. These conditions all attest to the financial health of South African listed companies over the period under review. This was interpreted favourably by investors, who generally considered companies to be worth more than the book value of their reported net assets.

Difficulties experienced in investing in emerging markets include lack of transparency, liquidity, concerns about corporate governance and corruption (Bruner, Conroy, Estrada, Kritzman & Li, 2002:319). Improving corporate control and the degree of governmental corruption are factors that have a positive market valuation effect – conversely, companies in more corrupt countries with weaker information environments tend to reflect lower M/B (Bruner *et al*., 2002:315). This may explain why the average M/B on the JSE over the period was 1.441 in H3 and 1.402 in H4, in comparison with the US in the early 2000's, where companies were valued more than seven times their book values (Lev, 2001:9).

Refer to Appendix D for the descriptive statistics of the individual industries in the H3 data. Across the individual industries, the median TSR ranged from 0.125 to 0.254 and the median M/B ranged from 1.129 to 2.047 – with Aggregated Consumer Services being considerably higher than the rest for both performance indicators. The median ROA in the individual industries ranged from 0.094 for Financials to 0.215 for Aggregated Consumer Services. The median GR in the individual industries ranged from 0.085 for Consumer Goods to 0.142 for Aggregated Consumer Services. Aggregated Technology earned the lowest average HEPS (15.35 cents) over the period, while Consumer Goods earned the highest (124.00 cents). Aggregated Consumer Services may be considered to display the greatest degree of financial and market performance, as it had the highest values of almost all the performance measures. None of the other industries were clearly distinguishable as the worst performing.

The median VAHU in H3 is presented per industry in Table 5.3. and is ranked in descending order.

Table 5.3. Median VAHU in H3

All industries	1.724
Financials	3.247
Basic Materials	2.042
Aggregated Consumer Services	1.709
Consumer Goods	1.695
Aggregated Industrials	1.524
Aggregated Technology	1.425

The median VAHU was highest in Financials, followed distantly by Basic Materials. The median VAHU in the other industries were lower and differed only marginally from each other. Financial companies in South Africa are best able to harness the power of their human capital to generate value and Aggregated Technology companies least able. This ranking echoes the movement in VAHU over the research period observed in H2 (refer to section 4.2.).

As discussed in sub-section 3.4.5.1., the average VAHU would be expected to be higher in Financials, Aggregated Technology and perhaps Aggregated Consumer Services. Conversely, the average VAHU in Aggregated Industrials, Consumer Goods and Basic Materials would intuitively be expected to be lower. The results presented in Table 5.3. are somewhat of a mismatch to the instinctive industry ranking in terms of the importance of human capital to value creation.

Due to the ever-evolving nature of the regulatory and legislative environment in the financial industry, as well as the ups and downs of the capital markets, financial companies are under considerable pressure to respond to these changes in order to maintain their competitive edge. Having highly skilled and knowledgeable employees who are able to keep up with and manage this environment, inspires consumer confidence in the competency of such companies. Mohiuddin *et al*. (2006:52), Goh (2005:391), Mavridis and Kyrmizoglou (2005:57), Mavridis (2004:110) and Muhammad and Ismail (2009:212) all confirmed the importance of human capital efficiency compared to physical capital efficiency in their studies of various sectors of the financial industry. Companies in the financial industry would, therefore, tend to have very high VAHU. This theory is confirmed in the context of South Africa, as Financials had the highest median VAHU and the greatest variability in VAHU (refer to Table 4.2. and Figure 4.5.).

Human capital efficiency was found to be higher than expected in Basic Materials and lower than expected in Aggregated Technology. Although the strike culture possibly contributed to the decline in VAHU in South Africa (refer to section 4.2.), it is ironic that the mining industry (which is historically the most susceptible to industrial action) has such a high VAHU. The unexpectedly high VAHU in Basic Materials is probably due partly to the very low wages paid per worker in the mining

sector and partly due to lowered employee costs due to the "no-work-no-pay" principle applied during industrial action. By 2011, the mining sector was responsible for 54% of all working hours lost due to industrial action in the country (Republic of South Africa, 2011:17). Although the workers in the mining sector are perceived to be 'unskilled labour' (*i.e.* lacking in expertise, skill and training), human capital efficiency is strong in Basic Materials, due to the ability of the 'unskilled' workforce to generate value despite being crippled by industrial action. The lower than expected VAHU observed in Aggregated Technology may be attributable to the nature of the knowledge capital in the industry. Many of the employees in the industry are involved in the research and development of future technologies, or are involved in pilot projects which ultimately do not become profit-generating. Their human capital costs may be incurred without related increases in value-added, resulting in the lower than expected level of VAHU.

The pairwise correlation analyses between the independent variable (VAHU), the control factors and the dependent variables in H3 are presented in Table 5.4. The correlations between VAHU and the control factors were previously discussed in the test for multicollinearity in sub-section 5.2.3. Moderate correlation between the dependent variables is considered acceptable and understandable as they are all measures of corporate performance. The remainder of the correlation analysis – between the dependent and independent variables, as well as between the dependent variables and control factors – serves as an introduction to the relationship between the VAHU and the dependent variables. Correlation coefficients which are too close to 0 denote minimal association between the variables, which implies that regression of the variables may yield minimal explanatory power.

Table 5.4. Correlation analysis for H3

	Independent variable	Dependent variables					Control factors		
	VAHU	ROA	GR	HEPS	M/B	TSR	LMC	DR	ROE
Independent variable									
VAHU	1.000								
Dependent variables									
ROA	0.489	1.000							
GR	0.193	0.223	1.000						
HEPS	0.328	0.313	0.081	1.000					
M/B	0.104	0.156	0.088	0.097	1.000				
TSR	0.141	0.273	0.110	0.156	0.136	1.000			
Control factors									
LMC	0.321	0.159	0.052	0.528	0.490	0.099	1.000		
DR	0.128	-0.150	0.044*	0.075	0.304	-0.139	0.196	1.000	
ROE	0.445	0.644	0.187	0.283	0.300	0.131	0.224	0.381	1.000

Note: Statistically significant at a 95% confidence level, unless marked with *

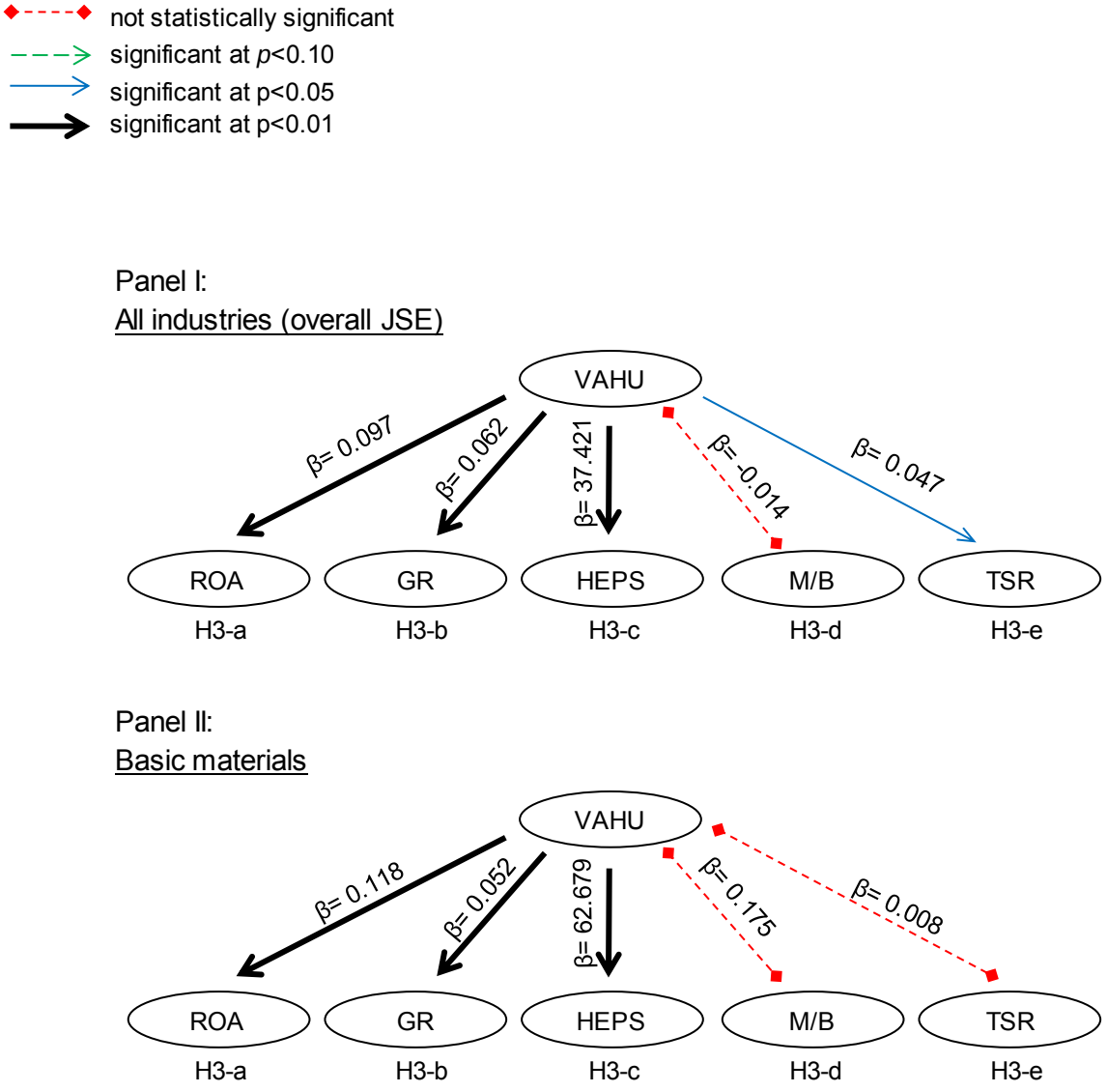
No overly strong correlations (0.9 and higher or -0.9 and lower) were found between any of the variables – independent, dependent or control factors. Very low correlations (0.1 and lower or -0.1 and higher) were identified between some of the dependent variables and control factors. Although these low correlations implied that a regression would probably indicate that those control factors do not hold much explanatory power for those dependent variables, it did not negate the potential research value in performing the regressions (H3a-e) to investigate the impact of VAHU on the dependent variables.

VAHU was found to have a positive and statistically significant linear relationship with all measures of financial and market performance. This supports the intuitive logic regarding the importance of human capital to corporate performance. VAHU was more strongly associated with ROA and HEPS than the other dependent variables. GR showed a moderate association with VAHU, while the relationships between VAHU and both M/B and TSR were weak.

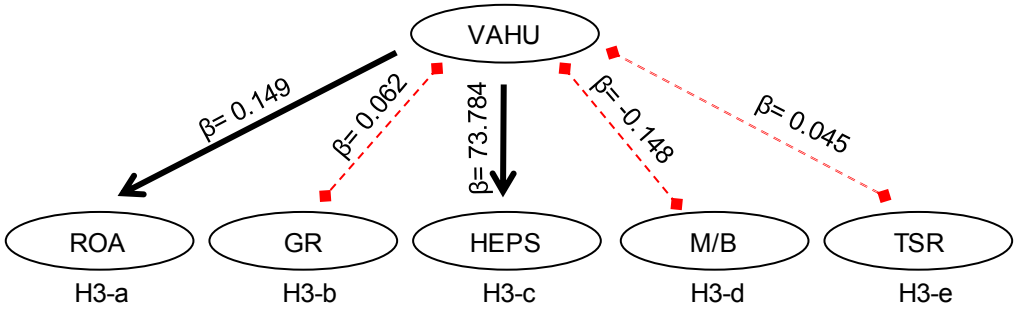
5.3.2. Regression results for H3

For the ease of the reader, the regression outputs for H3a-e, using VAHU as the independent variable, are presented diagrammatically in Figure 5.1. The complete regression results, including the control factors, are presented in tabular format in Appendix F.

