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The impact of board structures on intellectual capital performance in South Africa: An empirical investigation

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2014-03-06
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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Faculty of Commerce, Law and Management

School of Accountancy

The impact of board structures on intellectual capital performance in South Africa: An empirical investigation

A research report in partial fulfillment (50%) of the requirements for the degree of Master of Commerce

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DECLARATION

I declare that this research report is my own original work and that all sources have been accurately reported and acknowledged. It is submitted for the degree of Master of Commerce to the University of Witwatersrand, Johannesburg. This research has not been submitted for any degree or examination at this or any other university.

_____ _____

Katinka Vermeulen Date

ACKNOWLEDGEMENT

With grateful thanks to:

- My husband, family and friends for your support and encouragement.
- My supervisor, Gary Swartz, for your valuable assistance, support and guidance.

ABSTRACT

The well documented agency problem remains an ongoing debate, with the board as a central point of corporate governance providing a control mechanism. The effective composition and functioning of the board is therefore highlighted as being key to overcoming agency-problems (Hermalin and Weisback, 2003; Adams and Ferreira, 2009). This research report explores the relationship between the structural aspects of the board, including the average age of board members, the size of the board of directors and the specific positions women and ethnic persons hold on the board of South African listed companies, and intellectual capital performance measured using VAIC™ (Pulic, 2000), as well as market adjusted share returns. The population consists of all South African companies listed on the JSE Securities Exchange during 2011 with the final sample consisting of 193 companies after transformation of the data. The results of the regression analyses indicated no significant relationship between intellectual capital performance and board size, or specific positions being held by women or ethnic persons. A significant positive relationship however exists between the average age of the board of directors and intellectual capital performance. As a result, companies may be able to enhance their intellectual capital performance by increasing the average age of their board members.

Key words: *Board structure, Diversity, Ethnic, Gender, Age, Board size, Intellectual capital, Performance, South Africa.*

CHAPTER I - Introduction

1.1 Introduction

Chapter one of this research report provides the context in which the research study has been conducted. The chapter commences with a brief discussion regarding the role of the board of directors with respect to corporate governance, after which the research problem is stated, and previous studies are explored. The purpose and significance of the study is then clarified within a South African context, culminating in the main research question as stipulated in section 1.6.

1.2 Corporate governance and the board of directors

The separation of ownership and control of companies, and the resulting misalignment of the goals of shareholders and management remains an ongoing debate well documented in agency literature (Moldoveanu and Martin, 2001). One resulting mechanism to manage the agency problem is the refinement of regulation and corporate governance (Rossouw, Van der Watt and Malan, 2002). In recent times, The King Report on Governance for South Africa (King III) has identified the board as a central point of corporate governance (Institute of Directors of South Africa, 2009), and therefore the effective functioning of the board of directors is key to overcoming agency-problems (Hermalin and Weisback, 2003; Adams and Ferreira, 2009). Adherence to corporate governance principles by the board holds the directors accountable to the shareholders, creating shareholder value (Rossouw et al., 2002).

1.3 Research problem and limitations of previous research

Boone, Field, Karpoff and Raheja (2005) highlight that corporate board reform has received much attention in an effort to improve policies on corporate governance. King III emphasises that to create value is the main reason for the existence of a company, and is

the board's primary responsibility (Institute of Directors of South Africa, 2009). This core responsibility may be better accomplished through a specifically composed board of directors, as companies are able to improve board effectiveness and increase shareholder value by changing its board composition (Hermalin and Weisbach, 1991). King III recommends that the board of directors consider whether its size, diversity and demographics make it effective (Institute of Directors of South Africa, 2009). As South African listed companies are required to adhere to King III, the question arises as to whether there are specific board characteristics that contribute to firm value.

Various studies have measured the potential impact of board characteristics on firm value (Carter, Simkins and Simpson, 2003; Swartz and Firer, 2005; Ameer, Ramli and Zakaria, 2010; Black and Kim, 2012). This study adds to the body of literature in a number of ways. Firstly, with the exception of a few studies (Van der Zahn, 2004; Swartz, 2005; Swartz and Firer, 2005), most empirical research on the relationship between board characteristics and firm performance measured the latter using traditional measures such as return on assets and return on equity. This study follows the measurement used by Swartz and Firer (2005) and measures corporate performance in terms of the value added through a company's intellectual capital resources using the Value Added Intellectual Coefficient, VAIC™ (Pulic, 2000). Measuring firm value with reference to intellectual capital seems fitting as employees of modern companies contribute to firm value through their skills and experience; their performance being dependent on appropriate knowledge management (Gorry and Westbrook, 2012).

Secondly, no previous South African intellectual capital study has measured the relationship between intellectual capital performance and board size, and the average age of board members (Van der Zahn, 2004; Swartz, 2005; Swartz and Firer, 2005).

Finally, the only study that investigated the relationship between intellectual capital and the specific positions held by women and board members of colour in South Africa, was based on 1998 data (Van der Zahn, 2004). This research report measures the impact of these variables on intellectual capital using more recent data, more than ten years after the introduction of the Employment Equity Act, No.55 in 1998 and is the first study investigating the impact of these board characteristics on intellectual capital after the introduction of King III.

1.4 Purpose of this research report

The purpose of this research report is to explore the relationship between South African listed companies' intellectual capital performance, and the size of their board, average age of the board, and the specific positions women and persons of colour hold on the board.

The relationship between board characteristics and company performance was analysed using data drawn from a sample of South African companies listed on the Johannesburg Stock Exchange (JSE), and the Value Added Intellectual Co-efficient (VAIC™), in line with Swartz and Firer (2005).

1.5 Significance of this study

The significance of this study is established within the South African context. South Africa needs foreign and domestic capital in order to achieve its economic growth targets and with international capital demanding good corporate governance standards, the focus on improved corporate governance remains an area of utmost priority (Armstrong, Segal and

Davis, 2005). Drastic changes in South African corporate governance was initially driven mainly by demands from these foreign institutional investors in 1994 to align the country's governance principles with international norms, upon which the government, regulators, the South African Institute of Chartered Accountants (SAICA) and the JSE engaged to instigate new requirements and best practices (Malherbe and Segal, 2001).

The King Report on Corporate Governance is currently the most prevalent regulation in terms of corporate governance in South Africa. Subsequent to the Cadbury Report (European Corporate Governance Institute, 1992) being released in Britain, the King Report on Corporate Governance 1994 (King I) was released in South Africa in November 1994 (Malherbe and Segal, 2001). Malherbe and Segal (2001) point out that King I made the public aware of the importance of good corporate governance, with one of the areas of specific focus being the need for appropriate board structures. The King committee was tasked to consider the "special circumstances existing in South Africa, more particularly the entrance into the business community of members of disadvantaged communities" (Malherbe and Segal 2001:56).

The King committee had to ensure that the legislation appropriately catered for the South African labour market, and consequently the committee needed to take cognisance of the unique characteristics associated with the country following the Apartheid regime. At the time the South African labour market was characterised by inequality in employment, occupation and income as a result of the apartheid laws and other discriminating rulings. In 1998 the Employment Equity Act, No.55 was passed which specifically prohibits unfair discrimination on the grounds of, amongst others, race, gender and age, with the aim of achieving employment equity. Designated employers are required to put affirmative action measures in place to create equal opportunities for suitably qualified people from

designated groups and strive for equitable representation of these groups in all categories and levels in the workplace. Designated groups include black people (defined as Africans, Coloureds and Indians), women and people with disabilities (Department of Labour, 1998).

To comply with the act, South African companies are therefore forced to respond to the uncertainties in the business environment following the Apartheid regime and implement strategies to adhere to regulatory provisions regarding employment equity (Van der Zahn, 2004). Despite various policies, designated groups remain under-represented in the South African labour market and on corporate boards (Adams and Ferreira, 2009). Only 7,2% of directors in emerging markets are women (Gladman and Lamb, 2012), and as at March 2011 South African women directorships amounted to 15.8% while black directors held only 23% of the seats on the boards of JSE listed companies (Business Womens' Association of South Africa, 2011). As a company's board of directors is responsible for adherence to regulations and fundamental to the execution of good corporate governance principles (Institute of Directors of South Africa, 2009), the composition and diversity of the board of directors has received increased attention nationally.

The King Report on Governance for South Africa was issued in 2009 (King III) taking into account the Companies Act no. 71 of 2008 and international governance developments (Republic of South Africa, 2008). King III follows a voluntary basis for governance compliance (Institute of Directors of South Africa, 2009).

Paragraph 71 of King III states:

> "Every board should consider whether its size, diversity and demographics make it effective. Diversity applies to academic qualifications, technical expertise, relevant

industry knowledge, experience, nationality, age, race and gender."

(Institute of Directors of South Africa, 2009:33)

This research report investigates the relationship between these factors and firm value. Policymakers, managers, stakeholders and researchers in South Africa and internationally should therefore have interest in the results of this study.

1.6 Main research question

Is there a significant positive relationship between the specific board characteristics of South African publicly listed companies (as defined by King III) and intellectual capital performance?

1.7 Chapter conclusion

This chapter clarifies the role of the board of directors in corporate governance, and stated the research problem, the purpose of the research study given limitations of previous research in the field, the significance of the study in South Africa and the main research question addressed by the research study.

CHAPTER II - Literature review

2.1 Introduction

This chapter provides the background to the research report by reviewing previous literature in the field and defining the terms used in the study. Section 2.2 begins by drawing attention to the relevance of reviewing the relationship between corporate governance and firm performance and reviews the literature underlying the importance of the size of the board of directors, followed by a discussion regarding the diversity and demographics of the board. The latter is expanded by delving into literature considering the relevance of the age of the directors and the importance of the gender, race and position of the directors. The chapter then discusses the research underlying the concept of intellectual capital and the appropriateness of using a measure of intellectual capital as an indicator of performance; including a discussion on market-based measures. Finally, the chapter is concluded by providing the definition of terms used in the report.

2.2 Literature review

The relationship between various aspects of corporate governance and firm performance has received considerable attention recently both nationally and internationally, emphasising the strive towards more diverse boards of directors (Natesan, 2012). Research in this field is expanding in South Africa given its current relevance (Ho and Williams, 2003; Swartz and Firer, 2005; Khumalo, 2011; Ntim, 2011; Ntim and Osei, 2011) ; a recent study conducted by Ntim, Opong and Danbolt (2012) found that even the mere disclosure of good corporate governance practices had a positive impact on firm value. Previous studies have evaluated a range of board characteristics to assess whether these factors impact firm value, results of which are mixed.

2.2.1 Size of the board

The combined knowledge, skills, experience and resources required to achieve a company's objectives should be considered when determining the number of directors to serve on the board (Institute of Directors of South Africa, 2009). It is however not clear what board size in terms of numbers and mix would encompass the correct demographics and expertise that would lead to an efficient board (Nyirenda, 2010).

Furthermore, a company's board size affects how directors share information and fulfil their responsibilities (Council on foundations, 2010) and as a result, the advantages and disadvantages of increasing the size of the board should be considered along with whether this would bring about increased firm value.

Results from previous studies regarding the size of the board of directors have been varied from there being no impact identified, to preferences for small, medium, or large boards. Cheng (2008) and Khumalo (2011) found no association between board size and firm value, while a smaller board was preferred by both Hermalin and Weisback (2003) and Council on foundations (2010), a medium sized board by Berezinets, Ilina and Muravyev (2011), while Adams and Mehran (2008), Abidin, Kamal and Jusoff (2009), and Ntim, Opong and Danbolt (2010) found that board size is positively associated with firm value, and that a firm is perceived by the business community to be better governed if it has a larger board of directors (Musteen, Datta and Kemmerer, 2010).

This leaves a rather inconclusive view of whether board size matters, and validates the testing thereof particularly in a South African context.

2.2.2 Diversity and demographics of the board

A diverse board should by deduction provide a richer and broader set of skills to firms. Companies should therefore construct their boards in such a way that they can gain a competitive advantage by pooling of different expertise, perspectives, backgrounds and opinions of the board members (Van der Walt and Ingley, 2003). Despite the fact that there is still uncertainty regarding the value that is added by general diversity (Matsaba, 2010), a truly diverse board has been found to create synergies by bringing together a range of skills, experiences, backgrounds, leadership styles and perspectives (PricewaterhouseCoopers, 2011; Natesan, 2012), with the correlation between board diversity and shareholder value creation playing a vital part in good corporate governance (Carter et al., 2003).

Diversity enhances decision making as board members do not automatically convert to group norms, but are challenged to approach situations taking into account different perspectives, unique experiences, and providing an interplay of diverse characteristics (Ramirez, 2003). This in turn promotes innovation, greater creativity and more efficient decision making (Marimuthu, 2008) leading to an increased ability to solve organisational problems creatively (Van der Zahn, 2004). Furthermore, a diverse board is better able to resolve conflict due to the wide range of viewpoints, contributing to the controlling function, and the minimisation of potential agency issues (Erhardt, Werbel and Shrader, 2003).

Definition of diversity

King III defines diversity as the “academic qualifications, technical expertise, relevant industry knowledge, experience, nationality, age, race and gender” (Institute of Directors of South Africa, 2009:33).

This research report measures the effect of diversity on intellectual capital performance and share value; however, some of the defined components of diversity provide estimation issues. These include the difficulty of interpreting the relevance of specific academic qualifications within an industry; analysing data on academic qualifications is therefore considered to be beyond the scope of this study. In addition, as not all companies consistently disclose the nationality of their directors in their financial statements, this aspect of the definition has not been considered. Finally, the measurement of technical expertise, relevant industry knowledge and experience will be difficult using published financial data, and is therefore excluded. Therefore, for the purpose of this research report, diversity and demographics was evaluated in terms of age, race and gender. The excluded variables will be borne in mind when evaluating results.

2.2.3 Age of directors

The King report does not specify or place limitations on the age of board members, or the length of service of board members, due specifically to the limited skills in South Africa (Armstrong et al., 2005). The composition of the boards of directors of South African listed companies does however vary with respect to the average age of their board members, with the age of newly appointed independent directors generally increasing as companies seek to employ recently retired executives (PricewaterhouseCoopers, 2011).

Very little empirical research has been conducted on whether the average age of the board of directors impacts firm performance. A Swedish study conducted by Pesämaa, Klaesson and Haahti (2008) found that the average age of board members had no impact on performance as measured by sales, despite the authors' hypothesis that the seniority or newness of directors would have an impact on the performance of the company. In contrast, a study concerning the corporate governance of non-profit organisations by Siciliano (1996)

found that the increased age of the board assisted with fundraising for these organisations and led to higher donations received. Neither of these studies has related the average age of the board of directors to share performance or intellectual capital performance, but rather considered performance in the context of sales and donations received.

2.2.4 Gender, race and position of the directors

Many studies have measured the impact of gender and ethnic diversity on firm performance with variable results. Carter et al. (2003) and Matsaba (2010)) found that firm performance was meaningfully impacted by increasing the percentage of women on the board of directors; as gender diverse boards were considered to better contribute towards the monitoring functions of the board (Adams and Ferreira, 2009) with women bringing specific skills and expertise such as elements of team work and collaboration (PricewaterhouseCoopers, 2011). This was found to lead to improved strategic control, increased board development activities, and decreased levels of conflict on boards (Nielsen and Huse, 2010). However, Swartz and Firer (2005), Carter, D'Souza, Simkins and Simpson (2010) and Khumalo (2011) found that there was no association between female directors on the board and firm value, with Adams and Ferreira (2009) and Dobbin and Jung (2011) both having observed a negative association between gender diversity and firm performance in companies with otherwise good corporate governance.

Carter et al. (2003), Erhardt et al. (2003), Van der Zahn (2004) and Swartz and Firer (2005)'s studies on ethnic diversity found a significant positive relationship between the percentage members of colour on the board, and firm value.

Swartz and Firer (2005) did not find a significant relationship between the percentage of women on the board and intellectual capital performance, and suggest that a possible

reason for this unexpected relationship, consistent with Khumalo (2011), is the low number of women on the board leading to insufficient influence to create a material difference. They argue that the lack of influence that women exert on a board of directors may potentially be due to the fact that women are often subjected to a "glass ceiling", an invisible barrier preventing women from reaching leadership positions (Swartz and Firer, 2005). The paper further posits that the results may be attributed to the fact that in the study, women were not classified in terms of executive or non-executive positions on the board, and therefore again may have lacked influence; a factor that could potentially influence the findings of the study (Swartz and Firer, 2005).

Investigating the potential lack of influence by female directors, Nyirenda (2010) found a 79% probability that woman directors would be appointed as non-executive directors on South African boards, in comparison to men who had an almost equal probability of being appointed as either executive or non-executive directors. Furthermore, the paper asserts that women therefore seem to perform a compliance function on the board, as opposed to exerting significant influence on firm performance (Nyirenda, 2010).

This argument should however be tempered, as the non-executive status of directors does not preclude them from adding value and having significant influence. Non-executive directors contribute in a number of ways, such as bringing external business experience and external connections, as well as enhancing the perceived integrity of the board (Pass, 2004). As the type of assignments directors are tasked with may influence their level of contribution towards a firm's performance (Swartz and Firer, 2005), it is necessary to consider the nature of board involvement given to members of the board (Nielsen and Huse, 2010). Ma and Tian (2009) and Ntim (2011) found that firm performance is enhanced

overall by non-executive directors; with Mura (2007) also confirming that firm performance is positively correlated with the ratio of non-executive directors. These studies are encouraging, as King III requires the majority of the directors on the board to be non-executive (Institute of Directors of South Africa, 2009), therefore an executive status should not influence the level of influence a director can exert, the possibility of such lack of influence will however be borne in mind when interpreting results.

2.2.5 Intellectual capital

Defining corporate performance is an ongoing challenge in the economic and finance spheres, as the term is associated with a range of aspects regarding company performance, with recent perceptions of what constitutes corporate performance having evolved with the advance of economic theoretical frameworks, changes in fundamental production factors, and the economic environment (Firer and Mitchell Williams, 2003). The evolving landscape in sustainability reporting is also re-defining corporate performance, introducing triple bottom line performance metrics (economic, social and environmental).

Corporate performance should include reference to intellectual resources utilised in order to encourage a long term perspective of performance (Abidin et al., 2009) and recognise the importance of human capital as an investment rather than a cost (Pulic, 2004).

Companies can enhance long term firm value through focusing on accumulating intellectual capital and improving the management thereof by implementing sound corporate governance principles through an effective board of directors, since board characteristics have been found to be correlated with the valuation of intellectual capital (Wang, 2012).

The majority of empirical studies on board composition investigate the link between board characteristics and firm performance as defined by traditional measures such as return on equity (refer to Tables 1 and 2), with only a few studies having considered the impact of board structure on intellectual capital performance (Van der Zahn, 2004; Swartz and Firer, 2005). Firer and Mitchell Williams (2003) further argue that intellectual capital assets are increasingly recognised as the main source of wealth creation for companies, and that South Africa can benefit from shifting away from relying only on natural resources towards recognising the value of intellectual capital.

In supporting the importance of knowledge resources, Wang (2012) asserts that intellectual capital is fundamental to firm value, with the progression towards a knowledge based economy having changed companies' main competitive advantage from the effective utilisation of physical assets, to the accumulation and proper management of intellectual capital. This competitive advantage is derived from the intangible elements of intellectual capital working together as a unit to create synergies unique to the firm (Maree, 2011).

For the purposes of this study, intellectual capital was broken down into four components based on resource-based theory in line with the categorisation by Swartz and Firer (2005). The four components are defined as: human capital, customers, information technology-and-processes, and intellectual property (Swartz and Firer, 2005).

Measuring intellectual capital is however not a simple task, there is currently no single, standard, widely accepted technique available (Mitchell Williams, 2001). Bontis (2001) emphasises the difficulty of measuring intellectual capital noting that the components are intangible (Ze´ghal and Maaloul, 2010).