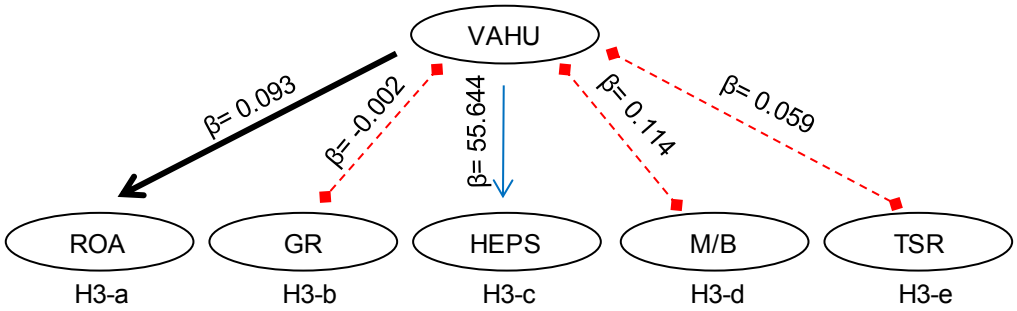
Figure 5.1. VAHU regression results for H3



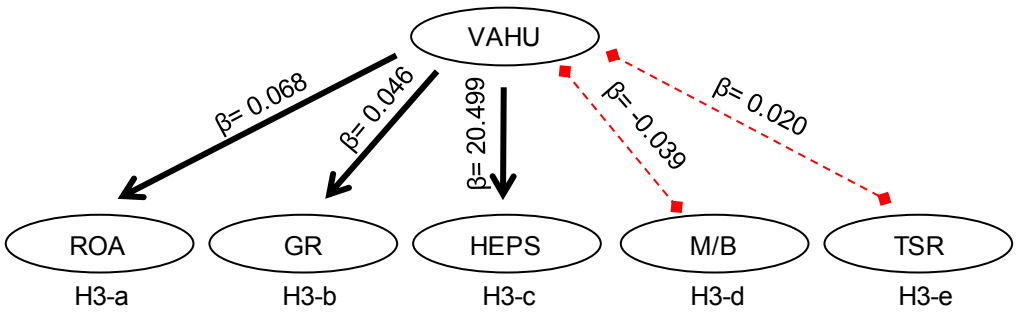
Panel III:
Consumer Goods



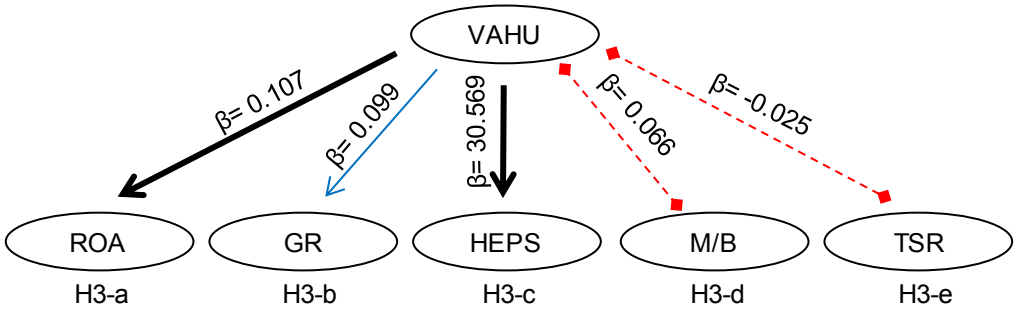
Panel IV:
Aggregated Consumer Services



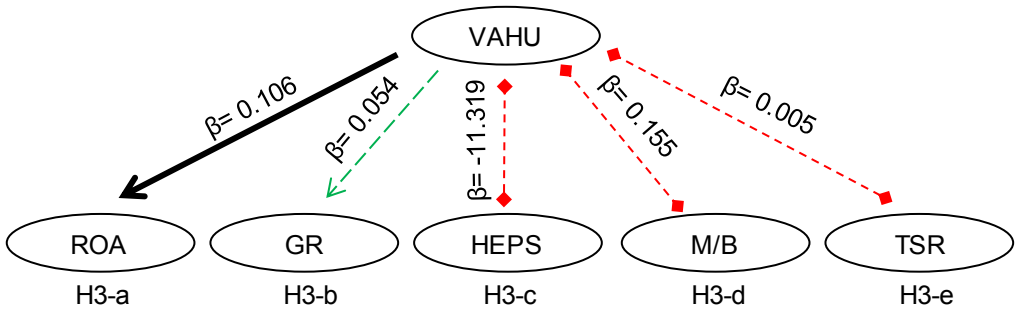
Panel V:
Financials



Panel VI:
Aggregated Industrials



Panel VII:
Aggregated Technology



As an overview to the results of the regression analysis, several obvious trends were identified in the analyses of the overall JSE and the individual industries and should be highlighted:

- The *β* coefficient for VAHU was not statistically significant with respect to M/B in any individual industry or on the overall JSE (H3-d in Panel I to VII of Figure 5.1.). The control factors were found to have the greatest explanatory power with respect to M/B ($p<0.01$) – LMC in Aggregated Technology; ROE in Financials; and DR in the rest of the individual industries and the overall JSE (refer to Appendix F).
- The *β* coefficient for VAHU was statistically significant ($p<0.05$) with respect to TSR in the overall JSE, although not in the individual industries (H3-e in Panel I to VII of Figure 5.1.).
- A very high *β* coefficient for VAHU was observed with respect to HEPS in all industries and in the overall JSE (H3-c in Panel I to VII of Figure 5.1.). With the exception of Aggregated Technology, these coefficients were all statistically significant ($p<0.05$). The magnitude of these standardised coefficients is a strong indication of persistent multicollinearity in the data set used in the H3-c regressions, which was not identified through the initial correlation analysis in sub-section 5.2.3. and Table 5.4. As a result, the *β* coefficients for VAHU grossly overstate the strength of the relationship with HEPS. However, multicollinearity does not affect the direction of the *β* coefficients and the regression results may still be used to validate H3-c. Further research using an alternative methodology is recommended to fully understand the relationship between VAHU and HEPS.

Overall analysis of the JSE

The results for regressions performed on the overall JSE are presented in Panel I of Figure 5.1. The β coefficient for VAHU was positive and highly statistically significant (p<0.001) with respect to ROA, GR and HEPS. The β coefficient for VAHU was also significantly positive with respect to TSR (p<0.05). As mentioned, it was not significant for M/B. H3-a, H3-b, H3-c and H3-e are therefore accepted and H3-d is rejected for the overall JSE. For the companies listed on the JSE, collectively, greater human capital efficiency is associated with greater financial performance and higher TSR.

Intra-industry analysis

The intra-industry analysis was performed to test whether the contemporaneous impact of VAHU observed in the overall JSE extends to the individual industries.

The results for regressions performed on Basic Materials, Financials and Aggregated Industrials are presented in Panel II, V and VI respectively of Figure 5.1. The coefficient for VAHU was positive and statistically significant (p<0.05) with respect to ROA, GR and HEPS for Basic Materials, Financials and Aggregated Industrials. The coefficients for VAHU were not significant with respect to M/B and TSR in these three industries. H3-a, H3-b and H3-c are accepted and H3-d and H3-e are rejected in Basic Materials, Financials and Aggregated Industrials.

The results for regressions performed on Consumer Goods and Aggregated Consumer Services are presented in Panel III and IV of Figure 5.1. The VAHU β coefficient was statistically significant (p<0.05) and positive with respect to ROA and HEPS in these two industries. However, their VAHU coefficients relating to GR, M/B and TSR were not statistically significant. H3-a and H3-c are accepted and H3-b, H3-d and H3-e are rejected in Consumer Goods and Aggregated Consumer Services.

The results for the regressions performed on Aggregated Technology are presented in Panel VII of Figure 5.1. The VAHU coefficients relating to HEPS, M/B and TSR were not

statistically significant. However, the β coefficients relating to ROA (p<0.01) and GR (p<0.10) were significantly positive. H3-a and H3-b are therefore accepted, while H3-c, H3-d and H3-e are rejected in Aggregated Technology.

Inter-industry analysis

The regression results for each measure of financial and market performance were analysed across the different industries in order to identify any trends.

As mentioned, the high β coefficients for VAHU observed with respect to HEPS were most likely due to multicollinearity in the underlying data. As multicollinearity only affects the magnitude (and not the direction) of β, the regression results were still useful. VAHU was found to have a significantly positive β (p<0.05) for HEPS in all industries, except Aggregated Technology (where it was not significant).

The β coefficient for VAHU was found to be positive and very highly statistically significant (p<0.001) with respect to ROA in all the industries. ROA also displayed the strongest association with VAHU in the preliminary correlation analysis (refer to Table 5.4.). On the other hand, no significant β coefficients were identified for VAHU with respect to M/B and TSR in any industry.

The VAHU β relating to GR was statistically significant (p<0.10) and positive in Basic Materials, Financials and Aggregated Industrials; although not significant in Consumer Goods and Aggregated Consumer Services.

5.4. H4: FUTURE IMPACT OF HUMAN CAPITAL EFFICIENCY

The study sought to ascertain whether financial and market performance of listed companies in South Africa can be explained as an outcome of human capital efficiency. Such an investigation would not be complete without examining the future effect that VAHU could have on the dependent variables:

H4: Higher human capital efficiency is associated with higher financial and market performance in the future, in South African listed companies for the financial year-ends falling in the period 31 December 2001 to 30 June 2011.

This hypothesis was therefore tested using the following regression models:

$$ROA^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \varepsilon \quad (H4\text{-}a)$$

$$GR^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \varepsilon \quad (H4\text{-}b)$$

$$HEPS^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \varepsilon \quad (H4\text{-}c)$$

$$M/B^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \beta_5(ROE^{t+1}) + \varepsilon \quad (H4\text{-}d)$$

$$TSR^{t+1} = \alpha + \beta_1(VAHU^{t}) + \beta_2(LMC^{t+1}) + \beta_3(DR^{t+1}) + \beta_4(IND) + \beta_5(ROE^{t+1}) + \varepsilon \quad (H4\text{-}e)$$

5.4.1. Descriptive statistics

The number of companies in the research population for H3 and H4 were presented in Figure 3.2. Company years per industry are shown in Table 5.8. Aggregated Industrials and Aggregated Technology are the largest and smallest industries on the JSE respectively, measured by both number of companies and company years.

Table 5.5. Company years used in H4

	ROA	GR	HEPS	M/B	TSR
All industries	1373	1373	1617	1372	1372
Basic Materials	170	170	205	169	204
Consumer Goods	165	165	189	188	188
Aggregated Consumer Services	300	347	347	299	346
Financials	194	236	236	193	193
Aggregated Industrials	401	401	401	400	400
Aggregated Technology	151	128	128	150	150

The descriptive statistics for the research population used in H4 are presented in Table 5.6. for the overall JSE and in Appendix E for each individual industry. The medians for the dependent and independent variables for the overall JSE and for each industry differed only marginally from the medians observed in H3. Aggregated Consumer Services was the best-performing industry, but no worst-performing industry could be identified.

Table 5.6. Descriptive statistics for H4

	H4 - All industries			
	Median	Minimum	Maximum	Std Dev
VAHU	1.727	-0.073	4.141	1.054
ROA	0.174	-0.035	0.385	0.105
GR	0.125	-0.279	0.553	0.208
HEPS	77.600	-243.027	576.753	204.945
M/B	1.402	-1.060	4.917	1.512
TSR	0.146	-0.971	2.093	0.509
LMC	14.158	7.357	20.285	2.344
DR	0.405	0.000	1.071	0.248
ROE	0.297	-0.099	0.751	0.213

The median VAHU in H4 is presented per industry in Table 5.7. Financials and Basic Materials exhibited the greatest human capital efficiency, while the other industries' human capital efficiency levels were clustered together at a lower level. Because there was only a slight difference between the median VAHU of Consumer Goods and Aggregated Consumer Services, their change in ranking from the ranking observed in H3, was deemed immaterial.

Table 5.7. Median VAHU in H4

All industries	1.727
Financials	3.365
Basic Materials	2.042
Consumer Goods	1.724
Aggregated Consumer Services	1.697
Aggregated Industrials	1.533
Aggregated Technology	1.493

The pairwise correlation analyses between the independent variable (VAHU), the control factors and the dependent variables in H4 are presented in Table 5.8.

Table 5.8. Correlation analysis for H4

	Independent variable	Dependent variables					Control factors		
	VAHU	ROA	GR	HEPS	M/B	TSR	LMC	DR	ROE
Independent variable									
VAHU	1.000								
Dependent variables									
ROA	0.221	1.000							
GR	0.093	0.246	1.000						
HEPS	0.279	0.292	0.081	1.000					
M/B	0.112	0.259	0.092	0.169	1.000				
TSR	-0.025*	0.277	0.111	0.151	0.151	1.000			
Control factors									
LMC	0.329	0.181	0.073	0.571	0.505	0.117	1.000		
DR	0.139	-0.194	0.035*	0.109	0.294	-0.134	0.183	1.000	
ROE	0.277	0.700	0.250	0.354	0.424	0.163	0.311	0.424	1.000

Note: Statistically significant at a 95% confidence level, unless marked with *

No overly strong correlations were observed between any of the variables. Similarly to the observations from the H3 data, some very weak and some negative associations were found between the control factors and dependent variables in the H4 data. These results do not detract from the research value to be gained from the regressions between VAHU and the dependent variables in H4a-e.

The correlation coefficient describing the relationship between VAHU and future TSR was not statistically significant, unlike in the contemporaneous analysis. VAHU again displayed statistically significantly positive correlation with future M/B, ROA, GR and HEPS. VAHU was, therefore, found to have a positive linear relationship with most measures of future financial market performance. Overall, VAHU was more strongly associated with future ROA and HEPS. The relationships

between VAHU and future GR and future M/B were weak, with a correlation coefficient of only 0.093 and 0.112 respectively.

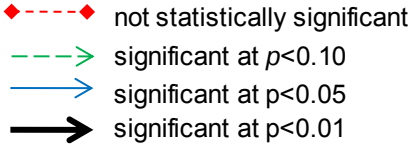
When the correlation matrices of H3 and H4 were compared, it was noted that the correlations between VAHU and ROA, GR and HEPS were lower in H4; and the correlation between VAHU and M/B was slightly higher in H4. These results neither support, nor contradict the idea that human capital efficiency has longer-term consequences for corporate performance.

The similarity between the statistical make-up of the research populations for H3 and H4 is to be expected, as the independent variables were lagged by only one year to illustrate the future effect on the dependent variables. Consequently, descriptive statistics for the H4 research population yielded fewer ancillary insights when analysed subsequent to examination of the H3 research population. The greatest research value to be gained from the H4 research population, therefore, laid primarily in the H4 regression results.

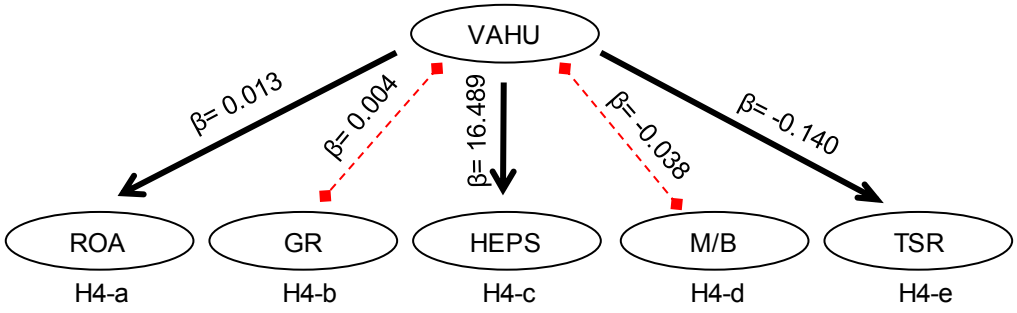
5.4.2. Regression results for H4

For the ease of the reader, the regression outputs for H4a-e, using VAHU as the independent variable, are presented diagrammatically in Figure 5.2. The complete regression results, including the control factors, are presented in tabular format in Appendix G.

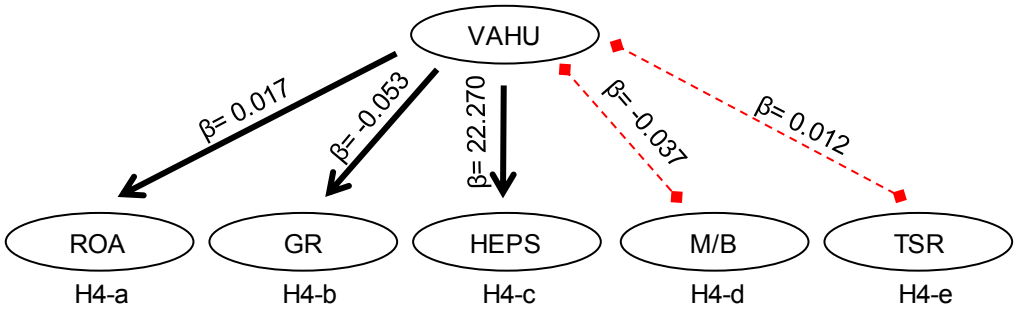
Figure 5.2. VAHU regression results for H4



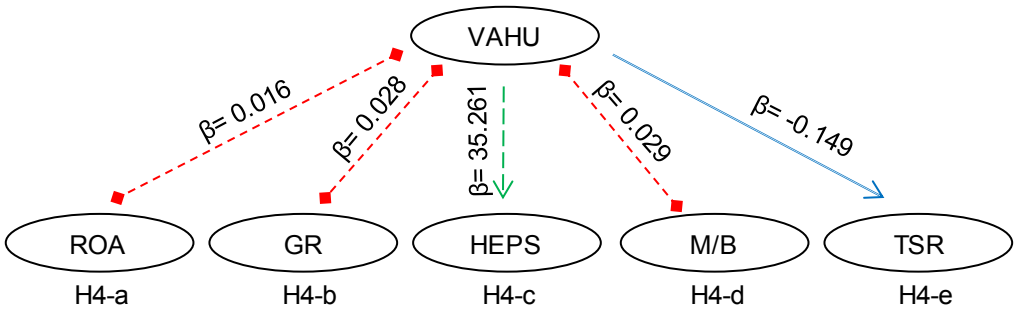
Panel I:
All industries (overall JSE)



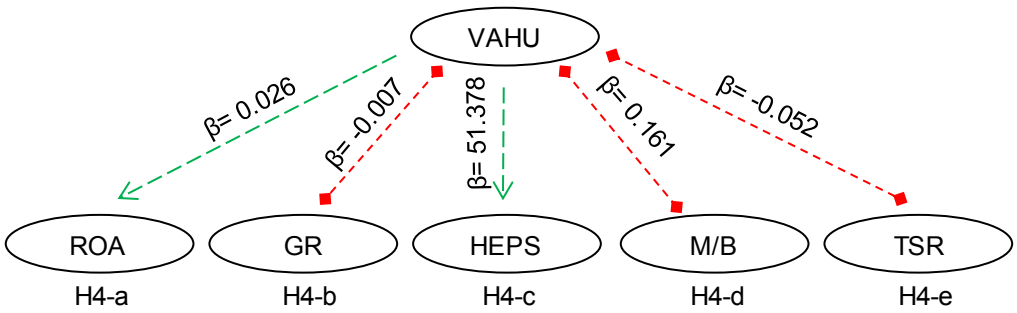
Panel II:
Basic materials



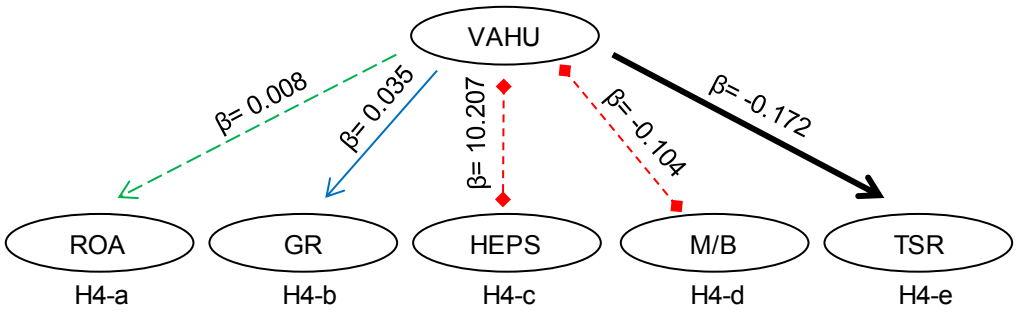
Panel III:
Consumer Goods



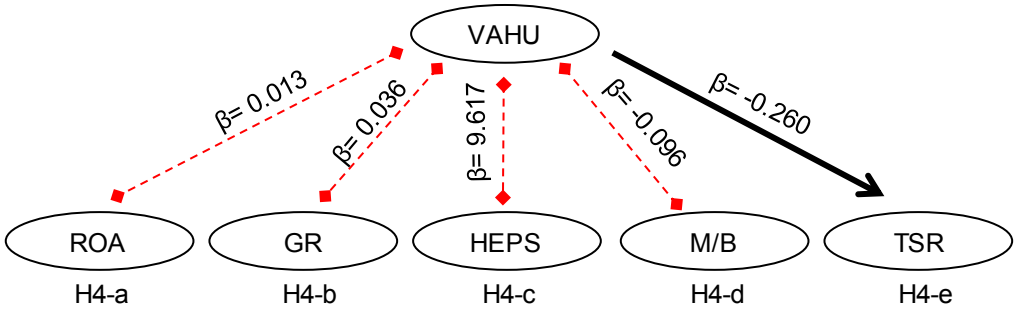
Panel IV:
Aggregated Consumer Services



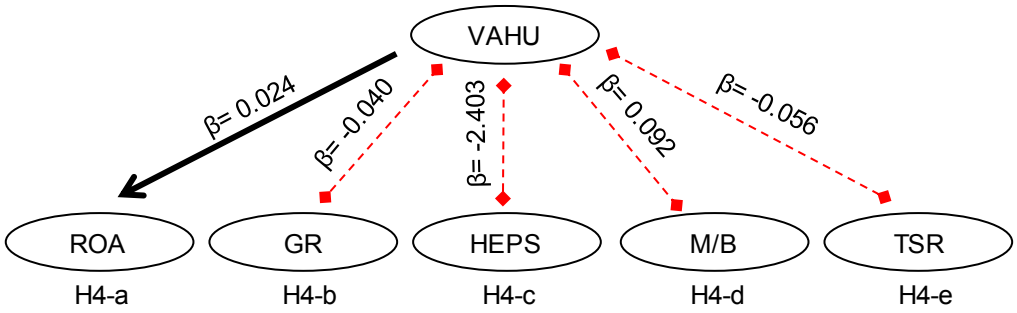
Panel V:
Financials



Panel VI:
Aggregated Industrials



Panel VII:
Aggregated Technology



The following obvious trends were observed in H4:

- Similarly to H3, the *β* coefficient for VAHU was not statistically significant with respect to M/B in any individual industry or in the overall JSE (H4-d in Panel I to VII of Figure 5.2.).
- Similarly to H3, multicollinearity was found in the data set used in the H4-c regression in each industry and the overall JSE resulting in the overstatement of *β* coefficients.
- The control factors were found to have greater explanatory power than VAHU with respect to all the dependent variables, with the exception of TSR.

Overall analysis of the JSE

The results for regressions performed on the overall JSE are presented in Panel I of Figure 5.2. The *β* coefficient for VAHU was positive and highly statistically significant (p<0.001) with respect to ROA and HEPS. The *β* coefficient for VAHU was also highly significant with respect to TSR (p<0.01), but the direction was negative. The VAHU coefficient was not significant for GR or M/B. H4-a and H4-c are therefore accepted and H4-b, H4-d and H4-e are rejected for the overall JSE. The collective results for JSE-listed companies are inconclusive and mixed regarding the association between human capital efficiency and corporate performance.