There are however various methods discussed in the literature available to measure intellectual capital. Swartz (2005) and Luthy (1998) categorise these methods into two main groups: overall organisational measures, and component-by-component approaches. The first group relates intellectual capital to shareholder value and measures intellectual capital in financial terms at an organisational level, comparable to a pre-determined benchmark. Examples of measures in this group are the use of Tobin q's, Market-to-book ratio and economic value added (EVA™).

Component-by-component approaches base the value of intellectual capital on various components, measuring each separately. Swartz (2005) criticizes these methods as they are often tailored for a single company or industry, raising doubt regarding their applicability to various companies, and therefore comparability.

The two measurement groups are compared in Table 1 and Table 2, and include a consideration of their appropriateness for this study (Swartz, 2005).

Swartz and Firer (2005) justify specific screening criteria to validate the use of a specific measure within the context of evaluating board characteristics as: " 1) the basic underlying feature of the measure should be based on a key component of intellectual capital rather than a measure of physical capital; and 2) [must be] simplistic enough to enhance understanding and to allow relative ease in collecting data" (Swartz and Firer, 2005: 155).

Table 1 and 2 therefore evidence that VAIC™ adheres to the screening criteria stipulated (Swartz and Firer, 2005) and considers the other available measures to be unsuitable for the context. The use of VAIC ™ is further advocated by Mitchell Williams (2001) as it highlights

the importance of employees' contribution to the value of the firm, and the method is consistent with prior South African studies (Ho and Williams, 2003; Van der Zahn, 2004; Swartz and Firer, 2005), the standardised and consistent measurement enabling comparison between studies. This study therefore measures intellectual capital by using VAIC™.

The reliability of VAIC™ was tested by repeating the analyses using a different, market-based measure of firm performance as a dependent variable. Diversity and market-based measures were found to be correlated by Wright, Ferris, Hiller and Kroll (1995), which measured the impact of exemplary management diversity on companies' share returns, concluding that diverse companies had a competitive advantage in this regard.

Two other market-based measures used in similar contexts were also considered, namely market adjusted share returns (MAR) and abnormal returns based on the capital asset pricing model (CAPM). Bhagat and Black (2002) used MAR to measure the impact of board independence on long term performance, whereas Gul, Srinidhi and Ng (2011) measured the impact of gender diversity on share prices using CAPM.

A recent South African study by Ward and Muller (2012) tested the appropriateness of using CAPM on the largest 160 JSE listed companies over 26 years, concluding that the use of a single beta CAPM was inappropriate. The study found no association between beta and returns for the last seven years of their study, and that the results from testing beta characteristics over the time-series indicated that the use of CAPM was redundant (Ward and Muller, 2012).

Furthermore, given the context of this research report, it was not deemed appropriate to use any market-based measure that adjusts for beta. In valuing the shares of a company, beta is a measure of risk which may have been adjusted for based on the level of diversity of the board of directors of the company.

This research report therefore follows the simple measure of share returns that does not adjust for beta in line with Bhagat and Black (2002); measured by accumulating returns over the measurement period, minus the return on the JSE All Share index, without an adjustment for beta.

2.3 Definition of terms

Directors of colour/ black directors- "black people" in terms of Employment Equity Act, classified as "Africans, Coloureds and Indians" (Department of Labour 1998:3)

Intellectual capital- "the sum of all knowledge a company is able to use in the process of conducting business to create value" (Ze'ghal and Maaloul, 2010: 41).

2.4 Chapter conclusion

The discussion above identifies that results from previous studies evaluating board composition provided contradictory results. Literature supporting a smaller board of directors was contradicted with studies that pointed towards a larger board. In addition, the impact of race and gender of directors on firm performance emphasised the importance of considering the role and responsibilities of the directors on the board before concluding.

The definition of corporate performance was then considered, concluding that the use of intellectual capital measured by using the VAIC™ as a performance measure was most

appropriate in the context of this research report. Finally, the chapter was concluded by an explanation of how VAIC™'s reliability is tested using MAR.

CHAPTER III - Research questions and rationale for hypotheses

3.1 Introduction

This chapter restates the purpose of the report and develops arguments that lead to certain propositions regarding the relationship between intellectual capital performance and the size of the board of directors; the average age of board members; and the specific positions women and persons of colour hold on the board. These propositions are then used to dissect the main research question into four sub-research questions, supported by the hypotheses that underlie this research study.

3.2 Purpose, research questions and null hypotheses

The purpose of this research report is to explore the relationship between South African listed companies' intellectual capital performance, the size of their board of directors; the average age of board members; and the specific positions women and persons of colour hold on the board.

3.1.1 Size of the board

The literature reviewed in section 2.1 provided mixed results, with some studies advocating a smaller board, and others pointing towards a larger board. Hermalin and Weisback (2003) and Uwuigbe and Fakile (2012) expressed concern regarding the fact that agency problems such as free-riding increased as the board expanded. In addition, it was found that a large board of directors hindered effective communication as not all members would be able to engage effectively (Council on foundations, 2010), and more effort and time was required to reach consensus on decisions (Cheng, 2008). A smaller board of directors, where individuals were more familiar, encouraged better group work (Council on foundations, 2010) and easier coordination between fewer members allowed members to meet more frequently, an aspect found to enhance corporate performance (Ma and Tian, 2009; Ntim and Osei, 2011).

In South Africa however, new legislation including the amended Companies Act and King report, have brought about increased demands on board members, which in turn is an argument for increasing the size of corporate boards (Adams and Ferreira, 2009).

In addition, given the drive towards diversity within the South African context, attention is drawn to the fact that larger boards not only increase the range of skills and perspectives available, but also provides the opportunity to diversify (Council on foundations, 2010). As board size increases, the proportion of women and minorities on the board increases (Carter et al., 2003), and independence is found to increase (Boone et al., 2005). This raises the proposition that there is a significant positive relationship between the size of the board of directors and firm performance.

Sub-research question 1:

Does a significant positive relationship exist between the size of the board of directors and intellectual capital performance?

Hypothesis from question 1:

H_0: There is no significant positive relationship between the size of the board of directors and intellectual capital performance.

H_1: There is a significant positive relationship between the size of the board of directors and intellectual capital performance.

3.1.2 Age of directors

Section 2.2.1 highlights the fact that the average age of the board of directors on South African listed companies varies, as there is no maximum or minimum age specified by regulation. As a result, some companies may have relatively young boards in comparison to

others depending on what attributes they want the board members to contribute. On the one hand, companies may be interested in adding younger members to the board to add a fresh perspective to the group; however a strong argument exists to include older members who contribute experience (PricewaterhouseCoopers, 2011). The proposition was therefore made that, given the experience that older board members may have, there is a significant positive relationship between the average age of the directors on the boards of directors and intellectual capital performance.

Sub-research question 2:

Does a significant positive relationship exist between the average age of the directors on the board of directors and intellectual capital performance?

Hypothesis from question 2:

H_0: There is no significant positive relationship between the average age of the directors on the board of directors and intellectual capital performance.

H_1: There is a significant positive relationship between the average age of the directors on the boards of director and intellectual capital performance.

3.1.3 Gender, race and position of the directors

Various studies (Erhardt et al., 2003; Swartz and Firer, 2005; Khumalo, 2011) have analysed whether women and a mix of ethnicity on boards of directors influenced company performance, however Van der Zahn (2004) is the only South African study found to have investigated whether the contribution is affected by the specific position held on the board. Based on 1998 data, the paper concluded that female and non-white directors who were non-executive directors had a positive effect on the firm's intellectual capital performance. The proposition was therefore made that there is a significant positive relationship between the percentage of non-executive women directors on the boards of directors and firm

performance, as well as a significant positive relationship between the percentage of directors of colour on the boards of directors, and firm performance.

Sub-research question 3:

Does a significant positive relationship exist between the percentage of non-executive women on the board of directors and intellectual capital performance?

Hypothesis from question 3:

H_0: There is no significant positive relationship between the percentage of non-executive women on the board of directors and intellectual capital performance.

H_1: There is a significant positive relationship between the percentage of non-executive women on the board of directors and intellectual capital performance.

Sub-research question 4:

Does a significant positive relationship exist between the percentage of non-executive members of colour on the board of directors and intellectual capital performance?

Hypothesis from question 4:

H_0: There is no significant positive relationship between the percentage of non-executive members of colour on the board of directors and intellectual capital performance.

H_1: There is a significant positive relationship between the percentage of non-executive members of colour on the board of directors and intellectual capital performance.

3.3 Chapter conclusion

This chapter proposed a significant positive relationship between the size of the boards of directors of companies, the average age of directors, the percentage of non-executive women directors on the boards of directors, and the percentage of non-executive directors of colour on the boards of directors, and firm performance, measured using intellectual

capital performance. A summary of the research questions and hypotheses posited are presented in Table 3.

CHAPTER IV - Methodology

4.1 Introduction

This chapter provides detail regarding the research methodology adopted, beginning with an overview of the research method employed, visually illustrated in Diagram 1. The discussion that follows starts with a detailed overview of the data used in the study, including detail on the population and study sample, the source of data and data screening and transformation procedures. This is followed by a detailed discussion on the descriptive statistics performed on the dataset. The parametric and non-parametric regression analyses that could have been performed based on the outcome of the descriptive statistics is then described in detail, stipulating the model constructs as well as the measurement of the dependent, independent and control variables. The latter section includes the interpretation of the output from the statistical programme used, *IBM SPSS version 20* (hereafter referred to as SPSS). The chapter is concluded by discussing the validity and reliability of the study, as well as providing defining assumptions, limitations and delimitations applicable to the research.

4.2 Overview of research method

The majority of papers investigating the relationship between board composition and firm performance use correlation and regression analyses (Carter et al., 2003; Erhardt et al., 2003; Firer and Mitchell Williams, 2003; Swartz, 2005; Swartz and Firer, 2005; Bhagat and Bolton, 2008; Guest, 2008; Carter et al., 2010; Ntim, 2011; Black and Kim, 2012). This paper follows those methodologies to measure the relationship between board structure and intellectual capital performance. Regression models were constructed to represent the anticipated relationships between firm performance (VAIC™), board composition and related control variables. The regression analyses were repeated, substituting VAIC™ with a market-based measure of return (MAR) as the dependent variable as a robustness test.

The research method employed can be summarised as follows, the various steps are discussed in the sections that follow:

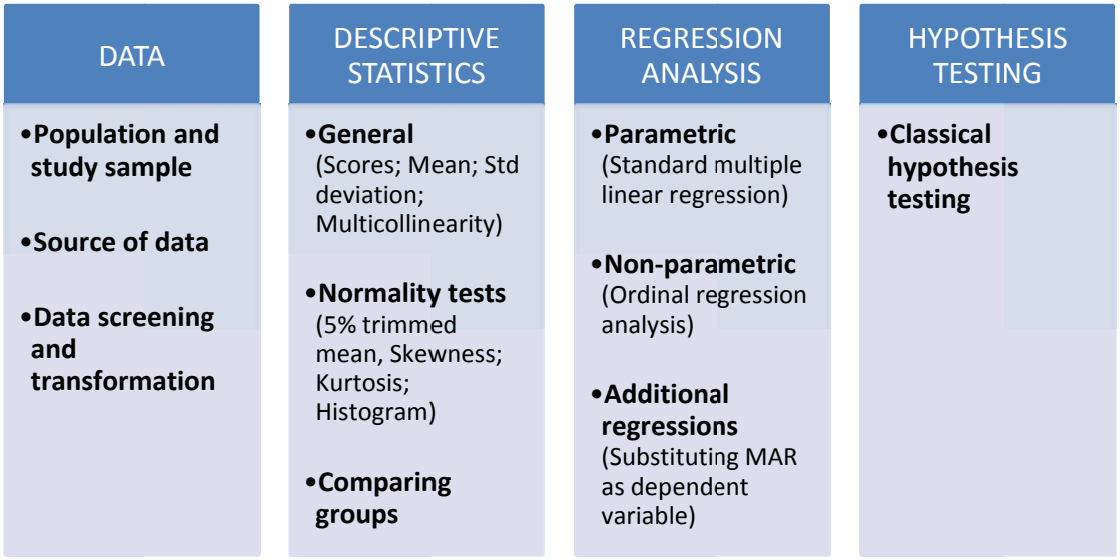


Diagram 1: Overview of research method

4.2.1 Data

4.2.1.1 Population and study sample

Company performance and board characteristics of South African publicly listed companies were measured and examined for each of their 2011 financial years. The sample was limited to companies listed on the JSE during 2011 due to the difficulty of obtaining information from private companies. Companies listed as at both 31 January and 31 December 2011 were obtained and compared to ensure that new listings during the year or companies that de-listed during the year (after their own financial year) were taken into account in the analysis. The final sample after data screening and transformation procedures consisted of 193 companies. A complete list of companies included in the final dataset is listed in Appendix B.

4.2.1.2 Source of data

Data was extracted at the time of the company's latest audited annual report, prior to and including 31 December 2011. The financial data was extracted from the secondary database McGregor BFA and supplemented with data from Inet Bridge to reconfirm data collected from McGregor BFA. This data was used to calculate each company's VAIC™, measure control variables and calculate MAR. Additional non-financial information on board structure characteristics were captured manually from the respective firms' statutory annual reports.

4.2.1.3 Data screening and transformation

Consistent with prior studies, (refer to (Ho and Williams, 2003; Swartz and Firer, 2005; Ma and Tian, 2009)), financial and utility sector firms were excluded due to the special regulation applicable to these firms which may influence the results. Companies whose shares had been suspended on the JSE due to reasons such as liquidation were also excluded from the sample. Furthermore, the following restrictions were placed on the data to ensure that the data could be used in the regression analyses (Swartz and Firer, 2005):

- Companies were excluded from the data set if the company had omitted key variables or misreported data values, such as not disclosing the board members' age or company staff costs; and
- Consistent with Swartz and Firer (2005), all negative intellectual capital variables were removed, as the regression model used would seek to fit a straight line between the independent and dependent variable resulting in for example, the percentage of non-executive women on the board of directors being below zero, which intuitively cannot be negative.

4.2.2 Descriptive statistics

4.2.2.1 General descriptive statistics

Prior to running the regression analyses, descriptive statistics were performed (refer to Appendix E, Table 4). The descriptive statistics used are in line with similar studies (Firer and Mitchell Williams, 2003; Swartz and Firer, 2005) and include the range of scores, the mean and the standard deviation of continuous primary variables. The range of scores refer to the minimum and maximum value, the mean relates to the middle of a distribution and is the statistical average of a sample; with the standard deviation being a common measure of dispersion around the mean (Koop, 2009). The descriptive statistics are used to describe the characteristics of the sample, test the underlying assumptions of the statistical techniques to be used, and address the research questions (Pallant, 2010).

In addition to the above, multicollinearity testing was performed in SPSS. Swartz and Firer (2005) suggest testing multicollinearity using the Pearson correlation coefficient between the two variables, a variance inflation factor (VIF) and Eigen Values. In addition, Pallant (2010) agrees and further suggests using a Tolerance factor to test collinearity. The *correlations* table showed the Pearson correlation between the independent variables and dependent variable, as well as the correlation amongst the independent variables. Where independent variables showed a bivariate correlation of 0.7 or more (Pallant, 2010), the variables were removed from the regression models. The *coefficients* table displayed the Tolerance and VIF. Tolerance for each independent variable indicates how much of the change in the independent variable is not explained by the other independent variables. If the value is less than 0.1, it indicates that multicollinearity may be present (Pallant, 2010). VIF is the inverse of the tolerance value, thus values above 10 would indicate the presence of multicollinearity (Pallant, 2010). The *collinearity diagnostics* summary displayed the Eigen

values. The Eigen value for each variable needs to be in the normal range of 100-1 000 (or below 100) to indicate no multicollinearity (Swartz and Firer, 2005).

4.2.2.2 Normality tests

Normality refers to the residuals being normally distributed about the predicted dependent variable scores. In order to test normality, "normality plots with tests" was run in SPSS, the program generating both a descriptives table and a histogram. The *descriptives table* displayed a 5% trimmed mean, which was compared to the original mean described above to assess whether extreme scores had a strong influence on the mean (Pallant, 2010). This table also included skewness and kurtosis values, providing information concerning the distribution of scores on the continuous variables. A skewness and kurtosis value that falls between the range of -1 and 1 is deemed acceptable and indicates a normal distribution (Muthen and Kaplan, 1985). The *histogram* graphically displays the scores of each interval of data (Pallant, 2010); the shape of the distribution was inspected for outliers.

4.2.2.3 Comparing groups

Following the tests in section 4.2.2.2, where data was found to be normally distributed, parametric tests could be performed; whereas non-parametric tests were used in instances where data was not normally distributed.

For normally distributed data, independent-samples t-tests were used to compare the mean scores for two different groups (Pallant, 2010), for example comparing the mean VAIC™ of a board with female directors, to a board without female representation on the board. The use of independent-samples t-tests is in line with Swartz and Firer (2005). The output generated by SPSS for the independent-samples t-test is reflected in two tables, a "group statistics"- and "independent samples test" table. The latter mentioned table displays the

results for the Levene's test for equality of variances run by SPSS. The *group statistics* table summarised the results for each group; whereas the *Levene's test for equality of variances* value indicates whether the variance of scores for the two groups are the same. The t-value reported depends on whether equal variances are assumed, which is the case if the value indicated is larger than 0.05 (Pallant, 2010).

The non-parametric alternative to the independent-samples t-test discussed above, to be used when data is not normally distributed, is the Mann-Whitney U test (Pallant, 2010). The output generated by SPSS includes a significance level (p), which is given as *Asymp.Sig (2-tailed).* If the Asymp.Sig (2-tailed) value reported is not less than or equal to 0.05, there is no statistically significant difference between the two groups (Pallant, 2010).

4.2.3 Regression analyses

Consistent with the research framework used by Swartz and Firer (2005), correlation design, extended to regression analysis was used. Multiple independent variables were included in the regression analyses, as this avoided potential spurious correlations arising between variables when using simple correlation as a result of variables being correlated with a third variable (Swartz and Firer, 2005). Regression models were constructed as described below and the regression analyses were conducted through SPSS.

4.2.3.1 Parametric analysis (Multiple linear regression analysis)

Multiple linear regression analysis examines the individual and collective contributions of various independent variables to the variation of a dependent variable, and builds a model of prediction of the dependent variable from a number of independent variables (Creswell, Ebersöhn, Eloff, Ferreira, Ivankova, Jansen et al., 2009).

The relationship between *k* independent variables (X) and the dependent variable (Y) is mathematically expressed by the following linear equation:

Equation 1: $Y= \alpha+ \beta_1X_1 + \beta_2X_2 + ... + \beta_kX_{k+\varepsilon}$; where

- α is the intercept of the line
- β is the slope of the regression line; and
- ε is an error term (Koop, 2009). The error term is normally distributed about a mean of zero and for the purposes of this research study ε is assumed to be zero in line with Swartz and Firer (2005).

A) Assumptions

Multiple linear regression analysis relies on the following assumptions:

- The sample size has to be large enough in order to extrapolate the results of the regression to the entire population or to a different sample (Pallant, 2010). Green (1991) evaluated numerous suggested methods to calculate a sample size in the context of regression analysis; the study did not support the use of a constant or minimum sample size, but rather validated the use of a sample size (N) based on the number of independent variables (m) identified. The paper introduced a rule-of-thumb of *N >= 50+8m* which could be applied in instances where m <= 7 (Green, 1991). For the purposes of this study, this rule-of-thumb was applied as one dependent variable and six control variables were included in each multiple regression as stipulated in section 3.6.2 of this report.
- In instances where independent variables are highly correlated, multicollinearity may exist, which would influence the interpretation of the regression results. Consequently, items that are highly correlated should be removed from the model (Pallant, 2010).

- Extreme cases, known as outliers, should be removed from the data set as part of the data screening process (Pallant, 2010).
- The difference between the obtained and the predicted dependent variable scores are referred to as residuals. The residuals for each variable in the analysis should be normally distributed about the predicted dependent variable scores (Pallant, 2010).