Intra-industry analysis

It was hoped that more detailed analysis focused on individual industries would yield more conclusive results than the analysis of the JSE as a whole.

The regressions for Basic Materials are presented in Panel II of Figure 5.2. The coefficient for VAHU was positive and highly statistically significant (p<0.01) with respect to ROA and HEPS. The VAHU coefficient relating to GR was also highly significant (p<0.01), but it was negative. The coefficients for VAHU were not statistically significant with respect to M/B and TSR. Therefore, H4-a and H4-c are accepted and H4-b, H4-d and H4-e are rejected in Basic Materials.

In Consumer Goods (Panel III of Figure 5.2.), no statistically significant *β* coefficients for VAHU were identified with respect to ROA, GR and M/B. The VAHU coefficients were significant and positive for HEPS (p<0.10) and negative for TSR (p<0.05). H4-a, H4-b, H4-d and H4-e were rejected and H4-c was accepted for Consumer Goods.

In Aggregated Consumer Services (Panel IV of Figure 5.2.), H4-a and H4-c were accepted and H4-b, H4-d and H4-e were rejected. No statistically significant *β* coefficients for VAHU were identified with respect to GR, M/B and TSR. The VAHU coefficients were significantly positive for ROA and HEPS (p<0.10).

The β coefficient for VAHU was significant and positive with respect to ROA (p<0.10) and GR (p<0.05) and negative with respect to TSR (p<0.01) in Financials (Panel V in Figure 5.2.). The β was not statistically significant for HEPS and M/B. H4-a and H4-b are accepted, while H4-c, H4-d and H4-e are rejected in Financials.

The VAHU coefficient was not statistically significant with respect to any performance measure in Aggregated Industrials (Panel VI of Figure 5.2.), with the exception of TSR. The coefficient relating to TSR was highly significant and negative (p<0.01). H4-a, H4-b, H4-c, H4-d and H4-e were rejected in Aggregated Industrials.

VAHU's β coefficient was not statistically significant with regard to any performance measure in Aggregated Technology (Panel VII of Figure 5.2.), with the exception of ROA. The coefficient relating to ROA was highly significant and positive (p<0.01). H4-a was accepted and H4-b, H4-c, H4-d and H4-e were rejected in Aggregated Technology.

Inter-industry analysis

Just as in the intra-industry analysis, no clear trends were identified across the industries for the individual performance measures.

The VAHU β for ROA was significant and positive in all industries, except for Consumer Goods and Aggregated Industrials (which were not significant). The β for VAHU was not significant for GR in any industry, with the exception of Basic Materials (significantly negative at p<0.01) and Financials (significantly positive at p<0.05).

The VAHU β for HEPS was significantly positive in Basic Materials, Consumer Goods and Aggregated Consumer Services, and not significant in Financials, Aggregated Industrials and Aggregated Technology.

TSR experienced no statistically significant VAHU *β* in Basic Materials, Aggregated Consumer Services and Aggregated Technology, while significantly negative *β* coefficients were found in Consumer Goods, Financials and Aggregated Industrials. Lastly, as was previously discussed, no significant *β* coefficients were identified for VAHU with respect to M/B in any industry.

5.5. SUMMARY OF THE FINDINGS

5.5.1. Industry VAHU

In South Africa, Financials and Basic Materials may be classified as 'high VAHU' industries. This finding, regarding the high level of human capital efficiency in South African financial services companies, agrees with traditional thinking regarding the knowledge and skill encapsulated in those employees. It also echoes prior research in India (Mohiuddin *et al*., 2006:52), Malaysia (Goh, 2005:391), Greece (Mavridis & Kyrmizoglou, 2005:57) and Japan (Mavridis & Kyrmizoglou, 2005:57).

The higher than expected VAHU in Basic Materials was decidedly unusual, as the majority of workers in the mining sectors are regarded as unskilled labour. The high VAHU observed in Basic Materials speaks to the incongruity of the mining culture in South Africa – where unskilled workers are paid very low wages in relation to the Rand value of what they are able to generate in valuable mineral output. When seen within the economic context of South Africa, it is understandable that the employees within this industry display strong human capital efficiency, without being highly educated or skilled.

On the other end of the spectrum, Aggregated Industrials and Aggregated Technology may be classified as 'low VAHU' industries. Companies in Aggregated Industrials are mostly involved with the manufacture and supply of industrial and electronic machinery and services; and construction and related building materials. The low VAHU observed in Aggregated Industrials was anticipated, as most of these operations are mechanised and their nature does not necessarily require unique expert skills. The low VAHU observed in Aggregated Technology was, however, not anticipated as

employees who work in the field of telecommunications, information technology and the supply of computer goods and services are generally assumed to have highly specialised know-how. The lower than expected VAHU in Aggregated Technology may be a consequence of the experimental aspects of their operations, where human capital expenditure is incurred on the research and development of technologies that may never generate earnings.

The VAHU of Consumer Goods and Aggregated Consumer Services are neither overly high nor low in relation to the other industries and, as such, were grouped together to be classified as 'moderate VAHU' industries. Although human capital is important in the delivery of consumer services, the moderate human capital *efficiency* observed in Aggregated Consumer Services might be because service industries struggle more to externalise the knowledge held within their human capital (Bontis *et al*., 2000:91).

5.5.2. The impact of human capital efficiency

It is clear that the supplementary analysis of the individual industries yielded more valuable information than would have been gained from limiting the scope of the study to the JSE as a whole. In fact, the statistical results for the overall JSE painted a picture of the relationship between VAHU and corporate performance which clouded or, in some cases, entirely contradicted that which was observed in the individual industries. Interestingly, a distinct difference in the influence held by VAHU on corporate performance was noted between the ‘high VAHU’, ‘moderate VAHU’ and ‘low VAHU’ industry classifications.

As mentioned in Chapter 2, much of the prior research (locally and internationally) regarding the impact of human capital, excluded those sectors which are traditionally considered to be less knowledge-intensive. Consequently, limited precedent research on less knowledge-intensive industries is available for comparison to the results found in this study. The conclusions formed from the H3 and H4 regressions which were performed in the individual industries and overall in the JSE have been summarised in Table 5.9. and Table 5.10. respectively.

Table 5.9. Summary of the findings on the contemporaneous impact of VAHU

		H3-a	*H3-b*	*H3-c*	*H3-d*	*H3-e*
		ROA	GR	HEPS	M/B	TSR
'High VAHU'	Financials	Positive	Positive	Positive	None	None
	Basic Materials	Positive	Positive	Positive	None	None
'Moderate VAHU'	Consumer Goods	Positive	None	Positive	None	None
	Aggregated Consumer Services	Positive	None	Positive	None	None
'Low VAHU'	Aggregated Industrials	Positive	Positive	Positive	None	None
	Aggregated Technology	Positive	Positive	None	None	None

It is undoubtedly clear that VAHU does not impact market performance contemporaneously in any South African industry (as represented by M/B and TSR). This finding contradicts most international studies – positive associations were found between VAHU and share prices or M/B in Athens (Maditinos *et al.,* 2011:146), Milan (Puntillo, 2009:112) and Turkey (Bozbura, 2004:366). More importantly, the findings in this study also contradict earlier research in South Africa – Swartz *et al.* (2006:78) observed a positive impact on share prices and Firer and Williams (2003:357) observed a negative impact on M/B. However, these South African studies may have been biased, as they were either derived using a model involving significant estimation risk, or they were limited to one year of data.

The fact that market performance is not related to human capital efficiency in South Africa may be due to the lack of sophistication in the relatively young JSE. Similar independence of market performance was experienced in Malaysia (Gan & Saleh, 2008:127) and in Thailand (Appuhami, 2007:24). Gan and Saleh (2008:127) proposed that share prices are governed less by fundamental analysis in emerging stock markets than mature stock markets. This implies that the share prices of companies in emerging markets are driven less by their true intrinsic worth and more by share history and market sentiment. In South Africa, an emerging financial market with a stock exchange which is more informationally inefficient than efficient, it is conceivable that share prices might be driven more by investor perceptions regarding crime, corruption and other more prominent

macroeconomic and microeconomic factors than by the implications of human capital efficiency. This suggestion is supported by the findings in H1, where a fairly small difference was found between the market value and book value of South African listed companies and much of that difference could be attributed to macroeconomic determinants.

Higher ROA is associated with higher VAHU in all industries in South Africa. These results re-emphasise the importance of human capital in deriving financial performance from fixed assets **–** a fact which is often overlooked in the highly industrialised South African economy, where physical capital developments are favoured over human capital developments. The results of this study imply that financial returns may be foregone if the trade-off experienced in South Africa between intellectual capital (including human capital) and physical capital is perpetuated. Human capital enhancement directly influences operational performance in a manufacturing environment by improving staff productivity, machine efficiency and customer satisfaction (Youndt, Snell, James & Lepak, 1996:858). The results of this study again differ from the exploratory work of Firer and Williams (2003:356), who observed no meaningful relationship between VAHU and ROA.

In the 'high VAHU' industries – Financials and Basic Materials – of South Africa, VAHU positively contributes to all contemporaneous measures of financial performance (ROA, GR and HEPS). This clarifies a study on the Malaysian financial sector (Muhammad & Ismail, 2009:2010) and the only previous study in South Africa (Firer & Williams, 2003:357), neither of which could confirm or deny any clear association between VAHU and profitability. In industries whose workers have a strong ability to manifest company value from their knowledge or their production capacity (*i.e*. 'high VAHU' industries), higher VAHU results in higher financial performance all around.

It would appear that in those industries where the employees are less able to translate their skills and expertise into value for the business, the association between VAHU and financial performance is selective. The 'moderate VAHU' industries – Consumer Goods and Aggregated Consumer Services – are comprised of food, beverage and motor manufacturers, fishing and farming sectors, retailers and personal services providers. While human capital does play a role in

service delivery and production in these companies, their financial performance is driven more by consumer demand than any other factor. It is hardly surprising, then, that VAHU holds no explanatory power for contemporaneous GR in these industries, yet still positively affects the bottom line (through ROA and HEPS).

Despite the low value-generating ability observed in the workforces of Aggregated Industrials and Aggregated Technology, VAHU was still found to positively impact all measures of financial performance – with the exception of HEPS in Aggregated Technology, which was found to be independent of VAHU. The exception lends support to the findings of Firer and Williams (2003:357), who observed a similar lack of association with profitability in the information sector. Although the disassociation between VAHU and HEPS in Aggregated Technology may be related to the research and development aspect of its operations, it is highly recommended that further research be undertaken to better understand the interrelationship between profitability and human capital in this industry.

Table 5.10. Summary of the findings on the future impact of VAHU

		H4-a	*H4-b*	*H4-c*	*H4-d*	*H4-e*
		ROA	GR	HEPS	M/B	TSR
'High VAHU'	Financials	Positive	Positive	None*	None	Negative*
'Moderate VAHU'	Basic Materials	Positive	Negative*	Positive	None	None
'Moderate VAHU'	Consumer Goods	None*	None	Positive	None	Negative*
'Moderate VAHU'	Aggregated Consumer Services	Positive	None	Positive	None	None
'Low VAHU'	Aggregated Industrials	None*	None*	None*	None	Negative*
'Low VAHU'	Aggregated Technology	Positive	None*	None	None	None

H4 results which differ from the H3 results in Table 5.9. are marked with *

Analysis of the future impact of VAHU (refer to Table 5.10.) delivered results which were considerably more mixed than the contemporaneous study and very often the future impact of VAHU did not correspond with the contemporaneous impact. H3-d and H4-d relating to M/B were

both completely rejected in every industry, as were H3-e and H4-e relating to TSR. With respect to GR, H3-b was accepted in more industries and H4-b was rejected in more industries. The hypotheses relating to ROA and HEPS were accepted in almost all industries, although the actual number of acceptances was slightly lower in the future impact (H4-a and H4-c) than the current impact (H3-a and H3-c). Inconclusive results about the future impact of VAHU were also found in Bangladesh (Kamath, 2008:700) and in Taiwan by lagging VAHU (Chen *et al*., 2005:159).

In the instances where the future and contemporaneous impact corresponded, it alluded to the longer-term persistence of the impact of VAHU on financial and market performance in those industries in South Africa. GR in consumer-driven industries and M/B are always independent of human capital efficiency. Higher human capital efficiency always contributes to higher ROA in 'high VAHU' industries and higher HEPS in consumer-driven industries.

Four cases of an inverse relationship with VAHU were identified in the future performance measures – GR in Basic Materials and TSR in Financials, Consumer Goods and Aggregated Industrials.

In section 4.2., it was proposed that the decline in VAHU experienced in South Africa is partially due to the long-term effect of inappropriately high wage settlements reached due to trade union-related industrial action. The inverse relationship between VAHU and future GR in Basic Materials lends support to this theory. The National Union of Mineworkers (NUM), which serves the employees of the mining companies which make up Basic Materials, has the second biggest trade union membership in South Africa. At an average of 8.8% per annum (Republic of South Africa, 2011:24), the wage increases negotiated and concluded by NUM were the highest in the country and far exceeded inflation. Their negative consequences are not felt immediately, as VAHU still has a positive contemporaneous effect on financial performance in Basic Materials. However, these wage settlements are usually enforceable for several years and, in order to remain viable in the long run, mining companies are forced to cut costs through large scale retrenchments and dismissals. In the medium term, therefore, the higher VAHU is associated with lower GR – through

lower mining output from the reduced production capacity of a smaller workforce. Over time, the shrinkage in the mining sector will eventually cause it to start losing its abnormally high human capital efficiency, through the reduction in value-added in the presence of rising wages. No reasonable explanation could be found for why lower current VAHU would be associated with higher future GR in Basic Materials – the other side of the same inverse relationship.

By 2011, approximately 54% of all working days lost due to work stoppages were attributable to industrial action sanctioned by the National Union of Metalworkers of South Africa (NUMSA) and the South African Transport and Allied Workers Union (SATAWU) (Republic of South Africa, 2011:52). These are two of the largest trade unions in South Africa and they are mostly affiliated with the companies in Consumer Goods and Aggregated Industrials. The constant media visibility of industrial action and inconveniences to the public, caused by strike action, may create an overall negative impression which pervades long-term investor perceptions of the risk relating to the two industries. In Aggregated Industrials, a long-term movement toward further automation and mechanisation would further reduce VAHU. The positive impact on TSR expected from a reduction in VAHU, once again points to the fixation of both South African companies and their investors on development of operating assets, at the cost of maximising the value of their human capital.

It is not clear what the root cause is of the negative impact of VAHU on future TSR in Financials. It is possible that, given the high VAHU observed in Financials, the relatively unsophisticated investors in South Africa are over-optimistic about the ability of those working in financial services to generate value – resulting in an equally negative backlash in market perception (and consequently, a drop in share price) when their unrealistic expectations are not realised later on. Further research into this curious anomaly is needed to clarify the inverse relationship between VAHU and future TSR in Financials.

In short, the following simple statements recapitulate the conclusive results of H3 and H4:

- Human capital efficiency has almost no effect on current or future market performance in South Africa.

- Higher human capital efficiency has a positive effect on current returns generated by any asset – tangible or intangible - in South Africa.
- Higher bottom line profitability is concurrently associated with higher human capital efficiency in almost every industry in South Africa.
- Higher revenue growth is associated with higher human capital efficiency in all industries contemporaneously, except those which are consumer-driven.
- In consumer-driven industries in South Africa, human capital efficiency is not a driver for revenue growth, but is still associated with higher profitability.
- In most industries, the longer-term effect of human capital efficiency on corporate performance is more unclear than its immediate effect.

The implications of these findings for the management of South African companies are discussed in Chapter 6.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. INTRODUCTION

Human capital comprises the physical and intellectual capabilities acquired through education and training that enable an employee to perform tasks effectively and productively. *Human capital efficiency* refers to an employee's ability to create value-added for his employer.

As a key resource for the creation of value – one which is not captured by conventional accounting – it was thought that human capital may contribute to the premium to net book value at which many companies trade. As a result, this study sought to investigate trends in the divergence between the book value and market value of JSE listed companies in South Africa.

The primary objectives of this research study, however, were to empirically confirm whether corporate financial and market performance in South Africa can be explained as an outcome of human capital efficiency, and whether human capital efficiency is improving in the country.

Chapter 1 served as an introduction to the concepts of human capital efficiency and the market value-book value gap. The research problems were examined in the context of South Africa, with emphasis on the extent of industrialisation, global competitiveness and education and skills development – thereby providing the motivation for a study of this nature using JSE listed companies. The foundation of existing research performed on human capital efficiency and its relationship with corporate performance, as well as on the M/B, was laid out in Chapter 2. Very few of these prior studies were focused on South Africa, further justifying the need for local research on the subject matter and providing a strong basis for comparison of the conclusions of this study with those results found internationally.

Chapter 3 described, in detail, the research design and methodology applied in order to address the research problems examined in the first chapter. The study constituted empirical research

using multivariate statistical regression of audited company financial statement panel data. The reasoning behind each individual statistical approach was presented (*e.g.* data sources, time period, control factors, choice of variable metrics used, *etc*.), along with a discussion of the tests of data integrity and consequent qualitative adjustments performed. Particular attention was paid to explanation of the origin, logic and calculation of VAHU, the measure of human capital efficiency used throughout the study.

Chapter 4 presented the results of the study into developments in the market value-book value gap and in human capital efficiency over time in South Africa. The statistical results of the investigation into the contemporaneous and future impact of human capital efficiency on the financial performance (as measured by ROA, HEPS and GR) and market performance (as measured by M/B and TSR) of South African listed companies were presented in Chapter 5. Reasons were proposed for the various conclusions reached in South Africa in Chapters 4 and 5, as well as for the dissimilarities of those conclusions when contrasted against the results of similar studies performed in other countries.

This sixth and final chapter serves as a synopsis of the flow of the research process through the various chapters of the thesis, drawing attention to shortcomings identified therein and highlighting the need for ancillary research. The results of the various research hypotheses in this study are woven together in this chapter into meaningful discourse on South African socio-economic conditions and suggestions are offered for effective human capital efficiency strategies for South African companies and their management.

6.2. BOOK VALUE *VERSUS* MARKET VALUE OF COMPANIES

For all industries in South Africa, it was found that the market value-book value gap increased from 2001 to 2011. However, despite this growing divergence between market and book values observed, the general fall in share prices on the stock market due to the global financial crisis of 2007 and subsequent recession *did* result in a temporary narrowing of this gap in South Africa.

Although the countless factors which contribute to the market value-book value gap are not the subject matter of this study, it was found that human capital efficiency is not one of them. On the contrary, in South Africa, human capital efficiency affects neither current nor future market-to-book ratios.

It was proposed in this study that, as South Africa is an emerging market, JSE prices may be driven more by the overall market sentiment of its fairly unsophisticated investors than by human capital efficiency. The narrowing of the market value-book value gap during the global financial crisis and recession point to a particular sensitivity of South African share prices (and consequently the market-book ratio) to movement in South African exchange rates, a rise or fall in the US dollar price of gold and – quite unusually – to prospective nationwide tourism opportunities. To improve the premium to net asset values at which their shares are trading, management of South African companies may be well advised to exploit their marketing potential during tourism-related events and hedge against exchange rate risk and gold price risk – rather than attempt to manage the value-generating capabilities of their employees.

In addition, the average market-to-book ratio was found to be significantly lower in South Africa than in the US over roughly the same time period. Given the negative value implications of company and governmental malfeasance (Bruner *et al*., 2002:315), it appears that concerns regarding corporate governance and corruption in government and business may play a bigger role in the investment decisions of South African investors than those of other countries. This creates a further incentive for tighter corporate control, as adequate corporate governance – possibly even the mere *perception* thereof – may significantly boost the attractiveness of a company to a South African investor. A crackdown on political and governmental corruption may yield similar results for the attractiveness of the South African stock market to international investors.

6.3. DEVELOPMENTS IN HUMAN CAPITAL EFFICIENCY

Human capital efficiency in South Africa was found to have declined from 2001 to 2011. The South African trade-off between tangible assets and all types of intellectual capital identified by prior researchers and the macroeconomic recessionary effects of 9/11 and the global financial crisis of 2007 may have been partly responsible for the observed deterioration in human capital efficiency.

In addition, this study further proposes poor basic education and excessive compensation levels imposed by the 'strike' culture in South Africa as contributing factors to the decline in human capital efficiency. With the falling quality of education in South Africa, the vast majority of the current body of students who form the country's future workforce are considered to be unable to read with comprehension and are only able to handle simple calculations. This means that if a company wishes to improve the value-generating ability of its workforce, the company itself may be forced to shoulder the cost of additional education and training to further develop these requisite skills in its employees. By 2011, employees exercising their constitutional right to strike had resulted in over two million working days being lost every year in South Africa. Coupled with the extent of collective bargaining by trade unions, it resulted in remuneration growth far outstripping economic growth in the country. Therefore, the erosion of value-added due to the 'strike' culture in South Africa contributed, at least in part, to the decline in human capital efficiency. From a business management perspective, it is not clear what strategies would be effective in minimising the negative impact of a strike on the value-creating capability of a company's labour force.

The product of these two factors (poor basic education and excessive compensation due to industrial action) is a peculiar phenomenon experienced in South Africa – a working population that is poorly educated, with the paradox of wages that are low in relation to the cost of living, yet which are becoming too high in relation to the level of output the workers produce. The consequences of this phenomenon appear to have had a unique effect on the value-generating ability of employees in the various industries in South Africa.

Based on the average VAHU in each industry from 2001 to 2011, Financials and Basic Materials were grouped as 'high VAHU' industries, Consumer Goods and Aggregated Consumer Services as 'moderate VAHU' industries, and Aggregated Industrials and Aggregated Technology as 'low VAHU' industries. These categorisations mostly correspond with common sense. However, the unexpected high human capital efficiency in Basic Materials is a direct consequence of the chasm between meagre mineworker wages and what mining companies earn from the minerals mined.

Problems in basic education, the scale of industrial action in the country, and the fixation of South African companies on their physical resources instead of their people have resulted in falling levels of human capital efficiency, which are sometimes counterintuitive to what one would expect, given the nature of the industry.

6.4. IMPACT ON CORPORATE FINANCIAL AND MARKET PERFORMANCE

The scope of the investigation into the impact of human capital efficiency on corporate performance in South Africa was extremely broad, as it involved both inter-industry and intra-industry analysis of the relationship between VAHU and five measures of financial and market performance (ROA, GR, HEPS, M/B and TSR), across six industries and the JSE as a whole, from 2001 to 2011. Seventy multivariate regressions were performed in total – 35 to examine the contemporaneous impact and 35 to examine the future impact. Prior international studies on this topic (reviewed in Chapter 2) were mostly restricted to intellectual capital-intensive business sectors and lacked the same degree of time depth, while the relevant South African studies on the topic were all exploratory in nature. Consequently, existing research available for a comparison to the results of this study was limited.

Although few clear conclusions could be reached from the study of the JSE as a whole and intra-industry analysis across the five performance measures also delivered somewhat mixed results, certain trends became much clearer once the human capital efficiency categories were taken into account.

Human capital efficiency has almost no effect on current or future market performance for South African listed companies.

Market performance, as measured by a company's trading premium to net asset value (*i.e.* M/B) and capital and dividend returns (*i.e*. TSR), is not dependent on any changes in human capital efficiency. The future impact on TSR in Financials, Consumer Goods and Aggregated Industrials are the only exceptions. The negative effect of human capital efficiency on TSR observed in Consumer Goods and Aggregated Industrials is likely to be a consequence of the increase in earnings potential due to automation and mechanisation in manufacturing processes, as well as poor investor perceptions regarding the extent of industrial action in those industries. It is important to note that this finding does not only imply that training the workers in these industries – thereby improving their value creating-ability – may result in lower share returns. It also implies that, although the degree of value creation by a company's workforce will decrease as the extent of automation in its production and distribution processes increases, in those industries where such automation is considered important for building business capacity (such as Consumer Goods and Aggregated Industrials), management should recognise the possible positive share implications of such mechanisation. The cause of the negative effect seen in Financials is unclear and requires further investigation (refer to section 6.6.).