When using multiple linear regression the VAIC™ was specified as the predictive variable (dependent variable), regressed to multiple explanatory (independent) control variables (Creswell et al., 2009). The aim of this research report is to assess the impact of the predictors on the dependent variable, and therefore the standard/simultaneous multiple regression model was employed with all of the independent variables entered into the equation simultaneously (Pallant, 2010).

B) Measure of the dependent variable (VAIC™)

The methodology for the measurement of intellectual capital was based on the studies of Firer and Mitchell Williams (2003) and Swartz and Firer (2005), with firm performance defined as intellectual capital measured by VAIC™, formalised by the relationship:

Equation 2: $VAIC^{TM}_i = CEE_i + HCE_i + SCE_i$ (Pulic, 2004)

Where:

$VAIC^{TM}_i$ = VA intellectual coefficient for firm i;

$CEE_i = VA_i / CE_i$; VA capital employed coefficient for firm i;

$HCE_i = VA_i / HC_i$; human capital coefficient for firm i ; and

$SCE_i = SC_i / VA_i$; structured capital coefficient for firm i;

$VA_i = I_i + DP_i + D_i + T_i + M_i + R_i + HC_i$; VA for firm I computed as the sum of interest expenses (I_i); depreciation expenses (DP_i); dividends (D_i) ; corporate taxes (T_i) ; income attributable to non-controlling interests (M_i) ; profits retained for the year (R_i) ; total investment in salaries and wages for firm i (HC_i);

CE_i = book value of the net assets for firm i;

HC_i = total investment in salaries and wages for firm i;

$SC_i = VA_i - HC_i$; structured capital for firm i. (Pulic, 2004)

C) Measure of the independent variables

The independent variables used in the multiple regression models were defined and measured as follows:

- The overall board size was measured as the total number of directors (executive and non-executive) on the board (Chaghadari, 2011).
- The age of board members was measured as the average age of all the directors on the board (Pesämaa et al., 2008).
- Non-executive women was measured as the percentage of female non-executive directors on the board to the total board size (Van der Zahn, 2004).
- Non-executive directors of colour were measured as the percentage of non-executive non-white directors on the board to the total board size (Van der Zahn, 2004).

D) Measure of control factors

Swartz (2005) highlights the fact that the predictive value of a regression model is increased by using control variables in addition to the explanatory variables (as defined in section 4.2.1.2 of this report). Therefore, in order to ensure the robustness of the regression

models, and to add predictive accuracy, the following six control factors were included in line with Swartz and Firer (2005):

- Company size: Total assets (TA) was used to control for company size;
- Profitability: Return on assets (ROA) as net profit divided by total assets and Return on Equity (ROE) as net profit divided by total equity. ROA measures how efficiently a company uses its total assets, whereas ROE is an indicator of the value created through using shareholders capital (excluding debt). As both the ROA and ROE ratios use an income measure (net profit) to determine a return on capital employed to produce this income, multicollinearity testing was performed on these ratios by inspecting the Pearson correlation coefficient between the variables, Variance inflation factors (VIF), Eigen Values and Tolerance factors (refer to section 4.2.2.1);
- Productivity: Turnover ratio (TOR) as turnover divided by total assets;
- Industry type: Dummy variables to indicate the industries within which companies operated. (E) indicated companies within the electronics and resources industries, (S) was used for service industry companies and (R) was used for companies in the retail sector; and
- Risk: Debt to asset ratio (DTA) as long term liabilities divided by total assets.

(Swartz and Firer, 2005)

E) Multiple linear regression models

The models are formalized by the following models in line with the models used by Swartz and Firer (2005):

Model 1: $VAIC^{TM} = \int (SIZE, TA, ROA, ROE, TOR, E, R, S, DTA)$;

Model 2: $VAIC^{TM} = \int (AVEAGE, TA, ROA, ROE, TOR, E, R, S, DTA)$;

Model 3: $VAIC^{TM} = \int (PERGENDER, TA, ROA, ROE, TOR, E, R, S, DTA)$;

Model 4: $VAIC^{TM} = \int$ (PERCOLOUR, TA, ROA, ROE, TOR, E, R, S, DTA);

Where:

$VAIC^{TM}$ =Value Added Intellectual Coefficient;

SIZE= the total number of directors (executive and non-executive) on the board;

AVEAGE= the average age of all the directors on the board;

PERGENDER= percentage of female non-executive directors;

PERCOLOUR= percentage of non-executive directors of colour;

TA= total assets;

ROA= return on assets ratio;

ROE= return on equity ratio;

TOR= Turnover ratio;

E= electronics industry, dummy variable;

R= retail industry, dummy variable;

S= service industry, dummy variable; and

DTA= debt to asset ratio.

F) SPSS output

When running a standard multiple regression in SPPS, the programme generates three important tables: a “model summary” box, a “coefficients” table and an “ANOVA” summary.

The *model summary* box, displays the R, R^2, adjusted R^2 and the standard error of estimate. For this research report, the R^2 (the coefficient of determination) was used as the tool to test

the internal validity of the study (Swartz and Firer, 2005) as this indicates how much of the change in the dependent variable is explained by the model (Pallant, 2010). This value is read in conjunction with the statistical significance value in the *ANOVA* summary to assess the statistical significance of the result (Pallant, 2010).

Referring to Equation 1 above, the slope of the regression surface, β, represents the regression coefficient that measures the influence of the independent variable on the dependent variable, indicating the degree to which a change in Y is due to a change in X. When these X values are standardised by restating the coefficients in terms of their standard deviation, the regression coefficients are called beta weights. Beta weights indicate the relative importance of a specific independent variable in relation to another.

The *coefficients* table mentioned above displays a "beta" value under the "standardised coefficients" column. The beta values for each independent variable was read in conjunction with the significance value (sig.) calculated by SPSS, indicating whether the variable is making a statistically significant contribution to the prediction. The statistical significance level for the purpose of this study was assessed at the sig.=0.05 level (Swartz and Firer, 2005; Pallant, 2010), where the variable made a significant contribution to the equation if the sig. value was less than 0.05, resulting in rejection of the null hypothesis.

SPSS calculates a difference value referred to as the t-statistic in the *coefficients* table. If the t-statistic is greater than a benchmark level of 2 it indicates a significant relationship at the 5% confidence level (Swartz and Firer, 2005). In order to reject the null hypothesis, the relationship between the variables must be positive and significant, therefore adopting a right one-tailed test, and accordingly, the t-statistic has to be both positive and significant in

order to reject the null hypothesis (Swartz, 2005). The statistics described above were interpreted based on the extent to which they disagree with the null hypotheses stated.

4.2.3.2 Non-parametric analysis (Ordinal regression analysis)

Ordinal regression analysis can be used in instances where the dependent variable is not normally distributed and the dependent variable can be categorised into ordered, or ranked categories (Gujarati and Porter, 2009).

A) Assumptions

The requirements for non-parametric techniques (such as ordinal regression analysis) are not as stringent as those for parametric tests and assumptions are not made regarding the distribution of the dependent variable (Pallant, 2010). These tests rely on the following two assumptions:

- The sample has to be random; and
- Observations should be independent, thus each case can only be counted once (Pallant, 2010).

However, ordinal regression assumes that the odds for each explanatory variable are consistent across the different rankings (UCLA: Statistical Consulting Group, 2013). This is referred to as the test of parallel lines or test for proportional odds and is tested in SPSS by considering the significance of the calculated Chi-square statistic (the sig. value in the *"test of parallel lines"* output box). If this sig. value is greater than 0.05 (at a confidence level of 95%), ordinal regression analysis can be employed and as the variable shows the same relationship between groups, one set of coefficients explains the relationship across all groups, as opposed to different coefficients for each ranking (Pallant, 2010; UCLA: Statistical Consulting Group, 2013).

When using ordinal regression for the purposes of this study, the VAIC™ values were ranked into three categories indicative of a low, medium or high level of intellectual capital.

B) Measure of the dependent variable (VAIC™Ranking)

The VAIC^{TM} values as defined in section 4.2.3.1, were categorised into different ordinal rankings, which in turn was then specified as the predictive variable (dependent variable), regressed to the key independent and control variables.

C) Measure of the independent variables

The independent variables used in the ordinal regression analysis are the same as specified for the multiple linear regression models in section 4.2.3.1. However, only the independent variables adhering to the requirements of the test of parallel lines were included in the regression analysis.

D) Measure of control factors

The control variables included in the ordinal regression analysis are the same as specified for the multiple linear regression models in section 4.2.3.1. However, only the control variables adhering to the requirements of the test of parallel lines were included in the regression analysis.

E) Ordinal regression models

The models are formalized by the following models based on the models used by Swartz and Firer (2005):

Model 5: VAIC^{TM}Ranking= ∫ (SIZE, TA, ROA, ROE, TOR, E, R, S, DTA);

Model 6: VAIC^{TM}Ranking = ∫ (AVEAGE, TA, ROA, ROE, TOR, E, R, S, DTA);

Model 7: VAIC^{TM}Ranking = ∫ (PERGENDER, TA, ROA, ROE, TOR, E, R, S, DTA);

Model 8: $VAIC^{TM}$Ranking = ∫ (PERCOLOUR, TA, ROA, ROE, TOR, E, R, S, DTA);

where the inputs are defined in section 4.2.3.1.

F) SPSS output

When running an ordinal regression in SPSS, the programme generates four important outputs: a "case processing summary", a "model fitting information" table, a "parameter estimates" summary, and a "pseudo R-square" box.

The *case processing summary* provides the number of observations in the study, with detail showing the number of observations in each ranked category or grouping, as well as indicating whether values are missing from the data set.

The *model fitting information* table indicates the parameters of the model as a whole and provides a "sig." value as part of its output; these sig.values are the p-values of the coefficients. The sig. value is compared to the statistical significance level, assessed at the sig.=0.05 level for the purposes of this study (Swartz and Firer, 2005; Pallant, 2010), where the variables in the model made a significant contribution to the equation if the sig. value is less than 0.05, resulting in rejection of the null hypothesis. The sig. value for each independent variable is found in the *parameter estimates* summary and is interpreted in the same way.

The *pseudo R-square* box reports three R^2 values, the highest of which is the Nagelkerke value and the most conservative of which is the McFadden value. The R^2 value indicates what percentage of the change in the dependent variable is attributable to the effect of the independent variables in the model.

4.2.3.3 Additional regressions (Using MAR as dependent variable)

The regression analyses discussed above were repeated, including the control factors, substituting the dependent variable with a simple measure of share return, market adjusted share return (MAR), in line with Bhagat and Black (2002). This was measured by cumulating returns over the measurement period (2011 financial year) minus the return on the JSE All Share index, without an adjustment for beta; the return for share i formalised by the relationship:

Equation 3: $MAR_{it} = R_{it} - R_{mt}$ (Kothari and Warner, 1997)

R_{it} = the monthly return inclusive of dividends for security i in a month t;

R_{mt}= the monthly return on the JSE All Share index in month t.

(Kothari and Warner, 1997)

The models are formalized by the following models:

Model 9: MAR = ∫ (SIZE, TA, ROA, ROE, TOR, E, R, S, DTA);

Model 10: MAR = ∫ (AVEAGE, TA, ROA, ROE, TOR, E, R, S, DTA);

Model 11: MAR = ∫ (PERGENDER, TA, ROA, ROE, TOR, E, R, S, DTA);

Model 12: MAR = ∫ (PERCOLOUR, TA, ROA, ROE, TOR, E, R, S, DTA);

4.2.4 Classical hypothesis testing

The purpose of this study was to determine which of the various board characteristics contributed to the prediction of intellectual capital performance, and to what extent, using regression analyses. The results from the regression analyses were used to test the hypotheses formed in section 3.2, to identify whether the independent variables have explanatory power over the dependent variable. Classical hypothesis testing entails stating

both a null hypothesis (H_0) and an alternative hypothesis (H_1) (Koop, 2009) and making objective conclusions regarding the relationship between the variables solely based on the analysis of available sampling data (Swartz and Firer, 2005).

4.3 Validity and reliability

Data was tested for normality with reference to the 5% trimmed mean, skewness and kurtosis statistics, as well as the inspection of the data distribution histograms. The captured data was explored using the range of scores, mean and standard deviation as descriptive statistics. In addition, the Mann-Whitney U-test and independent-samples t-tests were used to explore the distribution of data between groups. Furthermore, the independent variables included in the regression analyses were tested for multicollinearity (Firer and Mitchell Williams, 2003; Swartz and Firer, 2005).

The calculated VAIC ™ and MAR for each company is objective and verifiable as the inputs to the equation was based on audited or published information. Regression models were tested for validity and adequacy using SPSS outputs.

To ensure that the purpose of the study was achieved, the reliability of VAIC ™ was tested by using a different, market-based measure of firm performance (MAR) as dependent variable. The original regression results (regressed to VAIC™Rankings) were compared to results from additional multiple regressions, inputs constant in all aspects other than using share-return as the dependent variable as opposed to a VAIC™Ranking.

4.4 Assumptions, limitations and delimitations

The purpose of this research report was to explore the relationship between intellectual capital performance and the size of the board of directors, the average age, and specific

positions women and persons of colour hold on the board of companies listed on the JSE during 2011.

A limitation of this research report is that the elements of diversity and demographics considered did not take into account academic qualifications, technical expertise, relevant industry knowledge, experience or nationality of directors, due to the difficulty of obtaining the data and measuring and interpreting these factors.

Cognisance should also be taken of the fact that the actions of previous directors may influence current firm performance (Hermalin and Weisback, 2003). This study considered the impact of a specific board structure as at a company's yearend on the performance of the company during the fiscal year measured and does not take into account changes in the board structure over time, or the length of service of the members of the board (Swartz and Firer, 2005).

Furthermore, the study does not constitute a longitudinal study using panel data, but is a cross-sectional study (Swartz and Firer, 2005). The structure of South African corporations have changed dramatically over the past number of years due to political reform, increase in global trade and foreign investment and changes to regulations in line with international standards (Malherbe and Segal, 2001) . The inclusion of data over a period of years in the regression models is therefore inappropriate as the data is not comparable as a result of various changes affecting South African listed companies (for instance the credit crisis and new legislation such as the amended Companies Act and King report), factors which may have impacted the performance of companies over a period of years.

4.5 Chapter conclusion

Chapter four set out the methodology used in this research report. Regression models were constructed and the measurement for the dependent, independent and control variables defined. The chapter detailed the data used, the analysis thereof through SPSS and the validity and reliability of the study. The last section of the chapter stipulated the assumptions, limitations and delimitations of the study.

CHAPTER V - Analysis and interpretation of research results

5.1 Introduction

This chapter consists of an analysis and interpretation of the research results obtained. The chapter follows the flow of Diagram 1, starting with providing details regarding the sample used and the data screening and transformation that took place. This is followed by discussing the descriptive statistics for the primary independent variables. The chapter is concluded with section 5.4 which presents and discusses the results from the regression analyses performed.

5.2 Data

The combined list of companies listed during 2011, comprising of a total of 408 companies (listed in Appendix A), was extracted from McGregor BFA. Certain companies were removed from the population as part of the data screening and transformation procedures detailed in section 4.2.1.3.

93 financial and 2 utility companies were excluded, as well as a total of 38 companies due to their share information not being available as a result of the shares being delisted or suspended on the JSE. A further 60 companies were removed as they did not disclose the key variable staff costs or a variable in relation to the composition of the board of directors. 22 companies were removed as they displayed negative intellectual capital values.

As a result, the final sample consisted of 193 companies* as listed in Appendix B.

**408 – 93 – 2 – 38 – 60 – 22 = 193*

5.3 Descriptive statistics

Descriptive statistics results are presented in Appendix E, Tables 4-14.

5.3.1 General descriptive statistics

Refer to Appendix E, Table 4.

The descriptive statistics of the dependent variables and the key independent variables are discussed for 193 observations (Valid N listwise=193).

The greatest VAIC™ coefficient identified was 13.12, the lowest 0.02 with a standard deviation of 1.75. The lowest MAR value identified was -1.45 and the highest is 2.18.

While none of the King reports stipulate a maximum required size of the board (Armstrong et al., 2005; Institute of Directors of South Africa, 2009), the Institute of Directors of South Africa (2009) insists that in terms of King III a board should appoint at least two directors, namely the CEO and the finance director, and the Companies Act of 2008 requires that the board should consist of at least three directors in the case of a public company (Republic of South Africa, 2008). The average number of directors on the board of directors of South African companies listed on the JSE for the 2011 fiscal year is 9.86 directors (2008: 9.4 (Nyirenda, 2010)), comparable to the average US board size in 2011 of 10.7 directors (PricewaterhouseCoopers, 2011). In the sample studied, the lowest number of directors on a board was 2 directors (2008: 4 (Nyirenda, 2010)); the highest 22 directors (2008: 18 (Nyirenda, 2010)).

The average age of a director serving on the board of listed companies during 2011 was 52.76, younger than the US equivalent average age of directors of 62.4

(PricewaterhouseCoopers, 2011). The youngest board member identified was 34 years old and the oldest 66 years old.

On average, 12% of board members during 2011 were non-executive women, in line with the study by Business Womens' Association of South Africa (2011) reporting that women directorships (both executive and non-executive) amounted to 15.8% of the total board as at March 2011. The desciptive statistics indicate that 28% of the board consists of non-executive directors of colour. This is encouraging, as Business Womens' Association of South Africa (2011) reported that black directors held only 23% of the seats on boards (executive and non-executive) of JSE listed companies in March 2011. However, some companies still have no non-executive women or members of colour serving on their boards (minimum=0). The maximum values identified far greater than the average at 40% non-executive women and 78% non-executive members of colour.

Refer to Appendix E, Table 5-7.

Multicollinearity was tested using Pearson correlation coefficients, Tolerance levels, VIF values and Eigen values. The Pearson correlation coefficients were inspected and it was noted that all the independent variables show at least some relationship with the dependent variable. Furthermore, correlations between each of the independent variables were observed and it was noted that no two of the variables had a bivariate correlation of 0.7 or more.

None of the tolerance levels are less than 0.10, none of the VIF values are greater than 10 and the Eigen values where all well below the guideline of 100-1000, suggesting no evidence of mulicollinearity.

5.3.2 Normality tests

5.3.2.1 VAIC™

Refer to Appendix E, Table 8-9.

The mean VAIC™ value of 3.03 was compared to the 5% trimmed mean of 2.82, the difference indicating that the extreme scores are having a strong influence on the mean. The data was therefore trimmed for the outliers, removing ten extreme observations (193 x 5% = 9.65~ 10). The five highest and five lowest extreme values reported by SPSS were removed. The Skewness (3.211) and Kurtosis (14.193) values are significantly more than the acceptable range of -1 and 1. The values still do not fall within the acceptable range after trimming the data (Skewness=1.675; Kurtosis=4.220) suggesting that the dependent variable, VAIC™, is not normally distributed.

This is confirmed by inspection of the histogram (histogram for the full 193 observations, as the trimmed data did not improve the Skewness and Kurtosis values sufficiently). The shape of the histogram indicates the actual distribution of the data, the data being positively skewed. Inspection of the histogram corroborates the findings above that the data is not normally distributed.

5.3.2.2 MAR

Refer to Appendix E, Table 10-12.

The mean MAR value of -0.028 was compared to the 5% trimmed mean of -0.034, the difference indicating that the extreme scores are having a strong influence on the mean. The data was therefore trimmed for the outliers, removing ten extreme observations (193 x 5% =

9.65~ 10). The five highest and five lowest extreme values reported by SPSS were removed. The original data resulted in an acceptable Skewness value (0.706), but the Kurtosis value (6.131) was significantly more than the acceptable range of -1 and 1, suggesting that the dependent variable, MAR, is not normally distributed.

After removing the ten outliers as discussed above, the data distribution improved significantly, with both the Skewness (-0.295) and Kurtosis (0.332) values falling within the acceptable range of -1 and 1, suggesting that the dependent variable, MAR, is now normally distributed.

Inspecting the actual shape of the distribution in the histogram (based on the trimmed data of 183 observations), the data now appears to be reasonably normally distributed. The assumption of normality of the distribution is supported by the improved Skewness and Kurtosis values above.