Higher human capital efficiency has a positive effect on current returns generated by any asset – tangible or intangible – in South Africa.

This study empirically proved what common sense should imply – a more competent person will make better use of whatever resources are given to him than a less competent person. This finding directly challenges the existing tendency to trade-off physical assets for human capital in South Africa. Instead, it implies that management would be wise to invest in their workforce (in addition to their physical capital) as companies are likely to access greater benefit from their capital investments by building the value-creating ability of the employees that use them. In addition, the study extends the positive effect of human capital efficiency to intangible assets. Improving the

value-creating ability of a company's human capital will allow for greater returns from its intangible assets and other types of intellectual capital, both structural and relational. To harness the competitive benefit from good customer and supplier relationships, to improve the internal culture within the company and to spark innovation, it is recommended that management consider building the capacity for value creation of its workforce. These arguments - which support investment by a company in its human capital - echo the suggestion in section 6.3. that companies may need to provide further education and training to their workers to boost their human capital efficiency, in order to supplement the poor quality of basic education offered in South Africa.

Higher bottom line profitability is concurrently associated with higher human capital efficiency in almost every industry in South Africa.

Maximising the value-added per Rand spent on employee costs is associated with higher profitability (as measured by HEPS) in most industries in South Africa. It is also safe to say that, in most companies, employee compensation amounts to the greatest expense in their income statement – regardless of the industry in which the company operates. Keeping these employee costs to a minimum does not guarantee higher profits, as it is usually coupled with workforce shrinkage, which causes a reduction in production capacity. This study empirically proved that to improve their profitability, South African companies should focus their attention on maximising the value that they are able to extract from their employees; and that skills development, job-specific competency training and incentivising tertiary education should not be overlooked. The unusual exception to this finding is Aggregated Technology, where HEPS was found to be independent of VAHU – additional research in this business sector is suggested to understand the strange *lack* of relationship (both contemporaneous and future) between human capital efficiency and profitability.

Higher revenue growth is associated with higher human capital efficiency in all industries contemporaneously, except those which are consumer-driven.

Maximising the value-added per Rand spent on employee costs is associated with higher growth in company revenues in most industries in South Africa. This conclusion applies regardless of whether the workers in that industry tend to have a comparably stronger or weaker ability to translate their knowledge capital into value-added for the business (i.e. whether 'high VAHU' or 'low VAHU' industries). Augmenting each employee's ability to generate value-added by strengthening their capacity for production or service delivery, increases a company's capacity for generating revenue overall. Employers in South Africa are well advised to empower their employees through further skills development and training in order to bolster their company's GR. However, this finding does not hold true for Aggregated Consumer Services and Consumer Goods – 'moderate VAHU' industries – where GR is driven more by other factors.

In consumer-driven industries in South Africa, human capital efficiency is not a driver for revenue growth but is still associated with higher profitability.

The consumer-driven industries, Consumer Goods and Aggregated Consumer Services, were classified as 'moderate VAHU'. Their main operations involve the manufacturing of food and beverages, fishing and farming, motor manufacturing, retail companies and service providers. In these industries, the economic forces of supply and demand by consumers are ultimately the primary drivers of company turnover. However, management of the companies in these industries should still aim to improve the value-creating competencies of their employees, as it would result in a stronger net profit position per share (*i.e.* HEPS) through tighter management of other non-employee related costs and better use of the company's other resources during service delivery and production.

In most industries in South Africa, the longer-term effect of human capital efficiency on corporate performance is more uncertain than its immediate effect.

The future impact of human capital efficiency on corporate performance was found to differ vastly from the contemporaneous impact for most industries in South Africa. The only contemporaneous

effects of human capital efficiency which persists in the longer-term are the positive effect on ROA in 'high VAHU' industries and in consumer-driven industries. The long-lasting nature of the impact on ROA adds further strength to the argument for balancing the scale in South Africa in favour of greater human capital development by government and individual companies, rather than only investment in tangible assets. In addition, even when examined independently of the contemporaneous study results, there were no clear patterns in the future impact of human capital efficiency across the low, moderate and high VAHU categories for any of the other measures of corporate performance.

6.5. POTENTIAL LIMITATIONS OF THE STUDY

The value-generating ability of a labour force – human capital efficiency – is merely one characteristic of human capital. The greatest potential limitation at the core of this study is the choice of human capital indicator used. However, it must be emphasised that there is no generally accepted 'best' measure or measures of human capital and this study did not purport VAHU to be the best. Motivation was simply provided to support the use of VAHU as an acceptable and appropriate indicator for human capital *efficiency* within the context of this research study.

In addition, as financial data on training costs is not readily available, the effect of employer-funded training was excluded from the human capital efficiency metric.

Further constraints to the study were posed by the nature of the JSE. The South African stock exchange is relatively young, with far fewer listed companies than other international stock exchanges. The lack of usable share data which is available places an inherent limitation on the time depth and cross-sectional spread of any data drawn from the JSE. It necessitated the aggregation of industries which initially had an insufficient number of observations, which could possibly have obscured some of the results.

6.6. RECOMMENDATIONS FOR FUTURE RESEARCH

By its nature, directors' remuneration generally far exceeds those of the company's other employees. Therefore, in this study, directors' remuneration costs were specifically excluded when quantifying human capital efficiency to avoid potential distortion of the outcomes. It would be interesting to see whether a change in the scope of the research would yield different results by isolating the relationship between a company's corporate performance and the human capital efficiency of its directors instead.

As previously mentioned, VAHU also excludes employer-funded training. An investigation into the value-added per Rand spent on skills development of employees, and its impact on company performance, is desirable, as a positive outcome may incentivise companies toward a greater commitment to empowering their staff. Due to the lack of available data from financial statements, the feasibility of such a study would, however, be contingent on obtaining the training cost data from empirical quantitative company surveys.

Two unusual anomalies were identified from the results of this study (refer to section 6.4.) for which no reasonable explanation could be determined. The first anomaly was that HEPS was found to be completely independent of human capital efficiency in Aggregated Technology. Although this finding concurred with prior research (Firer & Williams, 2003:357) and although it is likely that Aggregated Technology was categorised as 'low VAHU' due to the research and development nature of its operations, the fact that human capital efficiency does not affect its bottom line is still peculiar. The second anomaly was that human capital efficiency was found to negatively impact future TSR in Financials, while having no contemporaneous impact. Further research into the relationship between profitability and human capital in the information sector of South Africa, as well as the interrelationship over time between share returns and human capital in the South African financial sector, are recommended.

Although several factors were proposed which may have contributed to the decline in human capital efficiency in South Africa, further investigation is recommended to empirically confirm causality. Finally, while this study is focused at a corporate level, a macroeconomic study on the relationship between human capital efficiency and country-level measures of financial and economic performance, may also yield valuable insights for South Africa as a whole.

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APPENDIX A

Test for survivorship bias

	ROA		GR		HEPS	
	H3-a	*H4-a*	*H3-b*	*H4-b*	*H3-c*	*H4-c*
All industries						
Listed	7.000%	7.490%	0.000%	0.190%	0.070%	0.060%
Delisted and listed	6.820%	7.270%	0.000%	0.190%	0.060%	0.050%
Difference	0.180%	0.220%	0.000%	0.000%	0.010%	0.010%
Basic Materials						
Listed	7.070%	7.280%	1.090%	0.450%	0.890%	0.690%
Delisted and listed	7.070%	7.280%	1.090%	0.450%	0.890%	0.690%
Difference	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Consumer Goods						
Listed	51.600%	14.780%	3.280%	1.840%	2.090%	1.780%
Delisted and listed	51.550%	14.610%	3.290%	1.830%	2.050%	1.730%
Difference	0.050%	0.170%	-0.010%	0.010%	0.040%	0.050%
Aggregated Consumer Services						
Listed	20.130%	17.030%	1.470%	3.410%	1.070%	0.990%
Delisted and listed	20.160%	16.920%	1.300%	3.240%	0.910%	0.770%
Difference	-0.030%	0.110%	0.170%	0.170%	0.160%	0.220%
Financials						
Listed	20.440%	28.200%	0.330%	0.640%	5.920%	5.470%
Delisted and listed	19.770%	27.140%	0.290%	0.580%	5.860%	5.690%
Difference	0.670%	1.060%	0.040%	0.060%	0.060%	-0.220%
Aggregated Industrials						
Listed	22.300%	6.650%	3.070%	3.270%	10.900%	10.090%
Delisted and listed	22.070%	6.540%	3.050%	3.190%	10.780%	9.980%
Difference	0.230%	0.110%	0.020%	0.080%	0.120%	0.110%
Aggregated Technology						
Listed	28.310%	5.500%	1.920%	10.080%	22.380%	18.440%
Delisted and listed	27.670%	4.910%	1.540%	9.570%	18.070%	16.540%
Difference	0.640%	0.590%	0.380%	0.510%	4.310%	1.900%

	M/B		TSR	
	H3-d	*H4-d*	*H3-e*	*H4-e*
All industries				
Listed	0.170%	0.360%	22.550%	27.350%
Delisted and listed	0.170%	0.360%	22.510%	27.330%
Difference	0.000%	0.000%	0.040%	0.020%
Basic Materials				
Listed	0.650%	1.140%	74.340%	74.190%
Delisted and listed	0.650%	1.140%	74.340%	74.190%
Difference	0.000%	0.000%	0.000%	0.000%
Consumer Goods				
Listed	26.950%	29.850%	9.630%	8.990%
Delisted and listed	26.920%	29.810%	9.580%	8.870%
Difference	0.030%	0.040%	0.050%	0.120%
Aggregated Consumer Services				
Listed	42.250%	43.760%	5.740%	5.420%
Delisted and listed	43.230%	44.640%	5.740%	5.270%
Difference	-0.980%	-0.880%	0.000%	0.150%
Financials				
Listed	1.800%	3.320%	1.590%	0.740%
Delisted and listed	1.640%	3.220%	1.520%	0.720%
Difference	0.160%	0.100%	0.070%	0.020%
Aggregated Industrials				
Listed	21.950%	26.920%	7.370%	11.240%
Delisted and listed	21.910%	26.520%	7.280%	11.070%
Difference	0.040%	0.400%	0.090%	0.170%
Aggregated Technology				
Listed	21.990%	29.640%	12.050%	2.790%
Delisted and listed	23.060%	29.800%	11.950%	2.700%
Difference	-1.070%	-0.160%	0.100%	0.090%

APPENDIX B

Breusch-Pagan test for heteroskedasticity

H3	ROA	GR	HEPS	M/B	TSR
All industries	2 306.510	811.140	3 002.550	1 579.870	529.680
Basic Materials	241.640	67.670	244.290	193.760	59.450
Consumer Goods	431.660	85.000	311.240	124.680	52.330
Aggregated Consumer Services	296.580	326.110	685.090	138.630	137.840
Financials	313.930	76.410	526.450	450.160	98.710
Aggregated Industrials	488.370	264.640	827.840	355.760	93.720
Aggregated Technology	110.110	55.380	404.140	128.840	40.630
	Note: All results are significant at p<0.05				

H4	ROA	GR	HEPS	M/B	TSR
All industries	1 318.480	653.430	2 739.700	1 520.640	775.740
Basic Materials	88.450	47.180	257.320	169.550	81.210
Consumer Goods	97.210	72.630	341.000	118.620	58.070
Aggregated Consumer Services	213.690	270.510	678.940	179.710	287.900
Financials	189.250	65.320	300.190	417.820	108.080
Aggregated Industrials	382.590	132.350	811.990	331.620	173.970
Aggregated Technology	131.490	43.660	437.140	134.350	63.060
	Note: All results are significant at p<0.05				

APPENDIX C

Comparative descriptive statistics for the unadjusted raw data

	H3 - All industries			H4 - All industries		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	6.915	1.724	67.116	3.700	1.727	11.031
ROA	0.176	0.175	0.139	0.175	0.174	0.131
GR	0.278	0.129	1.887	0.173	0.125	0.412
HEPS	369.665	71.300	3 697.894	234.168	77.600	403.967
M/B	3.575	1.441	18.337	2.593	1.402	3.895
TSR	0.306	0.168	1.174	0.192	0.146	0.509
LMC	13.969	14.076	2.438	14.066	14.158	2.344
DR	0.408	0.407	0.253	0.408	0.405	0.248
ROE	0.350	0.299	0.340	0.345	0.297	0.323

	H3 - Basic Materials			H4 - Basic Materials		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	2.789	2.042	10.022	3.014	2.042	9.532
ROA	0.187	0.171	0.205	0.179	0.165	0.188
GR	0.696	0.143	4.681	0.211	0.125	0.599
HEPS	1 287.739	100.900	9 642.495	354.229	100.600	569.067
M/B	9.610	1.798	45.971	4.385	1.874	5.762
TSR	0.333	0.151	1.335	0.177	0.103	0.561
LMC	14.928	14.902	2.485	15.063	14.991	2.328
DR	0.352	0.340	0.208	0.347	0.337	0.192
ROE	0.317	0.271	0.394	0.309	0.271	0.331

	H3 - Consumer Goods			H4 - Consumer Goods		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	1.585	1.695	1.018	1.688	1.724	0.648
ROA	0.151	0.155	0.123	0.154	0.155	0.122
GR	0.097	0.085	0.287	0.076	0.075	0.239
HEPS	258.888	124.000	480.971	257.807	133.000	437.819
M/B	2.565	1.129	5.390	2.905	1.203	6.162
TSR	0.234	0.187	0.556	0.194	0.187	0.441
LMC	13.985	14.131	2.473	14.189	14.320	2.366
DR	0.350	0.350	0.210	0.350	0.348	0.209
ROE	0.239	0.234	0.217	0.245	0.242	0.214

	H3 - Aggregated Consumer Services			H4 - Aggregated Consumer Services		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	2.166	1.709	1.908	2.147	1.697	1.919
ROA	0.220	0.215	0.113	0.216	0.215	0.115
GR	0.170	0.142	0.307	0.165	0.140	0.306
HEPS	191.366	102.100	239.623	188.009	102.600	232.057
M/B	2.692	2.047	2.530	2.704	2.039	2.568
TSR	0.332	0.254	0.618	0.273	0.238	0.445
LMC	14.141	14.665	2.277	14.192	14.665	2.227
DR	0.385	0.334	0.262	0.395	0.348	0.262
ROE	0.425	0.350	0.335	0.413	0.350	0.338

	H3 - Financials			H4 - Financials		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	29.419	3.247	158.887	12.829	3.365	25.044
ROA	0.111	0.094	0.126	0.107	0.088	0.113
GR	0.327	0.127	1.228	0.167	0.117	0.407
HEPS	223.626	46.650	466.616	261.406	97.750	429.356
M/B	3.262	1.328	10.144	1.965	1.178	2.880
TSR	0.376	0.125	1.962	0.148	0.097	0.476
LMC	14.288	14.554	2.258	14.516	14.729	2.301
DR	0.547	0.573	0.275	0.558	0.578	0.276
ROE	0.362	0.289	0.398	0.348	0.288	0.353

	H3 - Aggregated Industrials			H4 - Aggregated Industrials		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	2.264	1.524	7.978	1.912	1.533	2.476
ROA	0.180	0.183	0.103	0.177	0.180	0.105
GR	0.196	0.135	0.444	0.183	0.129	0.366
HEPS	240.834	55.800	466.239	234.050	64.700	413.524
M/B	2.143	1.151	3.249	2.092	1.135	3.093
TSR	0.275	0.135	1.003	0.159	0.085	0.545
LMC	13.421	13.280	2.393	13.558	13.479	2.215
DR	0.410	0.433	0.243	0.411	0.435	0.237
ROE	0.351	0.307	0.327	0.351	0.307	0.343

	H3 - Aggregated Technology			H4 - Aggregated Technology		
	Mean	Median	Std Dev	Mean	Median	Std Dev
VAHU	1.849	1.425	1.622	1.967	1.493	1.565
ROA	0.207	0.202	0.148	0.205	0.198	0.139
GR	0.233	0.124	0.549	0.241	0.125	0.577
HEPS	112.951	15.350	283.469	105.561	15.100	254.508
M/B	2.158	1.646	2.100	2.033	1.481	2.007
TSR	0.253	0.143	0.840	0.197	0.149	0.563
LMC	13.098	12.885	2.476	13.142	12.893	2.372
DR	0.347	0.368	0.232	0.344	0.351	0.224
ROE	0.341	0.320	0.247	0.335	0.316	0.232

APPENDIX D

Industry descriptive statistics for H3

	H3 - Basic Materials			
	Median	Minimum	Maximum	Std Dev
VAHU	2.042	-0.325	4.434	1.479
ROA	0.171	-0.483	0.959	0.205
GR	0.143	-0.306	0.601	0.279
HEPS	100.900	-250.786	570.392	252.365
M/B	1.798	0.000	5.135	1.821
TSR	0.151	-0.772	1.191	0.542
LMC	14.902	9.224	20.285	2.485
DR	0.340	0.004	0.959	0.208
ROE	0.271	-1.035	2.376	0.394

	H3 - Consumer Goods			
	Median	Minimum	Maximum	Std Dev
VAHU	1.695	-0.325	3.187	0.653
ROA	0.155	-0.457	0.757	0.123
GR	0.085	-0.306	0.601	0.179
HEPS	124.000	-250.786	570.392	191.861
M/B	1.129	0.018	5.135	1.345
TSR	0.187	-0.772	1.191	0.446
LMC	14.131	6.602	19.823	2.473
DR	0.350	0.002	0.846	0.210
ROE	0.234	-0.799	0.913	0.217

	H3 - Aggregated Consumer Services			
	Median	Minimum	Maximum	Std Dev
VAHU	1.709	-0.325	4.434	0.906
ROA	0.215	-0.259	0.569	0.113
GR	0.142	-0.306	0.601	0.160
HEPS	102.100	-54.000	570.392	184.296
M/B	2.047	0.045	5.135	1.679
TSR	0.254	-0.772	1.191	0.425
LMC	14.665	8.422	18.849	2.277
DR	0.334	0.001	0.923	0.262
ROE	0.350	-0.529	2.775	0.335

	H3 - Financials			
	Median	Minimum	Maximum	Std Dev
VAHU	3.247	-0.325	4.434	1.527
ROA	0.094	-0.293	0.802	0.126
GR	0.127	-0.306	0.601	0.266
HEPS	46.650	-250.786	570.392	202.255
M/B	1.328	0.027	5.135	1.449
TSR	0.125	-0.772	1.191	0.475
LMC	14.554	8.447	18.989	2.258
DR	0.573	0.001	0.978	0.275
ROE	0.289	-0.717	2.166	0.398

	H3 - Aggregated Industrials			
	Median	Minimum	Maximum	Std Dev
VAHU	1.524	-0.325	4.434	0.833
ROA	0.183	-0.268	0.648	0.103
GR	0.135	-0.306	0.601	0.223
HEPS	55.800	-250.786	570.392	205.062
M/B	1.151	0.008	5.135	1.455
TSR	0.135	-0.772	1.191	0.527
LMC	13.280	4.564	19.269	2.393
DR	0.433	0.000	0.978	0.243
ROE	0.307	-1.152	3.440	0.327

	H3 - Aggregated Technology			
	Median	Minimum	Maximum	Std Dev
VAHU	1.425	-0.325	4.434	0.992
ROA	0.202	-0.324	0.700	0.148
GR	0.124	-0.306	0.601	0.232
HEPS	15.350	-49.600	570.392	164.154
M/B	1.646	0.072	5.135	1.481
TSR	0.143	-0.772	1.191	0.495
LMC	12.885	6.259	19.366	2.476
DR	0.368	0.003	0.836	0.232
ROE	0.320	-0.529	1.481	0.247

APPENDIX E

Industry descriptive statistics for H4

	H4 - Basic Materials			
	Median	Minimum	Maximum	Std Dev
VAHU	2.042	-0.073	4.141	1.336
ROA	0.165	-0.035	0.385	0.127
GR	0.125	-0.279	0.553	0.256
HEPS	100.600	-243.027	576.753	243.133
M/B	1.874	0.186	4.917	1.688
TSR	0.103	-0.888	1.805	0.561
LMC	14.991	9.339	20.285	2.328
DR	0.337	0.007	0.926	0.192
ROE	0.271	-0.099	0.751	0.229

	H4 - Consumer Goods			
	Median	Minimum	Maximum	Std Dev
VAHU	1.724	-0.073	3.242	0.619
ROA	0.155	-0.035	0.385	0.094
GR	0.075	-0.279	0.553	0.167
HEPS	133.000	-243.027	576.753	195.932
M/B	1.203	0.035	4.917	1.364
TSR	0.187	-0.871	1.645	0.441
LMC	14.320	7.518	19.823	2.366
DR	0.348	0.002	0.846	0.209
ROE	0.242	-0.099	0.751	0.178

	H4 - Aggregated Consumer Services			
	Median	Minimum	Maximum	Std Dev
VAHU	1.697	-0.073	4.141	0.856
ROA	0.215	-0.035	0.385	0.099
GR	0.140	-0.279	0.553	0.155
HEPS	102.600	-54.000	576.753	183.582
M/B	2.039	-1.060	4.917	1.623
TSR	0.238	-0.922	1.833	0.445
LMC	14.665	8.740	18.849	2.227
DR	0.348	0.001	1.071	0.262
ROE	0.350	-0.099	0.751	0.214

	H4 - Financials			
	Median	Minimum	Maximum	Std Dev
VAHU	3.365	-0.073	4.141	1.265
ROA	0.088	-0.035	0.385	0.090
GR	0.117	-0.279	0.553	0.238
HEPS	97.750	-243.027	576.753	213.086
M/B	1.178	0.027	4.917	1.309
TSR	0.097	-0.921	1.664	0.476
LMC	14.729	8.447	18.989	2.301
DR	0.578	0.001	0.968	0.276
ROE	0.288	-0.099	0.751	0.236

	H4 - Aggregated Industrials			
	Median	Minimum	Maximum	Std Dev
VAHU	1.533	-0.073	4.141	0.771
ROA	0.180	-0.035	0.385	0.090
GR	0.129	-0.279	0.553	0.210
HEPS	64.700	-243.027	576.753	206.792
M/B	1.135	0.012	4.917	1.388
TSR	0.085	-0.971	2.093	0.545
LMC	13.479	7.458	19.074	2.215
DR	0.435	0.000	0.978	0.237
ROE	0.307	-0.099	0.751	0.197

	H4 - Aggregated Technology			
	Median	Minimum	Maximum	Std Dev
VAHU	1.493	-0.073	4.141	0.969
ROA	0.198	-0.035	0.385	0.110
GR	0.125	-0.279	0.553	0.218
HEPS	15.100	-49.600	576.753	162.055
M/B	1.481	0.104	4.917	1.405
TSR	0.149	-0.846	2.000	0.563
LMC	12.893	7.357	19.366	2.372
DR	0.351	0.003	0.836	0.224
ROE	0.316	-0.099	0.751	0.198

APPENDIX F

Regression results for H3

H3 - All industries

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept															
VAHU	0.097	13.605	0.000	0.062	5.385	0.000	37.421	5.506	0.000	-0.014	-0.276	0.783	0.047	2.277	0.023
LMC	0.016	4.397	0.000	0.019	1.995	0.046	26.019	2.879	0.004	0.670	16.992	0.000	0.088	3.644	0.000
DR	-0.071	-4.595	0.000	-0.026	-0.736	0.462	42.664	1.829	0.068	1.562	7.047	0.000	-0.625	-6.841	0.000
ROE										0.471	2.307	0.021	0.141	2.275	0.023
R-squared	0.520			0.060			0.150			0.500			0.070		
F-value	546.820			29.730			86.850			381.180			27.180		
significance	0.000			0.000			0.000			0.000			0.000		
n	1 507			1 507			1 507			1 506			1 506		