The results from the tests above demonstrate that the VAIC™ values are not normally distributed, whereas the trimmed data set for MAR is normally distributed.

5.3.3 Comparing groups

Statistical tests were performed to assess the differences in VAIC™ and MAR between board of directors that have women and members of colour on their board, and boards that do not.

5.3.3.1 VAIC™

Given the results from 5.3.2, VAIC™ values are not normally distributed, thus the Mann-Whitney U test was performed (non-parametric test).

Refer to Appendix E, Table 13.

The results of the Mann-Whitney U test indicated that there are no statistically significant differences in the VAIC™ coefficients of companies with women on their boards (n=43) and companies without (n=150) (Asymp. Sig (2-tailed)=0.219).

The results of the Mann-Whitney U test indicate that there are no statistically significant differences in the VAIC™ coefficients of companies with directors of colour on their boards (n=12) and companies without (n=183) (Asymp. Sig (2-tailed)=0.794).

5.3.3.2 MAR

Given the results from 5.3.2, MAR data appears to be reasonably normally distributed, thus the Independent-samples t-test was used to compare the differences in the two groups (parametric test).

Refer to Appendix E, Table 14.

The test was conducted to compare the market adjusted share return (MAR) of companies with women on their boards (n=145) and companies without (n=38). There was no significant difference in the MAR for companies with women on their boards (M=-0.052, SD=0.298) and companies without (M=0.0003, SD=0.311); t (181)=-0.964. The magnitude of differences in the means (mean difference=0.05, 95% CI -0.161 to 0.055) was very small.

The test was conducted to compare the market adjusted share return (MAR) of companies with directors of colour on their boards (n=173) and companies without (n=10). There was no significant difference in the MAR for companies with directors of colour on their boards (M=-0.519, SD=0.3) and companies without (M=0.14, SD=0.25); t(181)=-1.976. The

magnitude of differences in the means (mean difference=-0.659, 95% CI -0.383 to 0.0002) was very small.

5.4 Regression analyses

Given the results in 5.3 and the fact that multiple linear regression assumes normal distribution of the dependent variable, ordinal regression analysis was used for the VAIC™ regressions and multiple linear regression analysis used for the MAR regressions. In both cases, both univariate analyses (assuming only the key independent variable influenced the dependent variable), as well as multivariate analyses (where control variables were included as per the models used by Swartz and Firer (2005)) were performed to assess the impact on the results.

5.4.1 Ordinal regression analysis using SPSS

Multiple linear regression analysis using the ordinary least squares regression (OLS) could not be used because the dependent variable (VAIC™) is not normally distributed (refer to Appendix E, Table 8 and 9). Therefore, ordinal regression analysis (non-parametric) was used in SPSS to determine which independent variables had a significant impact on the intellectual capital of a company. In order to use ordered logistic regression, the intellectual capital coefficients were classified into three categories with an equal amount of observations, representing either a low (ranking 1, n=64), medium (ranking 2, n=64) or high (ranking 3, n=65) intellectual capital coefficient.

Refer to Appendix E, Table 15.

Prior to using ordinal regression, all the independent variables were tested for proportional odds (test of parallel lines) in relation to the VAIC™ranking . All the sig. values observed were greater than the required 0.05, except for the sig.value for the turnover ratio (TOR)

(sig.=0.03); indicating that this is the only control variable that should not be included in the regression analyses.

Refer to Appendix E, Table 16.

Ordinal regression analysis testing the significance of board size was run twice. The first regression assessed the extent to which only the key independent variable (size) influenced the dependent variable; the next regression included control variables as defined in section 4.2.3. The univariate analysis indicated that the model is not improved by including this variable (*model fitting information* sig.=.808) and that the size of the board does not show a significant positive relationship to the VAIC™Rankings at a confidence level of 5% (*parameter estimates* sig.=0.813). Furthermore, the pseudo R-square value of 0.000 indicates that size does not explain the change in the dependent variable.

The following result is observed when the control variables are included in the regression equation as per the model below:

Model 5 (adjusted)*: VAIC^{TM}Ranking= ∫ (SIZE, TA, ROA, ROE, E, R, S, DTA)

*TOR not included as a control variable.

The *pseudo R-square* value (McFadden=.123) indicates that 12,3% of the change in the VAIC™Ranking is explained by the model and the *model fitting information* sig. value of 0.000 shows that the model has been improved by including certain control variables. The p-values for ROA (sig.=0.000) and DTA (sig.=0.046), indicate that these variables are statistically significant to the model; whereas (consistent with the univariate analysis), size remains a non-significant variable (sig.=0.479).

Refer to Appendix E, Table 17.

Ordinal regression analysis testing the significance of the average age of board members was run twice. The first regression assessed the extent to which only the key independent variable (average age) influenced the dependent variable; the next regression included control variables as defined in section 4.2.3. The univariate analysis indicated that the model is improved by including this variable (*model fitting information* sig.=.037) and that average age does show a significant positive relationship to the VAIC™Rankings at a confidence level of 5% (*parameter estimates* sig.=0.038). Furthermore, the pseudo R-square value (McFadden=0.010,Nagelkerke=0.025) means that average age explains between 1% and 2.5% of the change in the dependent variable.

The following result is observed when the control variables are included in the regression equation as per the model below:

Model 6 (adjusted)*: $VAIC^{TM}Ranking = \int (AVEAGE, TA, ROA, ROE, E, R, S, DTA)$

*TOR not included as a control variable.

The *pseudo R-square* value (McFadden=.124) indicates that 12,4% of the change in the VAIC™Ranking is explained by the model and the *model fitting information* sig. value of 0.000 shows that the model has been improved by including certain control variables. The p-values for ROA (sig.=0.000), ROE (sig.=0.05) and DTA (sig.=0.05), indicate that these variables are statistically significant to the model; whereas (inconsistent with the univariate analysis), average age is now regarded as a non-significant variable (sig.=0.409).

Given the inconsistency between the univariate and the multivariate models, further analyses were performed to assess the impact of each control variable on the significance of

the average age. Regressions were run with two independent variables at a time: average age as the one independent variable and one additional control variable. The results showed that average age contributed significantly to the model, only when paired with the industry control variable (aveage sig.=0.047) and the DTA control variable (aveage sig.=0.048). However, a model constructed with both of these variables, did not result in average age being a significant variable to the model (aveage sig.=0.064).

Refer to Appendix E, Table 18.

Ordinal regression analysis testing the significance of the percentage non-executive women on the board was run twice. The first regression assessed the extent to which only the key independent variable (percentage non-executive women) influenced the dependent variable; the next regression included control variables as defined in section 4.2.3. The univariate analysis indicated that the model is not improved by including this variable (*model fitting information* sig.=0.414) and that the percentage non-executive women does not show a significant positive relationship to the VAIC™Rankings at a confidence level of 5% (*parameter estimates* sig.=0.423). Furthermore, the pseudo R-square value (McFadden=0.002,Nagelkerke=0.003) means that the percentage of non-executive women explains less than a percentage of the change in the dependent variable.

The following result is observed when the control variables are included in the regression equation as per the model below:

Model 7 (adjusted)*: $VAIC^{TM}Ranking = \int (PERGENDER, TA, ROA, ROE, E, R, S, DTA)$

*TOR not included as a control variable.

The *pseudo R-square* value (McFadden=.123) indicates that 12,3% of the change in the VAIC™Ranking is explained by the model and the *model fitting information* sig. value of 0.000 shows that the model has been improved by including certain control variables. The p-values for ROA (sig.=0.000), ROE (sig.=0.005) and DTA (sig.=0.045), indicate that these variables are statistically significant to the model; whereas (consistent with the univariate analysis), the percentage non-executive women is regarded as a non-significant variable (sig.=0.611).

Refer to Appendix E, Table 19.

Ordinal regression analysis testing the significance of the percentage non-executive directors of colour on the board was run twice. The first regression assessed the extent to which only the key independent variable (percentage non-executive directors of colour) influenced the dependent variable; the next regression included control variables as defined in section 4.2.3. The univariate analysis indicated that the model is not improved by including this variable (*model fitting information* sig.=0.956) and that the percentage non-executive directors of colour does not show a significant positive relationship to the VAIC™Rankings at a confidence level of 5% (*parameter estimates* sig.=0.956). Furthermore, the pseudo R-square value (McFadden=0.000,Nagelkerke=0.000) means that the percentage non-executive directors of colour explains none of the change in the dependent variable.

The following result is observed when the control variables are included in the regression equation as per the model below:

Model 8 (adjusted)*: $VAIC^{TM}Ranking = \int (PERCOLOUR, TA, ROA, ROE, E, R, S, DTA)$

*TOR not included as a control variable.

The *pseudo R-square* value (McFadden=.123) indicates that 12,3% of the change in the VAIC™Ranking is explained by the model and the *model fitting information* sig. value of 0.000 shows that the model has been improved by including certain control variables. The p-values for ROA (sig.=0.000), ROE (sig.=0.004) and DTA (sig.=0.045), indicate that these variables are statistically significant to the model; whereas (consistent with the univariate analysis), the percentage non-executive directors of colour is regarded as a non-significant variable (sig.=0.682).

Refer to Appendix E, Table 20.

The key independent variables in Models 5, 6, 7 and 8 were combined in one regression and the regression results indicated that the model is not improved by including these variables (*model fitting information* sig.=0.217) and confirmed the results of the tests above, that only the average age of the directors contribute significantly to the predictive power of the model at a confidence level of 5% (*parameter estimates* Aveage sig.=0.03). Furthermore, the pseudo R-square value (McFadden=0.014, Nagelkerke=0.033) indicates that the model explains between 1 and 3% of the change in the VAIC™Ranking.

Refer to Appendix E, Table 21.

The univariate regression analyses were re-run, with a slightly amended dependent variable to assess whether a different result is obtained. The VAIC™ values were ranked into ten categories as opposed to three categories above, with category 1-9 having 19 observations and category 10 consisting of 22 observations. All the variables except size adhered to the requirements of the test of parallel lines, but again only average age was a statistically

significant variable (sig.=0.006). This is consistent with the previous results when using the three rankings.

5.4.2 Additional regressions using MAR

Given that the MAR values are normally distributed (refer to Appendix E, Table 10 and 11), multiple linear regression analysis was performed in order to address the four sub-research questions (refer to Appendix E, Table 3).

Refer to Appendix E, Table 22.

The univariate analysis indicated that only 0.2% of the change in the dependent variable is explained by the model, with the model not being statistically significant (*ANOVA* sig.=0.597). The size variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=0.039) and did not make a statistically significant unique contribution to the model (sig.=0.263). The t-statistic for size is 0.53, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence level.

Multivariate analysis was performed by including the control variables in the regression equation as per the model below:

Model 9 : MAR = ∫ (SIZE, TA, ROA, ROE, TOR, E, R, S, DTA)

The analysis indicated that 15.5% of the change in the dependent variable is explained by the model, with the model being statistically significant (*ANOVA* sig.=0.000). The size variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=-0.013) and did not make a statistically significant unique contribution to the model (sig.=0.862). The t-statistic for size is -0.174, which is less than the

benchmark level of 2, indicating a non-significant relationship at the 5% confidence level. Collinearity diagnostics do not indicate multicollinearity between independent variables.

The fact that there is no significant relationship between the size of the board and MAR is consistent with the previous results when VAIC™ was used as the dependent variable.

Refer to Appendix E, Table 23.

The univariate analysis indicated that only 0.1% of the change in the dependent variable is explained by the model, with the model not being statistically significant (*ANOVA* sig.=0.644). The average age variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=0.034) and did not make a statistically significant unique contribution to the model (sig.=0.263). The t-statistic for average age is 0.462, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence level.

Multivariate analysis was performed by including the control variables in the regression equation as per the model below:

Model 10 : MAR = ∫ (AVEAGE, TA, ROA, ROE, TOR, E, R, S, DTA)

The analysis indicated that 15.5% of the change in the dependent variable is explained by the model, with the model being statistically significant (*ANOVA* sig.=0.000). The average age variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=-0.013) and did not make a statistically significant unique contribution to the model (sig.=0.863). The t-statistic for average age is -0.173, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence

level. Collinearity diagnostics do not indicate multicollinearity between independent variables.

The fact that there is no significant relationship between the average age of the board and MAR is not consistent with the previous results when VAIC™ was used as the dependent variable, despite the fact that the t-statistic is positive and thus in the same direction for both tests. It can therefore be concluded that the average age does contribute to intellectual capital as measured with VAIC, but does not appear to contribute to market value.

Refer to Appendix E, Table 24.

The univariate analysis indicated that only 0.2% of the change in the dependent variable is explained by the model, with the model not being statistically significant (*ANOVA* sig.=0.506). The percentage non-executive women variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=0.049) and did not make a statistically significant unique contribution to the model (sig.=0.263). The t-statistic for the percentage non-executive women is -0.666, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence level.

Multivariate analysis was performed by including the control variables in the regression equation as per the model below:

Model 11: MAR = ∫ (PERGENDER, TA, ROA, ROE, TOR, E, R, S, DTA)

The analysis indicated that 16% of the change in the dependent variable is explained by the model, with the model being statistically significant (*ANOVA* sig.=0.000). The percentage non-executive women variable did not contribute significantly in explaining the dependent

variable, MAR (*Standardised Coefficients* beta.=-0.071) and did not make a statistically significant unique contribution to the model (sig.=0.317). The t-statistic for the percentage non-executive women is -1.005, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence level. Collinearity diagnostics do not indicate multicollinearity between independent variables.

The fact that there is no significant relationship between the percentage non-executive women on the board and MAR is consistent with the previous results when VAIC™ was used as the dependent variable.

Refer to Appendix E, Table 25.

The univariate analysis indicated that only 0.7% of the change in the dependent variable is explained by the model, with the model not being statistically significant (*ANOVA* sig.=0.263). The percentage non-executive directors of colour variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=0.083) and did not make a statistically significant unique contribution to the model (sig.=0.263). The t-statistic for the percentage non-executive directors of colour is -1.122, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence level.

Multivariate analysis was performed by including the control variables in the regression equation as per the model below:

Model 12 : MAR = ∫ (PERCOLOUR, TA, ROA, ROE, TOR, E, R, S, DTA)

The analysis indicated that 16% of the change in the dependent variable is explained by the model, with the model being statistically significant (*ANOVA* sig.=0.000). The percentage non-executive directors of colour variable did not contribute significantly in explaining the dependent variable, MAR (*Standardised Coefficients* beta.=-0.079) and did not make a statistically significant unique contribution to the model (sig.=0.279). The t-statistic for the percentage non-executive directors of colour is -1.087, which is less than the benchmark level of 2, indicating a non-significant relationship at the 5% confidence level. Collinearity diagnostics do not indicate multicollinearity between independent variables.

The fact that there is no significant relationship between the percentage non-executive members of colour on the board and MAR is consistent with the previous results when VAIC™ was used as the dependent variable.

Refer to Appendix E, Table 26.

The key independent variables in models 9-12 were combined in one regression and the regression results indicated that the model is not statistically significant (*ANOVA* sig.=0.798, R^2=0.009) and confirmed the results above that none of the variables are significant.

This is in contrast to the results obtained when using VAIC™Rankings as the dependent variable. The latter regressions indicated that average age was a significant variable in explaining the change in the dependent variable.

5.5 Chapter conclusion

Four models were constructed to test the contribution of board characteristics to intellectual capital performance (VAIC™) and market adjusted return (MAR) within a South African context. The models tested are in line with the models used by Swartz and Firer

(2005), but were found not to have strong predictive ability as the control factors included in the model did not all contribute towards the explanatory power of the model. The results and the acceptance or rejection of the stated hypotheses are discussed in chapter 6.

CHAPTER VI - Conclusions and recommendations

6.1 Introduction

The purpose of this research report was to investigate the relationship between intellectual capital performance and certain board characteristics. Given the results of the research (detailed in Chapter 5), this chapter summarises the findings and subsequently rejects or accepts the applicable hypotheses. Conclusions are drawn and recommendations made for future research.

6.2 Summary of results

6.2.1 Hypothesis 1

H0: There is no significant positive relationship between the size of the board of directors and intellectual capital performance.

The regression results do not provide support for the proposition that there is a positive and significant relationship between the size of the board of directors and intellectual capital performance for South African publicly listed companies. As the significance level is more than 0.05 (*parameter estimates* sig.=0.813), the null hypothesis is accepted. This result is consistent with the results of Cheng (2008) and (Khumalo, 2011) that found no association between board size and firm value.

6.2.2 Hypothesis 2

H0: There is no significant positive relationship between the average age of the directors on the board of directors and intellectual capital performance.

The regression results provide support for the proposition that there is a positive and significant relationship between the average age of board members and intellectual capital

performance for South African publicly listed companies. As the significance level is less than 0.05 (*parameter estimates* sig.=0.038), the null hypothesis is rejected. This result means that boards may be able to improve their intellectual capital performance by increasing the average age of their board members. As the average age of the board increases, members are able to contribute more experience to the board, contributing to the intellectual capital of the company.

6.2.3 Hypothesis 3

H0: There is no significant positive relationship between the percentage of non-executive women on the board of directors and intellectual capital performance.

The regression results do not provide support for the proposition that there is a positive and significant relationship between the percentage of women on the board of directors and intellectual capital performance for South African publicly listed companies. As the significance level is more than 0.05 (*parameter estimates* sig.=0.423), the null hypothesis is accepted. This result is consistent with Swartz and Firer (2005); Carter et al. (2010), and Khumalo (2011) that found that there was no association between female directors on the board and firm value. The latter two authors argue that this result may be due to the low number of women who serve on the board. Companies not may be deliberately attempting to prevent women from serving on the board of directors (Msomi, 2006), but an underlying assumption may exist that women are not as skilled as men, with companies merely appointing women to meet required mandates and not in an effort to change the culture and composition of the board of directors and company (Matsaba, 2010). Swartz and Firer (2005) defends the results from the study, stating that it may be due to the glass ceiling that women are subjected to.

6.2.4 Hypothesis 4

H_0: There is no significant positive relationship between the percentage of non-executive members of colour on the board of directors and intellectual capital performance.

The regression results do not provide support for the proposition that there is a positive and significant relationship between the percentage of directors of colour and intellectual capital performance for South African publicly listed companies. As the significance level is more than 0.05 (*parameter estimates* sig.=0.956), the null hypothesis is accepted. This result is in contrast to the results found by Carter et al. (2003), Erhardt et al. (2003), Van der Zahn (2004) and Swartz and Firer (2005), and may be as a result of only looking at non-executive directors. The results of the study may have been different if executive members of colour were regressed to the intellectual capital of the companies as opposed to only considering non-executive directors.

6.2.5 Interpretation of the results

Three of the key variables did not display a positive, significant relationship with intellectual capital, with only the average age of the board of directors showing a positive, significant relationship. However, cognisance should be taken of the fact that the study was subject to limitations regarding the definition of "diversity and demographics". The results could have been different if the variables had been expanded to include technical expertise, relevant industry knowledge and experience.

6.3 Recommendations for future research

The results of the study may be influenced by the limitations stipulated in section 4.4 of this report and as a result, creates opportunities for future research.

This research report considered limited elements of diversity and demographics and did not take into account academic qualifications, technical expertise, relevant industry knowledge, experience or nationality of directors, due to the difficulty of obtaining the data and measuring and interpreting these factors. A future study could develop a model that quantifies the value of specific qualifications within a given sector, as well as develop a model to measure the technical expertise, knowledge and experience of directors. Furthermore, the research report did not take into account changes in directors during the year, an aspect which could be explored in future research.

This study assessed the impact on intellectual capital of the percentage non-executive women and directors of colour on the board. A future study could assess the impact of women and directors of colour, but consider only executive directors, as these directors may be in a position to exert more influence.

Given that the data used in the report is not comparable over periods of time, this report was limited to a cross-sectional study. Future research could perform a longitudinal study and make the necessary adjustments to the data (such as inflationary adjustments) to ensure that each period's data is comparable.