H3 - Basic Materials

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept	-0.058	-0.643	0.521	0.265	2.022	0.044	-307.841	-1.998	0.047				-0.028	-0.171	0.865
VAHU	0.118	9.772	0.000	0.052	3.912	0.000	62.679	4.675	0.000	0.175	1.397	0.164	0.008	0.295	0.768
LMC	0.000	0.000	1.000	-0.017	-1.939	0.054	27.943	2.633	0.009	0.737	7.703	0.000	0.015	1.328	0.185
DR	-0.043	-0.832	0.406	0.091	1.055	0.292	-174.525	-3.416	0.001	2.089	3.889	0.000	-0.221	-1.263	0.208
ROE										-0.748	-1.526	0.128	0.254	2.514	0.013
R-squared	0.610			0.080			0.270			0.430			0.050		
F-value	129.390			7.030			30.700			39.520			3.100		
significance	0.000			0.000			0.000			0.000			0.016		
n	251			251			251			211			250		

H3 - Consumer Goods

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept	-0.147	-2.615	0.010				-150.762	-0.929	0.354				0.293	1.426	0.155
VAHU	0.149	5.752	0.000	0.062	1.593	0.113	73.784	2.880	0.004	-0.148	-0.996	0.321	0.045	0.717	0.474
LMC	0.005	1.212	0.227	-0.009	-0.749	0.455	14.530	1.211	0.227	0.601	5.516	0.000	-0.006	-0.684	0.495
DR	-0.078	-3.805	0.000	-0.096	-1.564	0.120	-43.182	-0.524	0.601	1.823	3.458	0.001	-0.664	-3.223	0.001
ROE										0.677	1.202	0.231	0.623	2.684	0.008
R-squared	0.650			0.040			0.140			0.630			0.190		
F-value	117.470			2.510			10.190			70.940			11.310		
significance	0.000			0.060			0.000			0.000			0.000		
n	193			169			193			168			192		

H3 - Aggregated Consumer Services

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept				0.015	0.187	0.851	-319.933	-1.209	0.227				0.194	1.146	0.252
VAHU	0.093	5.303	0.000	-0.002	-0.208	0.835	55.644	2.283	0.023	0.114	0.922	0.357	0.059	1.460	0.145
LMC	0.013	1.249	0.213	0.010	1.989	0.047	23.279	1.119	0.264	0.645	8.643	0.000	0.005	0.334	0.738
DR	-0.036	-1.207	0.229	-0.009	-0.208	0.835	107.790	2.463	0.014	1.720	3.074	0.002	-0.382	-3.277	0.001
ROE										1.293	3.638	0.000	0.132	1.571	0.117
R-squared	0.400			0.010			0.190			0.680			0.070		
F-value	68.910			0.890			26.870			165.940			6.800		
significance	0.000			0.445			0.000			0.000			0.000		
n	307			353			353			306			352		

H3 - Financials

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept				0.255	1.686	0.093	-582.467	-4.737					-0.178	-1.427	0.155
VAHU	0.068	6.501	0.000	0.046	3.631	0.000	20.499	2.629	0.009	-0.039	-0.497	0.620	0.020	0.839	0.402
LMC	0.015	1.572	0.117	-0.017	-1.563	0.119	45.208	4.835	0.000	0.509	5.026	0.000	0.025	1.928	0.055
DR	-0.106	-2.993	0.003	0.035	0.740	0.460	40.332	0.845	0.399	0.713	1.575	0.116	-0.273	-2.203	0.028
ROE										0.790	3.168	0.002	0.225	2.013	0.045
R-squared	0.480			0.060			0.220			0.260			0.060		
F-value	76.920			6.080			28.120			22.340			4.780		
significance	0.000			0.000			0.000			0.000			0.001		
n	254			302			302			253			301		

H3 - Aggregated Industrials

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept															
VAHU	0.107	6.848	0.000	0.099	2.314	0.021	30.569	2.608	0.009	0.066	0.768	0.443	-0.025	-0.456	0.648
LMC	0.015	3.609	0.000	0.070	3.359	0.001	25.167	1.985	0.048	0.642	8.220	0.000	0.149	4.487	0.000
DR	-0.073	-4.360	0.000	-0.164	-2.756	0.006	64.843	1.972	0.049	1.520	4.463	0.000	-0.964	-6.462	0.000
ROE										0.432	1.312	0.190	0.041	0.391	0.696
R-squared	0.590			0.150			0.160			0.560			0.110		
F-value	204.290			24.270			25.710			131.920			12.600		
significance	0.000			0.000			0.000			0.000			0.000		
n	419			419			419			418			418		

H3 - Aggregated Technology

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept				-0.069	-0.582	0.562							-0.306	-1.320	0.189
VAHU	0.106	5.012	0.000	0.054	1.666	0.098	-11.319	-0.955	0.341	0.155	0.924	0.357	0.005	0.125	0.901
LMC	0.027	2.237	0.027	0.010	1.046	0.297	33.133	2.056	0.042	0.781	7.136	0.000	0.027	1.388	0.167
DR	-0.016	-0.310	0.757	0.024	0.260	0.795	80.040	1.455	0.148	0.627	0.873	0.384	-0.210	-1.119	0.265
ROE										0.447	0.663	0.508	0.539	2.597	0.010
R-squared	0.470			0.050			0.210			0.480			0.070		
F-value	38.060			2.910			11.610			29.560			3.070		
significance	0.000			0.037			0.000			0.000			0.018		
n	131			154			131			130			153		

APPENDIX G

Regression results for H4

H4 - All industries

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept							-447.992	-6.844	0.000						
VAHU	0.013	4.336	0.000	0.004	0.349	0.727	16.489	3.634	0.000	-0.038	-0.911	0.362	-0.140	-5.838	0.000
LMC	0.023	5.441	0.000	0.033	3.184	0.001	39.277	8.153	0.000	0.606	9.639	0.000	0.112	4.459	0.000
DR	-0.070	-4.683	0.000	-0.068	-1.968	0.049	42.029	1.871	0.062	1.412	6.565	0.000	-0.779	-7.764	0.000
ROE										1.095	4.458	0.000	0.461	4.063	0.000
R-squared	0.090			0.020			0.160			0.530			0.100		
F-value	44.210			7.400			106.030			372.860			37.260		
significance	0.000			0.000			0.000			0.000			0.000		
n	1 373			1 373			1 617			1 372			1 372		

H4 - Basic Materials

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept							-386.420	-3.379	0.001				0.028	0.127	0.899
VAHU	0.017	2.744	0.007	-0.053	-2.760	0.006	22.270	2.667	0.008	-0.037	-0.570	0.569	0.012	0.387	0.699
LMC	-0.008	-0.734	0.464	-0.034	-1.268	0.207	37.849	4.635	0.000	0.607	4.074	0.000	0.007	0.471	0.638
DR	-0.072	-1.451	0.149	0.206	1.399	0.164	-105.739	-1.740	0.083	2.017	2.820	0.005	-0.389	-1.812	0.071
ROE										1.190	2.576	0.011	0.507	1.725	0.086
R-squared	0.040			0.060			0.100			0.400			0.050		
F-value	2.300			3.920			7.890			27.870			2.570		
significance	0.079			0.010			0.000			0.000			0.039		
n	170			170			205			169			204		

H4 - Consumer Goods

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept							-282.730	-2.029	0.044	-6.816	-6.146	0.000	0.400	1.761	0.080
VAHU	0.016	1.341	0.182	0.028	1.135	0.258	35.261	1.825	0.070	0.029	0.497	0.620	-0.149	-2.434	0.016
LMC	0.024	3.020	0.003	0.006	0.473	0.637	28.622	2.724	0.007	0.542	6.889	0.000	0.006	0.426	0.670
DR	-0.105	-3.442	0.001	-0.128	-1.910	0.058	-59.324	-0.755	0.451	1.846	3.442	0.001	-0.851	-3.991	0.000
ROE										0.482	0.944	0.346	1.025	4.322	0.000
R-squared	0.160			0.030			0.100			0.630			0.220		
F-value	10.470			1.410			6.780			79.810			13.140		
significance	0.000			0.241			0.000			0.000			0.000		
n	165			165			189			188			188		

H4 - Aggregated Consumer Services

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept				0.002	0.019	0.984	-485.062	-2.528	0.012				0.249	1.570	0.117
VAHU	0.026	1.963	0.051	-0.007	-0.653	0.514	51.378	1.871	0.062	0.161	1.174	0.241	-0.052	-1.472	0.142
LMC	0.026	2.246	0.025	0.012	2.175	0.030	35.768	2.330	0.020	0.646	10.098	0.000	0.010	0.792	0.429
DR	-0.061	-1.793	0.074	-0.037	-0.900	0.369	95.802	2.143	0.033	1.260	2.501	0.013	-0.617	-4.648	0.000
ROE										2.267	3.971	0.000	0.603	5.186	0.000
R-squared	0.170			0.010			0.250			0.720			0.110		
F-value	20.960			1.380			39.530			192.710			10.700		
significance	0.000			0.248			0.000			0.000			0.000		
n	300			347			347			299			346		

H4 - Financials

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept				0.017	0.125	0.901	-670.899	-4.534	0.000						
VAHU	0.008	1.704	0.090	0.035	2.467	0.014	10.207	1.396	0.164	-0.104	-1.470	0.143	-0.172	-4.866	0.000
LMC	0.038	3.411	0.001	0.001	0.115	0.909	54.091	4.651	0.000	0.499	5.456	0.000	0.278	4.598	0.000
DR	-0.077	-1.897	0.059	0.022	0.551	0.582	54.648	1.143	0.254	0.843	3.412	0.001	-0.529	-4.101	0.000
ROE										0.619	2.234	0.027	0.390	2.295	0.023
R-squared	0.100			0.040			0.210			0.310			0.270		
F-value	7.210			3.160			20.890			21.550			17.950		
significance	0.000			0.025			0.000			0.000			0.000		
n	194			236			236			193			193		

H4 - Aggregated Industrials

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept															
VAHU	0.013	1.425	0.155	0.036	1.152	0.250	9.617	1.301	0.194	-0.096	-1.543	0.124	-0.260	-3.608	0.000
LMC	0.034	6.934	0.000	0.077	4.129	0.000	28.630	2.361	0.019	0.642	7.390	0.000	0.175	3.550	0.000
DR	-0.098	-5.910	0.000	-0.216	-3.705	0.000	63.484	1.666	0.096	1.497	3.930	0.000	-0.962	-5.555	0.000
ROE										0.471	1.180	0.239	0.233	1.116	0.265
R-squared	0.180			0.090			0.140			0.570			0.120		
F-value	30.050			14.020			21.020			129.910			14.060		
significance	0.000			0.000			0.000			0.000			0.000		
n	401			401			401			400			400		

H4 - Aggregated Technology

	ROA			GR			HEPS			M/B			TSR		
	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value	Std β	t-value	*p*-value
Intercept	0.172	1.937	0.055							-2.812	-1.499	0.136	-0.121	-0.367	0.714
VAHU	0.024	3.474	0.001	-0.040	-1.432	0.155	-2.403	-0.412	0.681	0.092	0.700	0.485	-0.056	-1.134	0.259
LMC	-0.001	-0.149	0.882	0.080	4.215	0.000	21.992	2.003	0.047	0.285	1.692	0.093	0.023	0.762	0.448
DR	-0.007	-0.151	0.880	-0.152	-1.593	0.114	103.025	1.566	0.120	0.568	0.875	0.383	-0.333	-1.461	0.146
ROE										1.813	1.922	0.056	0.704	2.766	0.006
R-squared	0.040			0.110			0.170			0.300			0.050		
F-value	2.270			5.230			8.800			16.380			1.990		
significance	0.083			0.002			0.000			0.000			0.099		
n	151			128			128			150			150		