The research study was performed within a South African context; future studies could measure the impact of the board structure on company performance in a country with different corporate governance legislation and requirements as governance needs differ across firms operating in different socio-political and economic conditions (Ho and Williams, 2003).

6.4 Conclusion

The results of the study seem to indicate that there is a lack of correlation between board composition and intellectual capital performance and the ability to generate abnormal returns for publicly listed South African companies. However, the results of the regression analyses provided empirical support for the proposition that a significant positive relationship exists between the average age of the board of directors and intellectual capital performance. As a result, companies may be able to enhance their intellectual capital performance by increasing the average age of their board members.

Despite the inclination to increase the average age of the board based on the results from this study, caution is advised when applying a uniform board structure as a company's board structure and the firm's characteristics are highly correlated, and it is thus not recommended that all companies have a uniform board of directors (Ho and Williams, 2003; Linck, Netter and Yang, 2008) given the different challenges and management problems companies face (Hermalin and Weisbach, 1991). In addition, merit criteria for director selection should be the primary concern for the board of directors of a company, ideally comprising of a diverse board (Van der Walt and Ingley, 2003).

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APPENDICES

Appendix A - All companies listed on McGregor BFA for the 2011 fiscal year

#	JSE TICKER	COMPANY NAME
1	1TM	1TIME HOLDINGS LTD
2	ABK	AFRICAN BRICK CENTRE LTD
3	ABL	AFRICAN BANK INVESTMENTS LTD
4	ACE	ACCENTUATE LTD
5	ACL	ARCELORMITTAL SA LTD
6	ACP	ACUCAP PROPERTIES LIMITED
7	ACT	AFROCENTRIC INVESTMENT CORP LIMITED
8	ADH	ADVTECH LIMITED
9	ADI	ADAPTIT HOLDINGS LTD
10	ADR	ADCORP HOLDINGS LIMITED
11	ADW	AFRICAN DAWN CAPITAL LTD
12	AEA	AFRICAN EAGLE RESOURCES PLC
13	AEG	AVENG LTD
14	AER	AMALGAMATED ELECTRONIC CORPORATION LIMITED
15	AET	ALERT STEEL HOLDINGS LIMITED
16	AFE	A E C I LIMITED
17	AFR	AFGRI LIMITED
18	AFT	AFRIMAT LIMITED
19	AFX	AFRICAN OXYGEN LIMITED
20	AGI	AG INDUSTRIES LIMITED
21	AGL	ANGLO AMERICAN PLC
22	AHL	AH-VEST LIMITED
23	AIP	ADCOCK INGRAM HOLDINGS LTD
24	ALM	ALLIANCE MINING CORP LIMITED
25	ALT	ALLIED TECHNOLOGIES LIMITED
26	AMA	AMALGAMATED APPLIANCE HOLDINGS LD
27	AME	AFRICAN MEDIA ENTERTAINMENT LIMITED
28	AMS	ANGLO AMERICAN PLAT LTD
29	AND	ANDULELA INVESTMENT HOLDINGS LTD
30	ANG	ANGLOGOLD ASHANTI LIMITED
31	ANS	ANYS LTD
32	AOO	AFRICAN AND OVERSEAS -N-
33	APK	ASTRAPAK LIMITED
34	APN	ASPEN PHARMACARE HOLDINGS LIMITED
35	AQP	AQUARIUS PLATINUM LIMITED
36	ARH	ARB HOLDINGS LIMITED
37	ARI	AFRICAN RAINBOW MINERALS LIMITED

38	ARL	ASTRAL FOODS LIMITED
39	ARQ	ANOORAQ RESOURCES CORPORATION
40	ART	ARGENT INDUSTRIAL LIMITED
41	ASA	ABSA GROUP LIMITED
42	ASO	AUSTRO GROUP LTD
43	ASR	ASSORE LIMITED
44	ATN	ALLIED ELECTRONICS CORPORATION LTD
45	ATR	AFRICA CELLULAR TOWERS LIMITED
46	AVI	AVI LIMITED
47	AVU	AVUSA LTD
48	AWA	ARROWHEAD PROP LTD A
49	AWT	AWETHU BREWERIES LIMITED
50	BAT	BRAIT SE
51	BAU	BAUBA PLATINUM LIMITED
52	BAW	BARLOWORLD LIMITED
53	BCX	BUSINESS CONNEXION GROUP A
54	BCF	BOWLER METCALF LIMITED
55	BCH	BEST CUT LTD
56	BCK	BLACKSTAR GROUP SE
57	BDM	BUILDMAX LIMITED
58	BEG	BEIGE HOLDINGS LIMITED
59	BEL	BELL EQUIPMENT LIMITED
60	BFS	BLUE FINANCIAL SERVICES LIMITED
61	BIK	BRIKOR LTD
62	BIL	BHP BILLITON PLC
63	BIO	BIOSCIENCE BRANDS LTD
64	BLU	BLUE LABEL TELECOMS LIMITED
65	BNT	BONATLA PROPERTY HOLDINGS LIMITED
66	BRN	BRIMSTONE INVESTMENT -N-
67	BSR	BASIL READ HOLDINGS LIMITED
68	BSS	BSI STEEL LTD
69	BTI	BRITISH AMERICAN TOBACCO PLC
70	BVT	THE BIDVEST GROUP LIMITED
71	BWI	B & W INSTRUMENTATION AND ELECTRICAL LTD
72	CAC	CAFCA LTD
73	CAP	CAPE EMPOWERMENT LTD
74	CAT	CAXTON CTP PUBLISHERS AND PRINTERS
75	CBH	COUNTRY BIRD HOLDINGS LTD
76	CCL	COMPU-CLEARING OUTSOURCING LIMITED
77	CCO	CAPITAL & COUNTIES PROP PLC
78	CDZ	CADIZ HOLDINGS LIMITED
79	CFR	COMPAGNIE FIN RICHEMONT
80	CGR	CALGRO M3 HOLDINGS LIMITED

81	CIL	CONSOLIDATED INFRASTRUCTURE GROUP
82	CKS	CROOKES BROTHERS LIMITED
83	CLH	CITY LODGE HOTELS LIMITED
84	CLI	CLIENTELE LIMITED
85	CLR	CLOVER INDUSTRIES LTD
86	CLS	CLICKS GROUP LIMITED
87	CMA	COMMAND HOLDINGS LIMITED
88	CMH	COMBINED MOTOR HOLDINGS LIMITED
89	CML	CORONATION FUND MANAGERS LIMITED
90	CMO	CHROMETCO LIMITED
91	CMP	CIPLA MEDPRO SA LTD
92	CND	CONDUIT CAPITAL LIMITED
93	CNL	CONTROL INSTRUMENTS GROUP LIMITED
94	COH	CURRO HOLDINGS LIMITED
95	COL	COLLIERS S A HOLDINGS LTD
96	COM	COMAIR LIMITED
97	CPI	CAPITEC BANK HOLDINGS LIMITED
98	CPL	CAPITAL PROPERTY FUND
99	CPN	CAPRICORN INV HLDGS LTD
100	CRD	CENTRAL RAND GOLD LIMITED
101	CRG	Cargo Carriers Limited
102	CRM	CERAMIC INDUSTRIES LIMITED
103	CRW	CORWIL INVESTMENTS LIMITED
104	CSB	CASHBUILD LIMITED
105	CSO	CAPITAL SHOPPING CENTRES GROUP PLC
106	CSP	CHEMICAL SPECIALITIES LIMITED
107	CUL	CULLINAN HOLDINGS LIMITED
108	CVI	CAPEVIN INVESTMENTS LTD
109	CVN	CONVERGENET HOLDINGS LTD
110	CZA	COAL OF AFRICA LTD
111	DAW	DISTRIBUTION AND WAREHOUSING NETWORK LTD
112	DCT	DATACENTRIX HOLDINGS LIMITED
113	DEC	DECILLION LIMITED
114	DGC	DIGICORE HOLDINGS LIMITED
115	DIA	DIPULA INCOME FUND LTD
116	DLG	DIALOGUE GROUP HOLDINGS LIMITED
117	DLV	DORBYL LIMITED
118	DMC	DIAMONDCORP PLC
119	DON	THE DON GROUP LIMITED
120	DRD	DRDGOLD LIMITED
121	DRN	DELRAND RESOURCES LTD
122	DST	DISTELL GROUP LIMITED
123	DSY	DISCOVERY HOLDINGS LIMITED

124	DTA	DELTA EMD LTD
125	DTC	DATATEC LIMITED
126	EFG	EFFICIENT GROUP LTD
127	EHS	EVRAZ HIGHVELD STEEL AND VANADIUM LIMITED
128	ELI	ELLIES HOLDINGS LIMITED
129	ELR	ELB GROUP LIMITED
130	EMI	EMIRA PROPERTY FUND
131	EOH	EOH HOLDINGS LTD
132	EPS	EASTERN PLATINUM LIMITED
133	EQS	EQSTRA HOLDINGS LIMITED
134	ERB	ERBACON INVESTMENT HOLDINGS LIMITED
135	ESR	ESORFRANKI LTD
136	EXL	EXCELLERATE HOLDINGS LIMITED
137	EXX	EXXARO RESOURCES LIMITED
138	FBR	FAMOUS BRANDS LIMITED
139	FCR	FERRUM CRESCENT LTD
140	FFA	FORTRESS INCOME FUND LTD
141	FGL	FINBOND GROUP LTD
142	FMC	FORBES AND MANHATTAN COAL CORPORATION
143	FPT	FOUNTAINHEAD PROPERTY TRUST
144	FRT	FARITEC HOLDINGS LIMITED
145	FSE	FIRESTONE ENERGY LIMITED
146	FSR	FIRSTRAND LIMITED
147	FUM	FIRST URANIUM CORPORATION
148	FVT	FAIRVEST PROPERTY HOLDINGS LIMITED
149	FWD	FREEWORLD COATINGS LIMITED
150	FWX	FONEWORX HOLDINGS LTD
151	GBG	GREAT BASIN GOLD LIMITED
152	GDN	GOODERSON LEISURE CORP
153	GDO	GOLD ONE INTERNATIONAL LTD
154	GFI	GOLD FIELDS LIMITED
155	GGM	GOLIATH GOLD MINING LTD
156	GIJ	GIJIMA GROUP LTD
157	GMB	GLENRAND MIB LTD
158	GND	GRINDROD LIMITED
159	GPL	GRAND PARADE INVESTMENTS LIMITED
160	GRF	GROUP FIVE LIMITED
161	GRT	GROWTHPOINT PROPERTIES LIMITED
162	HAR	HARMONY GOLD MINING COMPANY LIMITED
163	HCI	HOSKEN CONSOLIDATED INVESTMENTS LD
164	HDC	HUDACO INDUSTRIES LIMITED
165	HLM	HULAMIN LIMITED
166	HPA	HOSPITALITY PROPERTY FUND LIMITED

167	HSP	HOLDSPORT LIMITED
168	HUG	HUGE GROUP LTD
169	HWA	HWANGE COLLIERY COMPANY LIMITED
170	HWN	HOWDEN AFRICA HOLDINGS LIMITED
171	HWW	HARDWARE WAREHOUSE LTD
172	HYP	HYPROP INVESTMENTS LIMITED
173	ICC	INDUSTRIAL CREDIT COMPANY AFRICA
174	IDE	IDECO GROUP LIMITED
175	IDQ	INDEQUITY GROUP LIMITED
176	IFC	IFCA TECHNOLOGIES LIMITED
177	IFH	IFA HOTELS AND RESORTS LIMITED
178	ILA	ILIAD AFRICA LIMITED
179	ILV	ILLOVO SUGAR LIMITED
180	IMP	IMPALA PLATINUM HOLDINGS LIMITED
181	IMU	IMUNITI HOLDINGS LTD
182	ING	INGENUITY PROPERTY INVESTMENTS LTD
183	INL	INVESTEC LIMITED
184	IPL	IMPERIAL HOLDINGS LIMITED
185	IPS	IPSA GROUP PLC
186	IQG	IQUAD GROUP LTD
187	IRA	INFRASORS HOLDINGS LTD
188	ISA	ISA HOLDINGS LTD
189	ISB	INSIMBI REFRACTORY & ALLOY SUPPLIES LTD
190	ITE	ITALTILE LIMITED
191	ITR	INTERTRADING LIMITED
192	IVT	INVICTA HOLDINGS LIMITED
193	IWE	INTERWASTE HOLDINGS LTD
194	JBL	JUBILEE PLATINUM PLC
195	JCD	JCI LIMITED
196	JDG	JD GROUP LIMITED
197	JDH	JOHN DANIEL HOLDINGS LIMITED
198	JSC	JASCO ELECTRONICS HOLDINGS LIMITED
199	JSE	JSE LTD
200	KAP	KAP INTERNATIONAL HOLDINGS LIMITED
201	KBO	KIBO MINING PLC
202	KDV	KAYDAV GROUP LIMITED
203	KEH	KEATON ENERGY HOLDINGS LIMITED
204	KEL	KELLY GROUP LIMITED
205	KGM	KAGISO MEDIA LIMITED
206	KIO	KUMBA IRON ORE LIMITED
207	KIR	KAIROS INDUSTRIAL HOLDINGS LIMITED
208	LAB	LABAT AFRICA LIMITED
209	LAF	LONRHO PLC

210	LBH	LIBERTY HOLDINGS LIMITED
211	LEW	LEWIS GROUP LIMITED
212	LHC	LIFE HEALTHCARE GROUP HOLDINGS LTD
213	LHG	LITHA HEALTHCARE GROUP LTD
214	LNF	LONDON FINANCE & INVESTMENT GROUP PLC
215	LON	LONMIN PLC
216	MAS	MASONITE (AFRICA) LIMITED
217	MCU	M CUBED HOLDINGS LIMITED
218	MDC	MEDICLINIC INTERNATIONAL
219	MFL	METROFILE HOLDINGS LIMITED
220	MIP	MERCHANT AND INDUSTRIAL PROPERTIES LTD
221	MIX	MIX TELEMATICS LTD
222	MMG	MICROMEGA HOLDINGS LIMITED
223	MMH	MIRANDA MINERAL HOLDINGS LTD
224	MMI	MMI HOLDINGS LTD
225	MML	METMAR LIMITED
226	MMP	MARSHALL MONTEAGLE PLC
227	MND	MONDI LTD
228	MNY	MONEYWEB HOLDINGS LTD
229	MOB	MOBILE INDUSTRIES LIMITED
230	MOR	MORVEST BUS GROUP LTD
231	MPC	MR PRICE GROUP LIMITED
232	MPT	MPACT LIMITED
233	MRF	MERAFE RESOURCES LIMITED
234	MSM	MASSMART HOLDINGS LIMITED
235	MSP	MAS PLC
236	MST	MUSTEK LIMITED
237	MTA	METAIR INVESTMENTS LIMITED
238	MTE	MARSHALL MONTEAGLE HD SA
239	MTL	MERCANTILE BANK HOLDINGS LIMITED
240	MTN	MTN GROUP LIMITED
241	MTX	METOREX LIMITED
242	MUR	MURRAY AND ROBERTS HOLDINGS LIMITED
243	MVG	MVELAPHANDA GROUP LIMITED
244	MVGP	MVELAPHANDA GROUP LTD
245	MVL	MVELAPHANDA RESOURCES LIMITED
246	MVS	MVELASERVE LTD
247	MZR	MAZOR GROUP LIMITED
248	NAI	NEW AFRICA INVESTMENTS LIMITED
249	NCA	NEW CORPCAPITAL LIMITED
250	NCS	NICTUS BEPERK
251	NED	NEDBANK GROUP LIMITED
252	NEP	NEW EUROPE PROPERTY INVESTMENTS PLC

253	NHM	NORTHAM PLATINUM LIMITED
254	NPK	NAMPAK LIMITED
255	NPN	NASPERS LIMITED
256	NT1	NET 1 UEPS TECHNOLOGIES INC
257	NTC	NETCARE LIMITED
258	NUT	NUTRITIONAL HOLDINGS LTD
259	NWL	NU-WORLD HOLDINGS LIMITED
260	OAO	OANDO PLC
261	OAS	OASIS CRESCENT PROPERTY FUND
262	OCE	OCEANA GROUP LIMITED
263	OCT	OCTODEC INVESTMENTS LIMITED
264	OLG	ONELOGIX GROUP LIMITED
265	OLI	O-LINE HOLDINGS LIMITED
266	OML	OLD MUTUAL PLC
267	OMN	OMNIA HOLDINGS LIMITED
268	OPT	OPTIMUM COAL HOLDINGS LIMITED
269	ORE	ORION REAL ESTATE LTD
270	PAM	PALABORA MINING COMPANY LIMITED
271	PAN	PAN AFRICAN RESOURCES PLC
272	PAP	PANGBOURNE PROPERTIES LIMITED
273	PBT	PBT GROUP LIMITED
274	PCN	PARACON HOLDINGS LIMITED
275	PET	PETMIN LIMITED
276	PFG	PIONEER FOOD GROUP LIMITED
277	PGL	PALLINGHURST RESOURCES LTD
278	PGR	PEREGRINE HOLDINGS LIMITED
279	PHM	PHUMELELA GAMING AND LEISURE LTD
280	PIK	PICK N PAY STORES LIMITED
281	PKH	PROTECH KHUTHELE HOLDINGS LTD
282	PLD	PALADIN CAPITAL LIMITED
283	PLL	PLATFIELDS LIMITED
284	PLN	PLATMIN LIMITED
285	PMM	PREMIUM PROPERTIES LIMITED
286	PMV	PRIMESERV GROUP LIMITED
287	PNC	PINNACLE TECHNOLOGY HOLDINGS LTD
288	PNG	PINNACLE POINT GROUP LIMITED
289	POY	POYNTING HOLDINGS LIMITED
290	PPC	PRETORIA PORTLAND CEMENT COMPANY LD
291	PPE	PURPLE CAPITAL LIMITED
292	PPR	PUTPROP LIMITED
293	PSG	PSG GROUP LIMITED
294	PSV	PSV HOLDINGS LIMITED
295	PWK	PICK N PAY HOLDINGS LIMITED

296	PZG	PAMODZI GOLD LIMITED
297	QHL	QUEENSGATE HOTEL & LEISURE LTD
298	QPG	QUANTUM PROPERTY GROUP LIMITED
299	RAC	RACEC GROUP LTD
300	RAH	REAL AFRICA HOLDINGS LIMITED
301	RAR	RARE HOLDINGS LIMITED
302	RBA	RBA HOLDINGS LTD
303	RBP	ROYAL BAFOKENG PLATINUM LTD
304	RBW	RAINBOW CHICKEN LIMITED
305	RBX	RAUBEX GROUP LIMITED
306	RDF	REDEFINE PROPERTIES LTD
307	RDI	ROCKWELL DIAMONDS INCORPORATED
308	REB	REBOSIS PROPERTY FUND LIMITED
309	REI	REINET INVESTMENTS S.C.A
310	REM	REMGRO LIMITED
311	RES	RESILIENT PROPERTY INCOME FUND LTD
312	RGT	RGT SMART HI-PERFORMANCE DECISION SUPPORT
313	RIN	REDEFINE PROPERTIES INTERNATIONAL LTD
314	RLF	ROLFES HOLDINGS LTD
315	RLO	REUNERT LIMITED
316	RMH	RMB HOLDINGS LIMITED
317	RMI	RAND MERCH INS HLDGS LTD
318	RNG	RANDGOLD & EXPLORATION COMPANY LD
319	RSG	RESOURCE GENERATION LIMITED
320	RTO	REX TRUEFORM CLOTHING COMPANY LTD
321	SAB	SABMILLER PLC
322	SAC	SA CORPORATE REAL ESTATE FUND
323	SAH	SOUTH AFRICAN COAL MINING HOLDINGS LTD
324	SAL	THE SOUTH AFRICAN LAND AND EXPLORATION CO LTD
325	SAN	SANYATI HOLDINGS LIMITED
326	SAP	SAPPI LIMITED
327	SBK	STANDARD BANK GROUP LTD
328	SBL	SABLE HOLDINGS LIMITED
329	SBO	SAAMBOU HOLDINGS LIMITED
330	SBV	SABVEST LIMITED
331	SCL	SACOIL HOLDINGS LTD
332	SDH	SECUREDATA HOLDINGS LIMITED
333	SEP	SEPHAKU HOLDINGS LIMITED
334	SER	SEARDEL INVESTMENT CORPORATION LTD
335	SFH	S A FRENCH LIMITED
336	SFN	SASFIN HOLDINGS LIMITED
337	SGA	SYNERGY INCOME FUND A LU
338	SHF	STEINHOFF INTERNATIONAL HOLDINGS LTD

339	SHP	SHOPRITE HOLDINGS LIMITED
340	SIM	SIMMER AND JACK MINES LIMITED
341	SKJ	SEKUNJALO INVESTMENTS LIMITED
342	SKW	SKINWELL HOLDINGS LTD
343	SKY	SEA KAY HOLDINGS LTD
344	SLL	STELLA VISTA TECHNOLOGIES LIMITED
345	SLM	SANLAM LIMITED
346	SLO	SOUTHERN ELECTRICITY COMPANY LD
347	SNT	SANTAM LIMITED
348	SNU	SENTULA MINING LTD
349	SNV	SANTOVA LIMITED
350	SOH	SOUTH OCEAN HOLDINGS LIMITED
351	SOL	SASOL LIMITED
352	SOV	SOVEREIGN FOOD INVESTMENTS LIMITED
353	SPA	SPANJAARD LIMITED
354	SPG	SUPER GROUP LIMITED
355	SPP	THE SPAR GROUP LIMITED
356	SQE	SQUARE ONE SOLUTIONS GROUP LIMITED
357	SSK	STEFANUTTI STOCKS HOLDINGS LTD
358	STA	STRATCORP LIMITED
359	SUI	SUN INTERNATIONAL LIMITED
360	SUR	SPUR CORPORATION LTD
361	SVB	SILVERBRIDGE HOLDINGS LTD
362	SVN	SABVEST LTD -N-
363	SYC	SYCOM PROPERTY FUND
364	TAS	TASTE HOLDINGS LIMITED
365	TAW	TAWANA RESOURCES NL
366	TBS	TIGER BRANDS LIMITED
367	TBX	THABEX LIMITED
368	TCS	TOTAL CLIENT SERVICES LIMITED
369	TDH	TRADEHOLD LIMITED
370	TFG	THE FOSCHINI GROUP LTD
371	TFX	TOP-FIX HOLDINGS LTD
372	TKG	TELKOM SA LIMITED
373	TLM	TELEMASTERS HOLDINGS LIMITED
374	TMT	TREMATON CAPITAL INVESTMENTS LTD
375	TON	TONGAAT HULETT LIMITED
376	TPC	TRANSPACO LIMITED
377	TRE	TRENCOR LIMITED
378	TRU	TRUWORTHS INTERNATIONAL LIMITED
379	TSH	TSOGO SUN HOLDINGS LTD
380	TSX	TRANS HEX GROUP LIMITED
381	TTO	TRUSTCO GROUP HOLDINGS LIMITED

382	UBU	UBUBELE HOLDINGS LIMITED
383	UCS	UCS GROUP LIMITED
384	UNI	UNIVERSAL INDUSTRIES
385	UUU	URANIUM ONE INC
386	VIF	VIVIDEND INCOME FUND LTD
387	VIL	VILLAGE MAIN REEF LIMITED
388	VKE	VUKILE PROPERTY FUND LIMITED
389	VLE	VALUE GROUP LIMITED
390	VMK	VERIMARK HOLDINGS LTD
391	VOD	VODACOM GROUP LTD
392	VOX	VOX TELECOM LTD
393	VUN	VUNANI PROPERTY INVESTMENT FUND LTD
394	WBO	WILSON BAYLY HOLMES-OVCON LIMITED
395	WEA	W G WEARNE LIMITED
396	WEZ	WESIZWE PLATINUM LTD
397	WGR	WITWATERSRAND CONSOLIDATED GOLD RESOURCES
398	WHL	WOOLWORTHS HOLDINGS LIMITED
399	WIL	WILDERNESS HOLDINGS LIMITED
400	WKF	WORKFORCE HOLDINGS LIMITED
401	WNH	WINHOLD LIMITED
402	WSL	WESCOAL HOLDINGS LIMITED
403	WTL	WILLIAM TELL HOLDINGS LTD
404	YRK	YORK TIMBER HOLDINGS LIMITED
405	ZCI	ZCI LIMITED
406	ZED	ZEDER INVESTMENTS LTD
407	ZPT	ZAPTRONIX LIMITED
408	ZSA	ZURICH INSURANCE COMPANY S A LTD

Appendix B - All companies included in the final data set (final sample)

#	JSE TICKER	COMPANY NAME
1	1TM	1TIME HOLDINGS LTD
2	ACE	ACCENTUATE LTD
3	ACL	ARCELORMITTAL SA LTD
4	ACT	AFROCENTRIC INVESTMENT CORP LIMITED
5	ADI	ADAPTIT HOLDINGS LTD
6	ADR	ADCORP HOLDINGS LIMITED
7	ADW	AFRICAN DAWN CAPITAL LTD
8	AEG	AVENG LTD
9	AER	AMALGAMATED ELECTRONIC CORPORATION LIMITED
10	AFE	A E C I LIMITED
11	AFR	AFGRI LIMITED
12	AFT	AFRIMAT LIMITED
13	AFX	AFRICAN OXYGEN LIMITED
14	AHL	AH-VEST LIMITED
15	AIP	ADCOCK INGRAM HOLDINGS LTD
16	ALT	ALLIED TECHNOLOGIES LIMITED
17	AMA	AMALGAMATED APPLIANCE HOLDINGS LD
18	AME	AFRICAN MEDIA ENTERTAINMENT LIMITED
19	AMS	ANGLO AMERICAN PLAT LTD
20	ANG	ANGLOGOLD ASHANTI LIMITED
21	AOO	AFRICAN AND OVERSEAS -N-
22	APK	ASTRAPAK LIMITED
23	APN	ASPEN PHARMACARE HOLDINGS LIMITED
24	ARI	AFRICAN RAINBOW MINERALS LIMITED
25	ARL	ASTRAL FOODS LIMITED
26	ART	ARGENT INDUSTRIAL LIMITED
27	ASO	AUSTRO GROUP LTD
28	ASR	ASSORE LIMITED
29	ATN	ALLIED ELECTRONICS CORPORATION LTD
30	AVI	AVI LIMITED
31	AVU	AVUSA LTD
32	BAW	BARLOWORLD LIMITED
33	BCX	BUSINESS CONNEXION GROUP A
34	BCF	BOWLER METCALF LIMITED
35	BDM	BUILDMAX LIMITED
36	BEG	BEIGE HOLDINGS LIMITED
37	BEL	BELL EQUIPMENT LIMITED
38	BIL	BHP BILLITON PLC
39	BLU	BLUE LABEL TELECOMS LIMITED
40	BSR	BASIL READ HOLDINGS LIMITED

41	BSS	BSI STEEL LTD
42	BVT	THE BIDVEST GROUP LIMITED
43	BWI	B & W INSTRUMENTATION AND ELECTRICAL LTD
44	CAT	CAXTON CTP PUBLISHERS AND PRINTERS
45	CBH	COUNTRY BIRD HOLDINGS LTD
46	CFR	COMPAGNIE FIN RICHEMONT
47	CGR	CALGRO M3 HOLDINGS LIMITED
48	CIL	CONSOLIDATED INFRASTRUCTURE GROUP
49	CKS	CROOKES BROTHERS LIMITED
50	CLH	CITY LODGE HOTELS LIMITED
51	CLR	CLOVER INDUSTRIES LTD
52	CLS	CLICKS GROUP LIMITED
53	CMH	COMBINED MOTOR HOLDINGS LIMITED
54	CMP	CIPLA MEDPRO SA LTD
55	COH	CURRO HOLDINGS LIMITED
56	COM	COMAIR LIMITED
57	CRM	CERAMIC INDUSTRIES LIMITED
58	CSB	CASHBUILD LIMITED
59	CSO	CAPITAL SHOPPING CENTRES GROUP PLC
60	CUL	CULLINAN HOLDINGS LIMITED
61	DAW	DISTRIBUTION AND WAREHOUSING NETWORK LTD
62	DGC	DIGICORE HOLDINGS LIMITED
63	DRD	DRDGOLD LIMITED
64	DST	DISTELL GROUP LIMITED
65	DTC	DATATEC LIMITED
66	EFG	EFFICIENT GROUP LTD
67	EHS	EVRAZ HIGHVELD STEEL AND VANADIUM LIMITED
68	ELI	ELLIES HOLDINGS LIMITED
69	ELR	ELB GROUP LIMITED
70	EQS	EQSTRA HOLDINGS LIMITED
71	ERB	ERBACON INVESTMENT HOLDINGS LIMITED
72	ESR	ESORFRANKI LTD
73	EXX	EXXARO RESOURCES LIMITED
74	FBR	FAMOUS BRANDS LIMITED
75	FWX	FONEWORX HOLDINGS LTD
76	GBG	GREAT BASIN GOLD LIMITED
77	GDO	GOLD ONE INTERNATIONAL LTD
78	GFI	GOLD FIELDS LIMITED
79	GND	GRINDROD LIMITED
80	GRF	GROUP FIVE LIMITED
81	HAR	HARMONY GOLD MINING COMPANY LIMITED
82	HDC	HUDACO INDUSTRIES LIMITED
83	HLM	HULAMIN LIMITED

84	HUG	HUGE GROUP LTD
85	IDE	IDECO GROUP LIMITED
86	ILA	ILIAD AFRICA LIMITED
87	ILV	ILLOVO SUGAR LIMITED
88	IMP	IMPALA PLATINUM HOLDINGS LIMITED
89	IPL	IMPERIAL HOLDINGS LIMITED
90	IQG	IQUAD GROUP LTD
91	IRA	INFRASORS HOLDINGS LTD
92	ISA	ISA HOLDINGS LTD
93	ISB	INSIMBI REFRACTORY & ALLOY SUPPLIES LTD
94	ITE	ITALTILE LIMITED
95	IVT	INVICTA HOLDINGS LIMITED
96	JDG	JD GROUP LIMITED
97	JSC	JASCO ELECTRONICS HOLDINGS LIMITED
98	KAP	KAP INTERNATIONAL HOLDINGS LIMITED
99	KDV	KAYDAV GROUP LIMITED
100	KEH	KEATON ENERGY HOLDINGS LIMITED
101	KGM	KAGISO MEDIA LIMITED
102	KIO	KUMBA IRON ORE LIMITED
103	KIR	KAIROS INDUSTRIAL HOLDINGS LIMITED
104	LEW	LEWIS GROUP LIMITED
105	LHC	LIFE HEALTHCARE GROUP HOLDINGS LTD
106	LON	LONMIN PLC
107	MAS	MASONITE (AFRICA) LIMITED
108	MDC	MEDICLINIC INTERNATIONAL
109	MFL	METROFILE HOLDINGS LIMITED
110	MIX	MIX TELEMATICS LTD
111	MMG	MICROMEGA HOLDINGS LIMITED
112	MML	METMAR LIMITED
113	MND	MONDI LTD
114	MOR	MORVEST BUS GROUP LTD
115	MPC	MR PRICE GROUP LIMITED
116	MPT	MPACT LIMITED
117	MRF	MERAFE RESOURCES LIMITED
118	MSM	MASSMART HOLDINGS LIMITED
119	MST	MUSTEK LIMITED
120	MTA	METAIR INVESTMENTS LIMITED
121	MTN	MTN GROUP LIMITED
122	MUR	MURRAY AND ROBERTS HOLDINGS LIMITED
123	MVS	MVELASERVE LTD
124	MZR	MAZOR GROUP LIMITED
125	NCS	NICTUS BEPERK
126	NHM	NORTHAM PLATINUM LIMITED

127	NPK	NAMPAK LIMITED
128	NPN	NASPERS LIMITED
129	NTC	NETCARE LIMITED
130	NWL	NU-WORLD HOLDINGS LIMITED
131	OCE	OCEANA GROUP LIMITED
132	OLG	ONELOGIX GROUP LIMITED
133	OLI	O-LINE HOLDINGS LIMITED
134	OMN	OMNIA HOLDINGS LIMITED
135	OPT	OPTIMUM COAL HOLDINGS LIMITED
136	PAM	PALABORA MINING COMPANY LIMITED
137	PAN	PAN AFRICAN RESOURCES PLC
138	PET	PETMIN LIMITED
139	PFG	PIONEER FOOD GROUP LIMITED
140	PHM	PHUMELELA GAMING AND LEISURE LTD
141	PIK	PICK N PAY STORES LIMITED
142	PKH	PROTECH KHUTHELE HOLDINGS LTD
143	PNC	PINNACLE TECHNOLOGY HOLDINGS LTD
144	POY	POYNTING HOLDINGS LIMITED
145	PPC	PRETORIA PORTLAND CEMENT COMPANY LD
146	PSV	PSV HOLDINGS LIMITED
147	PWK	PICK N PAY HOLDINGS LIMITED
148	RBW	RAINBOW CHICKEN LIMITED
149	RBX	RAUBEX GROUP LIMITED
150	REM	REMGRO LIMITED
151	RGT	RGT SMART HI-PERFORMANCE DECISION SUPPORT
152	RLF	ROLFES HOLDINGS LTD
153	RLO	REUNERT LIMITED
154	RNG	RANDGOLD & EXPLORATION COMPANY LD
155	RTO	REX TRUEFORM CLOTHING COMPANY LTD
156	SAB	SABMILLER PLC
157	SDH	SECUREDATA HOLDINGS LIMITED
158	SER	SEARDEL INVESTMENT CORPORATION LTD
159	SHF	STEINHOFF INTERNATIONAL HOLDINGS LTD
160	SHP	SHOPRITE HOLDINGS LIMITED
161	SNU	SENTULA MINING LTD
162	SNV	SANTOVA LIMITED
163	SOH	SOUTH OCEAN HOLDINGS LIMITED
164	SOL	SASOL LIMITED
165	SOV	SOVEREIGN FOOD INVESTMENTS LIMITED
166	SPA	SPANJAARD LIMITED
167	SPG	SUPER GROUP LIMITED
168	SUI	SUN INTERNATIONAL LIMITED
169	SUR	SPUR CORPORATION LTD

170	TAS	TASTE HOLDINGS LIMITED
171	TBS	TIGER BRANDS LIMITED
172	TCS	TOTAL CLIENT SERVICES LIMITED
173	TFG	THE FOSCHINI GROUP LTD
174	TKG	TELKOM SA LIMITED
175	TLM	TELEMASTERS HOLDINGS LIMITED
176	TON	TONGAAT HULETT LIMITED
177	TPC	TRANSPACO LIMITED
178	TRE	TRENCOR LIMITED
179	TRU	TRUWORTHS INTERNATIONAL LIMITED
180	TSX	TRANS HEX GROUP LIMITED
181	UBU	UBUBELE HOLDINGS LIMITED
182	VIL	VILLAGE MAIN REEF LIMITED
183	VLE	VALUE GROUP LIMITED
184	VMK	VERIMARK HOLDINGS LTD
185	VOD	VODACOM GROUP LTD
186	WBO	WILSON BAYLY HOLMES-OVCON LIMITED
187	WHL	WOOLWORTHS HOLDINGS LIMITED
188	WIL	WILDERNESS HOLDINGS LIMITED
189	WKF	WORKFORCE HOLDINGS LIMITED
190	WNH	WINHOLD LIMITED
191	WTL	WILLIAM TELL HOLDINGS LTD
192	YRK	YORK TIMBER HOLDINGS LIMITED
193	ZCI	ZCI LIMITED

Appendix C - Board structure of companies included in the final data set

#	Ticker	Board size	Average age	Women	Non-exec women	Percentage non-exec women	Colour	Non-exec colour	Percentage non-exec colour
1	1TM	13	44	4	2	15%	7	5	38%
2	ACE	7	53	1	1	14%	3	3	43%
3	ACL	13	55	3	2	15%	6	5	38%
4	ACT	7	64	2	2	29%	3	3	43%
5	ADI	9	46	3	2	22%	6	4	44%
6	ADR	11	46	3	3	27%	7	6	55%
7	ADW	5	44	2	2	40%	0	0	0%
8	AEG	13	53	2	2	15%	4	2	15%
9	AER	5	51	1	0	0%	0	0	0%
10	AFE	11	55	2	2	18%	6	5	45%
11	AFR	9	47	3	3	33%	4	4	44%
12	AFT	10	58	1	1	10%	2	2	20%
13	AFX	10	52	1	1	10%	4	3	30%
14	AHL	7	52	2	2	29%	5	2	29%
15	AIP	9	53	1	1	11%	3	3	33%
16	ALT	11	59	1	1	9%	4	4	36%
17	AMA	11	55	0	0	0.00%	1	1	9%
18	AME	6	46	2	1	17%	3	3	50%
19	AMS	13	59	4	0	0%	6	2	15%
20	ANG	11	59	1	1	9%	8	8	73%
21	AOO	7	60	2	0	0%	1	1	14%
22	APK	7	50	2	2	29%	3	3	43%
23	APN	10	53	2	2	20%	3	3	30%
24	ARI	17	58	2	2	12%	6	4	24%
25	ARL	10	55	2	2	20%	2	1	10%
26	ART	10	48	1	0	0%	1	1	10%
27	ASO	7	55	0	0	0%	1	1	14%
28	ASR	9	65	1	1	11%	2	2	22%
29	ATN	15	59	2	2	13%	4	4	27%
30	AVI	12	50	2	2	17%	3	3	25%
31	AVU	13	55	2	2	15%	7	6	46%
32	BAW	15	56	2	2	13%	7	6	40%
33	BCA	11	43	5	3	27%	5	4	36%
34	BCF	7	62	0	0	0%	1	0	0%
35	BDM	9	58	0	0	0%	2	2	22%
36	BEG	7	51	1	1	14%	2	2	29%
37	BEL	11	52	2	1	9%	2	2	18%
38	BIL	12	60	2	2	17%	2	2	17%

39	BLU	11	47	1	1	9%	3	3	27%
40	BSR	8	52	1	1	13%	4	4	50%
41	BSS	8	48	0	0	0%	1	1	13%
42	BVT	22	58	5	5	23%	7	6	27%
43	BWI	12	54	0	0	0%	3	1	8%
44	CAT	9	56	1	1	11%	2	2	22%
45	CBH	8	57	0	0	0%	0	0	0%
46	CFR	19	63	1	0	0%	0	0	0%
47	CGR	9	50	1	1	11%	2	2	22%
48	CIL	10	50	0	0	0%	1	1	10%
49	CKS	10	56	1	1	10%	2	2	20%
50	CLH	9	52	2	2	22%	4	4	44%
51	CLR	14	56	0	0	0%	1	1	7%
52	CLS	10	54	3	2	20%	4	3	30%
53	CMH	9	60	1	1	11%	3	3	33%
54	CMP	8	44	2	2	25%	4	4	50%
55	COH	9	46	2	2	22%	3	3	33%
56	COM	17	53	1	1	6%	5	4	24%
57	CRM	10	60	2	2	20%	3	3	30%
58	CSB	10	56	1	1	10%	2	2	20%
59	CSO	12	61	1	1	8%	1	1	8%
60	CUL	10	49	3	2	20%	3	3	30%
61	DAW	10	50	2	1	10%	4	3	30%
62	DGC	14	50	1	1	7%	4	4	29%
63	DRD	6	53	0	0	0%	1	1	17%
64	DST	16	59	3	3	19%	3	3	19%
65	DTC	8	55	1	1	13%	2	2	25%
66	EFG	10	51	4	4	40%	3	3	30%
67	EHS	14	49	2	2	14%	3	3	21%
68	ELI	9	48	0	0	0%	1	1	11%
69	ELR	8	58	0	0	0%	1	0	0%
70	EQS	10	57	2	2	20%	3	3	30%
71	ERB	10	49	2	1	10%	3	3	30%
72	ESR	6	62	0	0	0%	2	2	33%
73	EXX	11	54	1	1	9%	7	6	55%
74	FBR	8	59	0	0	0%	1	1	13%
75	FWX	6	49	0	0	0%	2	2	33%
76	GBG	10	59	2	0	0%	3	0	0%
77	GDO	8	47	0	0	0%	1	1	13%
78	GFI	14	60	3	3	21%	6	6	43%
79	GND	16	53	0	0	0%	3	3	19%
80	GRF	8	54	4	3	38%	3	3	38%
81	HAR	16	57	2	2	13%	8	7	44%

82	HDC	7	54	2	2	29%	2	2	29%
83	HLM	13	55	2	2	15%	8	7	54%
84	HUG	12	45	2	0	0%	2	0	0%
85	IDE	5	46	1	1	20%	3	2	40%
86	ILA	7	50	2	2	29%	3	3	43%
87	ILV	15	54	2	1	7%	4	4	27%
88	IMP	13	51	4	3	23%	7	7	54%
89	IPL	17	54	3	3	18%	7	5	29%
90	IQG	9	41	1	1	11%	4	4	44%
91	IRA	7	48	0	0	0%	2	2	29%
92	ISA	7	41	1	0	0%	1	1	14%
93	ISB	9	51	1	1	11%	2	2	22%
94	ITE	7	49	2	2	29%	1	1	14%
95	IVT	9	51	0	0	0%	2	2	22%
96	JDG	12	55	1	1	8%	3	2	17%
97	JSC	9	51	2	2	22%	3	3	33%
98	KAP	11	54	1	1	9%	3	3	27%
99	KDV	5	43	0	0	0%	1	1	20%
100	KEH	9	46	2	1	11%	2	2	22%
101	KGM	12	50	2	2	17%	8	6	50%
102	KIO	10	53	2	2	20%	5	5	50%
103	KIR	3	54	0	0	0%	1	1	33%
104	LEW	9	53	3	3	33%	3	3	33%
105	LHC	12	55	2	2	17%	5	5	42%
106	LON	11	58	1	1	9%	3	3	27%
107	MAS	9	52	0	0	0%	1	1	11%
108	MDC	16	55	2	2	13%	3	3	19%
109	MFL	9	48	3	3	33%	4	4	44%
110	MIX	13	50	2	0	0%	2	2	15%
111	MMG	6	38	0	0	0%	0	0	0%
112	MML	7	56	1	1	14%	1	1	14%
113	MND	9	53	2	2	22%	2	1	11%
114	MOR	9	44	2	1	11%	6	3	33%
115	MPC	2	44	1	0	0%	0	0	0%
116	MPT	7	54	2	2	29%	2	2	29%
117	MRF	12	49	5	4	33%	9	8	67%
118	MSM	9	48	2	2	22%	3	3	33%
119	MST	7	47	1	1	14%	3	3	43%
120	MTA	9	54	1	1	11%	3	3	33%
121	MTN	12	56	2	2	17%	8	6	50%
122	MUR	13	58	3	2	15%	3	3	23%
123	MVS	8	48	3	3	38%	5	4	50%
124	MZR	7	57	1	0	0%	1	1	14%

125	NCS	8	55	0	0	0%	0	0	0%
126	NHM	11	58	2	2	18%	6	5	45%
127	NPK	12	54	3	3	25%	7	6	50%
128	NPN	14	61	3	3	21%	5	5	36%
129	NTC	9	58	1	1	11%	5	4	44%
130	NWL	6	57	0	0	0%	1	1	17%
131	OCE	11	51	3	2	18%	7	6	55%
132	OLG	9	50	0	0	0%	3	3	33%
133	OLI	10	49	0	0	0%	3	3	30%
134	OMN	10	54	2	2	20%	2	2	20%
135	OPT	12	49	1	1	8%	8	7	58%
136	PAM	8	46	2	1	13%	4	3	38%
137	PAN	6	49	0	0	0%	1	1	17%
138	PET	11	56	2	1	9%	2	1	9%
139	PFG	12	53	1	1	8%	5	5	42%
140	PHM	14	54	1	1	7%	6	4	29%
141	PIK	12	54	3	2	17%	2	2	17%
142	PKH	4	46	1	1	25%	3	3	75%
143	PNC	7	52	2	2	29%	4	3	43%
144	POY	7	44	0	0	0%	2	1	14%
145	PPC	14	51	4	3	21%	10	7	50%
146	PSV	8	47	1	1	13%	4	4	50%
147	PWK	7	66	1	1	14%	1	0	0%
148	RBW	11	54	1	1	9%	4	4	36%
149	RBX	8	53	1	1	13%	3	3	38%
150	REM	18	58	2	1	6%	4	4	22%
151	RGT	11	49	1	0	0%	2	2	18%
152	RLF	7	47	2	1	14%	4	4	57%
153	RLO	12	56	4	3	25%	5	5	42%
154	RNG	5	45	1	1	20%	1	1	20%
155	RTO	7	60	1	0	0%	1	1	14%
156	SAB	18	57	3	3	17%	2	2	11%
157	SDH	7	47	0	0	0%	2	2	29%
158	SER	11	50	2	2	18%	6	5	45%
159	SHF	18	55	2	2	11%	3	3	17%
160	SHP	10	63	0	0	0%	1	0	0%
161	SNU	8	54	1	1	13%	3	2	25%
162	SNV	9	53	0	0	0%	0	0	0%
163	SOH	9	52	2	2	22%	1	1	11%
164	SOL	9	54	4	2	22%	6	4	44%
165	SOV	9	50	0	0	0%	2	2	22%
166	SPA	8	34	1	0	0%	1	0	0%
167	SPG	8	58	0	0	0%	2	2	25%

168	SUI	13	55	3	3	23%	5	5	38%
169	SUR	11	52	1	0	0%	2	2	18%
170	TAS	9	51	0	0	0%	0	0	0%
171	TBS	12	56	3	2	17%	6	4	33%
172	TCS	4	49	2	1	25%	4	2	50%
173	TFG	12	55	3	3	25%	4	4	33%
174	TKG	9	54	2	2	22%	7	7	78%
175	TLM	5	46	0	0	0%	0	0	0%
176	TON	13	55	5	5	38%	9	9	69%
177	TPC	6	57	0	0	0%	0	0	0%
178	TRE	9	66	0	0	0%	0	0	0%
179	TRU	9	57	1	1	11%	2	2	22%
180	TSX	5	51	0	0	0%	3	1	20%
181	UBU	9	48	3	1	11%	3	1	11%
182	VIL	11	48	2	2	18%	4	3	27%
183	VLE	6	54	0	0	0%	3	1	17%
184	VMK	3	58	0	0	0%	1	1	33%
185	VOD	12	49	2	2	17%	4	4	33%
186	WBO	9	54	3	3	33%	4	4	44%
187	WHL	13	56	4	3	23%	5	4	31%
188	WIL	16	50	0	0	0%	3	3	19%
189	WKF	7	47	2	2	29%	2	2	29%
190	WNH	7	59	1	1	14%	1	1	14%
191	WTL	7	51	1	0	0%	1	0	0%
192	YRK	7	50	0	0	0%	2	2	29%
193	ZCI	8	62	1	0	0%	3	3	38%

Appendix D – Financial analysis of companies included in the final data set

#	Ticker	VAIC	MAR	TA	ROA	ROE	TOR	R	E	S	DTA
1	1TM	1.54	-1.17	623,742,000	(0.25)	(1.79)	2.0608	0	0	1	0.0256
2	ACE	12.87	-0.21	198,688,000	(0.37)	(0.63)	1.2552	1	0	0	0.0430
3	ACL	2.13	-0.09	32,422,000,000	0.00	0.00	0.9701	0	1	0	0.0213
4	ACT	2.27	0.21	1,242,987,000	0.09	0.22	1.0871	0	0	1	0.1609
5	ADI	3.73	0.24	105,615,000	0.10	0.23	1.6431	0	0	1	0.0149
6	ADR	2.25	-0.11	1,926,673,000	0.06	0.11	2.7947	0	0	1	0.0313
7	ADW	2.79	-0.51	128,441,000	0.03	0.16	0.3755	0	0	1	0.0870
8	AEG	2.42	-0.10	24,553,400,000	0.05	0.09	1.3979	1	0	0	0.0020
9	AER	3.00	0.12	173,575,000	0.12	0.16	0.8108	0	1	0	0.0181
10	AFE	2.66	0.04	12,457,000,000	0.06	0.16	1.0755	1	0	0	0.1210
11	AFR	3.05	-0.10	7,978,000,000	0.02	0.12	0.8772	1	0	0	0.0702
12	AFT	2.87	-0.09	952,881,000	0.08	0.12	0.8967	1	0	0	0.0547
13	AFX	2.58	-0.19	5,354,000,000	0.03	0.06	0.9798	1	0	0	0.0833
14	AHL	1.55	0.42	44,140,000	(0.06)	(0.16)	2.0001	1	0	0	0.2662
15	AIP	2.89	-0.05	5,235,460,000	0.14	0.24	0.8507	1	0	0	0.0662
16	ALT	2.78	-0.36	4,557,000,000	0.05	0.10	2.1178	0	0	1	0.0507
17	AMA	3.07	-0.09	653,224,000	0.09	0.12	1.2651	1	0	0	-
18	AME	2.63	0.11	171,708,000	0.15	0.23	1.0330	0	0	1	0.0012
19	AMS	2.78	-0.24	87,280,000,000	0.04	0.06	0.5899	0	1	0	0.0115
20	ANG	3.73	0.09	86,858,000,000	0.13	0.28	0.5759	0	1	0	0.2360
21	AOO	2.51	-0.14	327,435,000	0.06	0.14	1.6635	1	0	0	-
22	APK	2.42	-0.20	2,148,320,000	0.05	0.11	1.2674	0	0	1	0.1208
23	APN	3.84	-0.09	26,797,400,000	0.10	0.20	0.4805	1	0	0	0.1586
24	ARI	5.39	0.00	32,309,000,000	0.10	0.16	0.4610	0	1	0	0.0723
25	ARL	3.13	0.12	3,385,394,000	0.13	0.27	2.5421	1	0	0	0.0294

26	ART	1.93	-0.17	2,049,218,000	0.03	0.04	0.8564	1	0	0	0.1058
27	ASO	1.80	-0.13	581,306,000	0.01	0.01	0.6659	0	1	0	-
28	ASR	4.90	-0.58	15,031,954,000	0.21	0.30	0.7017	0	1	0	-
29	ATN	2.56	-0.13	12,419,000,000	0.04	0.11	1.8367	0	1	0	0.0610
30	AVI	3.20	0.16	5,383,200,000	0.13	0.24	1.5548	1	0	0	0.0080
31	AVU	2.07	0.13	4,099,000,000	0.05	0.09	1.2954	0	0	1	0.0693
32	BAW	2.26	0.30	30,932,000,000	0.03	0.08	1.6107	1	0	0	0.2194
33	BCX	2.29	-0.06	3,682,853,000	0.03	0.04	1.1714	0	0	1	0.0681
34	BCF	3.16	0.23	489,573,000	0.16	0.20	1.2075	0	0	1	0.0088
35	BDM	0.27	-1.45	1,109,373,000	(0.33)	(0.65)	1.2342	0	1	0	0.0918
36	BEG	3.62	-0.11	452,970,000	0.03	0.06	1.3129	1	0	0	0.0570
37	BEL	2.45	0.48	3,870,209,000	0.07	0.16	1.3102	0	1	0	0.0581
38	BIL	7.67	0.13	102,891,000,000	0.23	0.42	0.6972	0	1	0	0.1204
39	BLU	4.45	-0.08	5,089,088,000	0.08	0.15	3.6552	0	0	1	0.0031
40	BSR	2.46	0.19	4,899,737,000	0.03	0.08	1.2716	1	0	0	0.1100
41	BSS	2.51	0.15	991,760,000	0.04	0.09	1.8719	0	1	0	0.0970
42	BVT	2.82	0.02	47,829,918,000	0.07	0.20	2.4772	1	0	0	0.0918
43	BWI	0.60	-0.59	418,689,000	(0.04)	(0.09)	1.6322	1	0	0	0.0001
44	CAT	2.43	-0.03	6,141,809,000	0.08	0.09	0.7067	0	0	1	-
45	CBH	2.72	0.41	1,371,840,000	0.09	0.27	2.0663	1	0	0	0.1965
46	CFR	2.60	0.24	9,693,000,000	0.11	0.16	0.7110	1	0	0	0.0150
47	CGR	3.84	0.48	393,422,000	0.04	0.10	0.7164	1	0	0	0.0094
48	CIL	3.26	0.31	1,624,953,000	0.07	0.12	0.8896	0	1	0	0.0502
49	CKS	3.29	-0.28	599,285,000	0.19	0.26	0.4978	1	0	0	0.0795
50	CLH	3.58	-0.35	1,249,656,000	0.09	0.43	0.6323	0	0	1	0.1512
51	CLR	2.05	-0.15	3,545,488,000	0.05	0.10	1.8453	1	0	0	0.1221
52	CLS		0.00					1	0	0	

		3.81		4,254,783,000	0.15	0.67	3.3146				0.0000
53	CMH	2.71	0.17	2,176,761,000	0.06	0.20	3.3822	1	0	0	0.1168
54	CMP	4.49	-0.09	2,837,135,000	0.10	0.14	0.6148	1	0	0	0.0984
55	COH	1.73	0.75	597,412,000	(0.01)	(0.02)	0.2784	0	0	1	0.2049
56	COM	2.59	-0.06	2,103,621,000	0.04	0.10	1.7055	0	0	1	0.1304
57	CRM	3.31	-0.08	1,448,064,000	0.09	0.11	1.0685	1	0	0	0.0064
58	CSB	2.48	0.08	2,136,536,000	0.07	0.19	2.6527	1	0	0	0.0012
59	CSO	11.85	-0.03	7,399,900,000	0.00	0.01	0.0697	0	0	1	0.4986
60	CUL	2.61	0.35	440,421,000	0.05	0.14	0.8873	0	0	1	-
61	DAW	1.95	-0.34	2,558,797,000	(0.01)	(0.03)	1.4822	1	0	0	0.0160
62	DGC	2.42	0.00	782,937,000	0.06	0.08	0.8740	0	1	0	0.0422
63	DRD	1.49	-0.20	2,288,661,000	(0.13)	(0.23)	1.1209	0	1	0	-
64	DST	6.19	-0.11	8,483,580,000	0.11	0.17	1.4531	1	0	0	0.0499
65	DTC	2.13	0.02	1,996,932,000	0.02	0.06	2.1548	0	0	1	0.0238
66	EFG	1.21	0.48	89,384,000	0.03	0.04	0.5458	0	0	1	-
67	EHS	1.91	-0.74	4,458,000,000	0.01	0.02	1.2533	0	1	0	-
68	ELI	2.43	-0.11	964,793,000	0.10	0.16	1.3641	0	1	0	0.0455
69	ELR	2.40	0.47	1,271,411,000	0.05	0.17	1.0294	1	0	0	0.0162
70	EQS	3.83	0.15	10,641,000,000	0.03	0.11	0.7129	1	0	0	0.4295
71	ERB	1.08	-0.53	628,530,000	(0.11)	(0.15)	1.6091	1	0	0	0.0369
72	ESR	1.88	-0.62	1,464,351,000	(0.03)	(0.06)	0.9331	1	0	0	0.0577
73	EXX	4.23	0.24	36,920,000,000	0.21	0.32	0.5771	0	1	0	0.0596
74	FBR	4.00	0.26	1,139,312,000	0.20	0.33	1.6484	0	0	1	0.1071
75	FWX	3.36	-0.29	127,504,000	0.15	0.20	0.7182	0	1	0	0.0642
76	GBG	3.07	-0.84	850,310,000	(0.02)	(0.04)	0.2003	0	1	0	0.3082
77	GDO	3.66	0.64	387,235,000	0.13	0.15	0.4862	0	1	0	-
78	GFI	3.37	0.07	84,282,000,000	0.08	0.15	0.4969	0	1	0	0.1313

79	GND	2.54	-0.26	20,430,371,000	0.03	0.06	1.7469	0	1	0	0.1090
80	GRF	2.02	-0.32	7,770,978,000	(0.03)	(0.10)	1.1848	1	0	0	0.0299
81	HAR	2.26	-0.07	39,844,000,000	0.02	0.02	0.3123	0	1	0	0.0308
82	HDC	2.92	-0.08	4,537,577,000	0.07	0.22	0.7013	0	1	0	0.5082
83	HLM	2.03	-0.01	7,519,095,000	0.01	0.02	0.9253	0	1	0	0.0836
84	HUG	1.09	0.62	421,720,000	(0.04)	(0.06)	-	0	1	0	-
85	IDE	1.51	-1.31	120,106,000	(0.01)	(0.05)	-	0	1	0	0.0153
86	ILA	0.83	-0.74	1,986,643,000	(0.12)	(0.31)	2.1290	1	0	0	0.0013
87	ILV	2.31	-0.22	9,836,600,000	0.06	0.11	0.8243	1	0	0	0.0239
88	IMP	2.87	-0.15	67,604,000,000	0.10	0.14	0.4901	0	1	0	0.0251
89	IPL	2.27	0.17	36,533,000,000	0.07	0.21	1.7701	0	0	1	0.1813
90	IQG	0.27	0.44	145,088,000	(0.11)	(0.14)	0.5902	0	0	1	0.0985
91	IRA	2.73	-0.59	622,646,000	0.05	0.07	0.3845	0	1	0	0.1025
92	ISA	4.61	0.23	54,627,000	0.25	0.31	1.0841	0	0	1	-
93	ISB	2.74	-0.06	290,089,000	0.04	0.15	2.5249	0	1	0	0.1212
94	ITE	6.51	0.02	2,296,000,000	0.14	0.20	0.6625	1	0	0	0.1398
95	IVT	3.67	0.31	6,888,867,000	0.05	0.22	0.6581	0	1	0	0.5303
96	JDG	2.00	-0.18	16,734,000,000	0.04	0.09	0.7986	1	0	0	0.1147
97	JSC	1.99	-0.39	754,503,000	0.01	0.03	1.0119	0	1	0	0.1806
98	KAP	2.47	-0.05	2,635,600,000	0.05	0.09	1.6511	1	0	0	0.0085
99	KDV	2.55	0.26	199,914,000	0.09	0.15	2.4193	1	0	0	0.0619
100	KEH	6.17	-0.75	783,407,000	0.02	0.03	0.0449	0	1	0	-
101	KGM	2.35	-0.08	1,224,415,000	0.17	0.29	0.8178	0	0	1	0.0037
102	KIO	2.64	0.18	34,413,000,000	0.50	1.08	1.4109	0	1	0	-
103	KIR	3.63	0.01	126,799,000	(0.30)	0.65	1.4803	0	1	0	0.5109
104	LEW	2.53	0.18	5,571,700,000	0.13	0.19	0.8216	1	0	0	0.0718
105	LHC		0.29					0	0	1	-

		2.48		8,468,017,000	0.15	0.37	1.1587				
106	LON	2.23	-0.32	4,862,000,000	0.06	0.09	0.4097	0	1	0	0.0617
107	MAS	1.88	-0.03	540,330,000	0.02	0.03	1.2111	1	0	0	-
108	MDC	2.23	-0.05	43,537,000,000	0.03	0.12	0.4278	0	0	1	0.5187
109	MFL	2.65	0.17	606,406,000	0.12	0.24	0.7595	0	0	1	0.3277
110	MIX	2.18	0.02	994,208,000	0.07	0.10	0.8918	0	0	1	0.0363
111	MMG	1.74	1.72	519,358,000	0.01	0.03	1.4932	0	0	1	0.1255
112	MML	3.62	-0.02	1,340,306,000	0.03	0.08	1.7360	0	1	0	0.0548
113	MND	2.96	0.11	5,645,000,000	0.06	0.13	1.0691	1	0	0	0.1306
114	MOR	2.46	0.02	554,081,000	0.02	0.05	1.4570	0	0	1	0.1248
115	MPC	2.63	0.35	3,861,137,000	0.26	0.42	2.7643	1	0	0	0.0416
116	MPT	2.55	0.09	5,605,200,000	0.02	0.04	1.1206	0	0	1	0.2054
117	MRF	2.29	-0.55	3,922,138,000	0.03	0.04	0.6187	0	1	0	0.0797
118	MSM	5.83	-0.01	14,289,400,000	0.08	0.34	3.3207	1	0	0	0.0566
119	MST	1.71	0.05	1,669,539,000	0.06	0.14	-	0	1	0	-
120	MTA	2.79	0.49	2,482,126,000	0.16	0.26	1.7300	1	0	0	0.0111
121	MTN	6.63	0.08	181,408,000,000	0.11	0.23	0.6719	0	0	1	-
122	MUR	1.91	-0.38	19,560,500,000	(0.09)	(0.41)	1.5610	1	0	0	0.0626
123	MVS	3.23	-0.23	2,260,485,000	0.05	0.14	2.0195	0	0	1	0.1391
124	MZR	1.85	-0.64	261,313,000	0.04	0.04	0.7147	1	0	0	0.0120
125	NCS	2.29	0.14	936,058,000	0.02	0.14	0.4932	1	0	0	0.0126
126	NHM	1.97	-0.23	11,929,571,000	0.03	0.03	0.2993	0	1	0	-
127	NPK	2.59	0.10	12,908,000,000	0.05	0.11	1.3117	0	0	1	0.1053
128	NPN	3.68	0.07	69,855,000,000	0.08	0.13	0.4736	0	0	1	0.1940
129	NTC	2.40	-0.06	50,664,000,000	0.03	0.31	0.4583	0	0	1	0.6005
130	NWL	1.99	-0.14	864,584,000	0.02	0.03	1.9265	1	0	0	0.0231
131	OCE	3.55	0.16	2,022,996,000	0.16	0.25	1.8078	1	0	0	-

132	OLG	2.71	0.41	475,945,000	0.08	0.19	1.4744	0	0	1	0.1708
133	OLI	2.65	0.24	332,783,000	0.12	0.17	1.4194	1	0	0	0.1016
134	OMN	2.76	0.05	6,304,000,000	0.07	0.13	1.4860	1	0	0	0.0446
135	OPT	3.03	-0.28	11,462,142,000	0.04	0.07	0.4615	0	1	0	0.0490
136	PAM	3.37	0.26	7,202,000,000	0.20	0.40	1.1183	0	1	0	0.1047
137	PAN	2.80	0.25	113,116,000	0.15	0.19	0.7002	0	1	0	-
138	PET	9.03	-0.13	1,790,766,000	0.06	0.08	0.3582	0	1	0	0.0540
139	PFG	2.31	0.22	9,863,015,000	0.07	0.13	1.7087	1	0	0	0.0861
140	PHM	3.71	0.08	604,489,000	0.10	0.16	1.4561	0	0	1	-
141	PIK	3.62	-0.04	11,100,300,000	0.07	0.36	4.6797	1	0	0	0.0565
142	PKH	2.66	-0.73	853,877,000	0.05	0.12	1.2527	1	0	0	0.2004
143	PNC	2.92	0.58	1,728,695,000	0.13	0.35	2.8693	0	1	0	0.0319
144	POY	2.28	2.18	44,925,000	0.06	0.08	1.8169	0	1	0	0.0351
145	PPC	4.46	-0.29	6,419,000,000	0.13	0.91	1.0634	1	0	0	0.4205
146	PSV	1.65	-0.23	289,978,000	(0.03)	(0.06)	1.3051	0	1	0	0.0724
147	PWK	3.58	0.00	11,100,700,000	0.04	0.38	4.6795	1	0	0	0.0565
148	RBW	2.55	-0.17	4,768,303,000	0.08	0.13	1.8081	1	0	0	-
149	RBX	2.77	-0.30	4,011,132,000	0.11	0.17	1.1333	1	0	0	0.0578
150	REM	6.13	-0.03	55,987,000,000	0.19	0.21	0.2671	1	0	0	0.0028
151	RGT	2.37	-0.63	28,373,000	0.12	0.18	0.9764	0	0	1	0.0481
152	RLF	3.45	0.33	277,108,000	0.12	0.20	1.6625	1	0	0	0.0314
153	RLO	4.09	-0.05	6,106,300,000	0.22	0.34	1.7556	0	1	0	0.0001
154	RNG	9.16	-0.72	213,992,000	0.22	0.28	-	0	1	0	-
155	RTO	2.84	0.12	327,682,000	0.12	0.15	1.6631	1	0	0	0.0292
156	SAB	3.11	0.01	39,108,000,000	0.06	0.11	0.4963	1	0	0	0.1841
157	SDH	1.40	-0.31	380,614,000	(0.01)	(0.02)	1.0682	0	0	1	0.0071
158	SER		0.86					1	0	0	

		2.31		2,107,841,000	0.00	0.01	1.1484				0.0000
159	SHF	2.71	0.08	100,919,000,000	0.05	0.16	0.5681	1	0	0	0.2587
160	SHP	2.71	0.03	20,703,757,000	0.12	0.35	3.4920	1	0	0	0.0011
161	SNU	2.32	-0.14	4,412,021,000	0.01	0.01	0.5445	0	1	0	0.1269
162	SNV	2.67	1.17	347,876,000	0.05	0.16	5.8769	0	0	1	0.0108
163	SOH	2.35	-0.48	1,081,702,000	0.04	0.06	1.1658	0	1	0	0.0648
164	SOL	3.96	0.07	177,972,000,000	0.11	0.18	0.8003	0	1	0	0.0812
165	SOV	2.47	-0.51	1,116,032,000	0.02	0.06	0.9974	1	0	0	0.2838
166	SPA	2.70	-0.15	71,955,000	0.07	0.12	1.4185	1	0	0	0.1222
167	SPG	3.35	0.03	7,485,566,000	0.04	0.12	1.2416	0	0	1	0.1321
168	SUI	4.75	-0.08	10,848,000,000	0.04	0.29	0.8197	0	0	1	0.2706
169	SUR	2.67	-0.06	555,963,000	0.13	0.17	0.7256	0	0	1	0.0100
170	TAS	2.33	0.20	216,484,000	0.08	0.15	1.0798	1	0	0	0.1389
171	TBS	4.00	0.10	16,196,100,000	0.16	0.26	1.2614	1	0	0	0.0332
172	TCS	0.97	-0.67	30,146,000	(0.49)	2.16	1.5761	0	0	1	0.0056
173	TFG	3.78	0.14	10,702,500,000	0.12	0.24	0.9284	1	0	0	0.0839
174	TKG	2.57	-0.02	54,347,000,000	0.02	0.04	0.6156	0	0	1	0.1521
175	TLM	2.90	0.20	63,014,000	0.16	0.30	4.2553	0	0	1	0.0053
176	TON	2.85	-0.17	14,491,000,000	0.06	0.17	0.6681	1	0	0	-
177	TPC	3.09	0.06	487,677,000	0.13	0.23	1.9562	0	0	1	0.0531
178	TRE	13.12	0.19	20,318,000,000	0.05	0.21	0.2288	0	0	1	0.5514
179	TRU	3.27	0.15	6,224,000,000	0.31	0.39	1.2625	1	0	0	-
180	TSX	2.02	-0.38	922,561,000	(0.05)	(0.14)	0.7132	0	1	0	0.0617
181	UBU	1.86	-1.01	386,307,000	0.01	0.02	1.4165	1	0	0	0.2513
182	VIL	2.44	-0.71	2,976,685,000	(0.60)	(1.01)	0.6090	0	1	0	0.0751
183	VLE	2.65	-0.06	1,234,961,000	0.08	0.19	1.2861	0	0	1	0.1579
184	VMK	3.29	0.84	171,172,000	0.20	0.42	2.6970	1	0	0	0.0462

185	VOD	4.20	0.32	41,435,000,000	0.20	0.53	1.4769	0	0	1	0.1757
186	WBO	2.95	-0.17	9,491,748,000	0.08	0.20	1.5557	1	0	0	0.0145
187	WHL	3.31	0.04	9,065,000,000	0.18	0.41	2.8221	1	0	0	0.0567
188	WIL	2.84	-0.30	730,766,000	0.14	0.29	1.3031	0	0	1	0.1561
189	WKF	2.48	0.01	448,242,000	0.05	0.12	2.9367	0	0	1	0.0204
190	WNH	2.13	0.06	696,211,000	0.02	0.07	1.4224	1	0	0	0.2359
191	WTL	1.61	-0.24	313,068,000	(0.03)	(0.05)	0.5784	1	0	0	0.1079
192	YRK	2.43	-0.03	3,316,134,000	0.01	0.02	0.2892	1	0	0	0.1627
193	ZCI	0.02	-0.37	150,531,000	(0.03)	(0.04)	0.1643	0	1	0	-

Appendix E - Tables

Table 1- Examples of the organisational level/financial basis approach

Adapted from Swartz (2005).

MEASURE	MAJOR PROPONENT	DESCRIPTION	SUITABILITY WITHIN THE RESEARCH CONTEXT (Including examples of recent supporters within a similar research context as this proposed study)
Economic Value Added (EVA™)	Stewart (1998)	Calculated by adjusting the firm's disclosed profit with charges related to intangibles. Changes in EVA provide an indication of whether the firm's intellectual capital is productive or not.	Measurement model too complex. Complicated adjustment procedures are required and only one resource, capital employed, is considered. Not suitable within the research context.
Market to Book Value	Luthy (1998)	The value of intellectual capital is considered to be the difference between the firm's stock market value and the company's book value.	Stock market value is not an appropriate measure within the context of this research. Recent supporters of this approach: Black and Kim (2012)
Tobins q	Stewart (1998) Bontis (1998)	The q is the ratio of the stock market value of the firm divided by the replacement cost of its assets. Changes in q provide a proxy for measuring effective performance or not of a firm's intellectual capital.	Stock market value is not an appropriate measure within the context of this research. Maree (2011) points out that there is a difficulty in obtaining the true replacement cost of assets. Recent supporters of this approach: Ameer et al. (2010) Black and Kim (2012) Carter et al. (2003) Adams and Ferreira (2009) Adams and Mehran (2008) Ameer et al. (2010) Carter et al. (2003) Carter et al. (2010) Ntim (2011)
Value Added	Pulic (2000)	Measures how	Calculations are objective, reliable,

Intellectual Coefficient (VAIC™)		efficiently intellectual capital and capital employed create value based on the relationship of three major components: (1) Capital employed, (2) Human capital, (3) Structural capital	simplistic and comparable to previous studies. This method is suitable within the research context. <u>Recent supporters of this approach:</u> Swartz and Firer (2005) Firer and Mitchell Williams (2003) Van der Zahn (2004) Abidin et al. (2009)
Human Resource Costing and Accounting (HRCA)	Johanson (1996)	Calculates the hidden impact of HR related costs which reduce a firm's profits. Adjustments are made to the profit and loss. Intellectual capital is measures by calculation of the contribution of human assets held by the company divided by capitalised salary expenditures	Measurement model does not capture most of the components of intellectual capital. Human capital only one aspect of intellectual capital. Not suitable within the research context.
Calculated Intangible Value	Stewart (1998) Luthy (1998)	Calculates the excess return on hard assets and uses this figure as a basis for determining the proportion of return attributable to intangible assets.	Measurement model too complex, not suitable within the research context.
Knowledge Capital Earnings	Lev and Sougiannis (1999)	Knowledge capital earnings are calculated as the portion of normalised earnings over and above expected earnings attributable to book assets.	Measurement model too complex, not suitable within the research context.

Table 2- Examples of the component-by-component approach

Adapted from Swartz (2005).

MEASURE	MAJOR PROPONENT	DESCRIPTION	SUITABILITY WITHIN THE RESEARCH CONTEXT (Including examples of recent supporters within a similar research context as this proposed study)
Skandia Navigator™	Edvinsson and Malone (1997)	Intellectual capital is measured through the analysis of up to 164 metrics (91 intellectually based and 73 traditional metrics) that cover five areas of focus: (1) Financial, (2) Customer, (3) Process, (4) Renewal and Development, (5) Human.	Taking the context of the research into consideration, not suitable within the research context.
IC – Index™	Roos, G., Dragonetti and L. (1997)	Consolidates all individual indicators representing intellectual properties and components into a single index. Changes in the index are then related to changes in the firm's market valuation.	Measurement model too complex. Taking the context of the research into consideration, not suitable within the research context.
Technology Broker	Brooking (1996)	Value of intellectual capital of a firm is assessed based on diagnostic analysis of a firm's response to twenty questions covering four major components of intellectual capital.	Measurement model is subjective. Questions must be evaluated for relevance. Not suitable within the research context.
Intangible Asset Monitor	Sveiby (1997)	Management selects indicators, based on strategic objectives of the firm to measure four aspects of creating value from	Taking the context of the research into consideration, not suitable within the research context.

		intangible assets. (1) Growth, (2) Renewal, (3) Utilisation/Efficiency and (4) Risk reduction/Stability.	
Citation-Weighted Patents	Bontis (1998)	A technology factor is calculated on the patents developed by a firm. Intellectual capital and its performance are measured based on the impact of research and development efforts on a series of indices, such as number of patents and cost of patents to sales turnover, that describe the firm's patents.	Patents form part of structural capital. Measurement model does not capture most of the components of intellectual capital. Not suitable within the research context.
Balanced Scorecard	Kaplan and Norton (1996)	A company's performance is measured by indicators covering four major focus perspectives: (1) Financial, (2) Customer, (3) Internal process, and (4) Learning perspective.	Taking the context of the research into consideration, not suitable within the research context.
Inclusive Valuation Methodology (IVM)	McPherson and Pike (2001)	Uses hierarchies of weighted indicators that are combined, and focuses on relative rather than absolute values. Combined Value Added = Monetary Value Added combined with Intangible Value Added.	Measurement model appears to be too complex. Not suitable within the research context.
The Value Explorer™	Andriesson (2005)	Accounting methodology proposed by KPMG	Taking the context of the research into consideration, not suitable within the research context.

		for calculating and allocating value to five types of intangible assets: (1) Assets and endowments, (2) Skills and tacit knowledge, (3) Collective values and norms, (4) Technology and explicit knowledge, (5) Primary and management processes.	
Value Chain Scoreboard™	Lev (2002)	A matrix of non-financial indicators arranged in three categories according to the cycle of development. Discovery/Learning, Implementation, and Commercialisation.	Taking the context of the research into consideration, not suitable within the research context.
Human Capital Intelligence	Bontis and Fitz-enz (2002)	Sets of human capital indicators are collected and benchmarked against a database.	Taking the context of the research into consideration, not suitable within the research context.
Accounting for the Future (AFTF)	Nash (1998)	A system of projected discounted cash flows. The difference between AFTF value at the end and beginning of the period is the value added during the period.	Taking the context of the research into consideration, not suitable within the research context.
Total Value Creation TVC™	Andersen and McLean (2000)	A project initiated by the Canadian Institute of Chartered Accountants. TVC uses discounted projected cash flows to re examine how events affect	Taking the context of the research into consideration, not suitable within the research context

		planned activities.	
Intellectual Asset Valuation	Sullivan (2000)	Methodology for assessing the value of Intellectual Property.	Intellectual property forms part of structural capital. Measurement model does not capture most of the components of intellectual capital. Not suitable within the research context.

Table 3- Summary of research questions and hypotheses

RESEARCH QUESTION	HYPOTHESIS
Sub-research question 1: Does a significant positive relationship exist between the size of the board of directors and intellectual capital performance?	*Hypothesis from question 1:* There is a significant positive relationship between the size of the board of directors and intellectual capital performance.
Sub-research question 2: Does a significant positive relationship exist between the average age of the directors on the board of directors and intellectual capital performance?	*Hypothesis from question 2:* There is a significant positive relationship between the average age of the directors on the boards of director and intellectual capital performance.
Sub-research question 3: Does a significant positive relationship exist between the percentage non-executive women on the board of directors and intellectual capital performance?	*Hypothesis from question 3:* There is a significant positive relationship between the percentage non-executive women on the board of directors and intellectual capital performance.
Sub-research question 4: Does a significant positive relationship exist between the percentage non-executive members of colour on the board of directors and intellectual capital performance?	*Hypothesis from question 4:* There is a significant positive relationship between the percentage non-executive members of colour on the board of directors and intellectual capital performance.

Table 4- General descriptive statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
Size	193.00	2.00	22.00	9.86	3.25
Aveage	193.00	34.00	66.00	52.76	5.33
Percentagenon-execwomen	193.00	-	0.40	0.12	0.11
Percentagenon-execcolour	193.00	-	0.78	0.28	0.17
VAIC	193.00	0.02	13.12	3.03	1.75
MAR	193.00	(1.45)	2.18	(0.03)	0.41
TA	193.00	28,373,000	181,408,000,000	11,457,489,674	25,378,642,784
ROA	193.00	(0.60)	0.50	0.06	0.11
ROE	193.00	(1.79)	2.16	0.14	0.29
TOR	193.00	-	5.88	1.28	0.90
Industry ('R)	193.00	-	1.00	0.43	0.50
Industry E	193.00	-	1.00	0.29	0.46
Industry S	193.00	-	1.00	0.28	0.45
DTA	193.00	-	0.60	0.09	0.12
Valid N (listwise)	193.00				

Table 5- Pearson correlation coefficients

Correlations

		VAIC	Size	Aveage	Percentage non-execwomen	Percentage non-execcolour	TA	ROA	ROE	TOR	R	E	S	DTA
Pearson Correlation	VAIC	1.000	.056	.187	.050	-.068	.206	.179	.112	-.104	-.025	.004	.023	.222
	Size	.056	1.000	.280	.095	.079	.371	.086	-.084	-.099	.031	-.029	-.005	.035
	Aveage	.187	.280	1.000	-.072	-.103	.278	.096	.093	.004	.149	-.021	-.143	.123
	Percentage non-	.050	.095	-.072	1.000	.561	.129	-.011	.080	-.022	.010	-.116	.107	.043
	Percentage non-	-.068	.079	-.103	.561	1.000	.210	-.040	.068	-.145	-.121	.048	.085	.013
	TA	.206	.371	.278	.129	.210	1.000	.149	.095	-.172	-.113	.131	-.008	.118
	ROA	.179	.086	.096	-.011	-.040	.149	1.000	.442	.069	.057	-.062	-.001	-.120
	ROE	.112	-.084	.093	.080	.068	.095	.442	1.000	.136	.011	-.074	.063	.073
	TOR	-.104	-.099	.004	-.022	-.145	-.172	.069	.136	1.000	.209	-.292	.064	-.202
	Industry ('R)	-.025	.031	.149	.010	-.121	-.113	.057	.011	.209	1.000	-.555	-.541	-.087
	Industry E	.004	-.029	-.021	-.116	.048	.131	-.062	-.074	-.292	-.555	1.000	-.398	-.044
	Industry S	.023	-.005	-.143	.107	.085	-.008	-.001	.063	.064	-.541	-.398	1.000	.140
	DTA	.222	.035	.123	.043	.013	.118	-.120	.073	-.202	-.087	-.044	.140	1.000

Table 6- Tolerance and VIF

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Size	.789	1.267
	Aveage	.809	1.236
	Percentagenon-execwomen	.658	1.521
	Percentagenon-execcolour	.630	1.588
	TA	.735	1.361
	ROA	.745	1.343
	ROE	.733	1.364
	TOR	.818	1.223
	Industry E	.727	1.376
	Industry S	.786	1.272
	DTA	.868	1.152

Table 7- Eigen values

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions											
				(Constant)	Size	Aveage	Percentage non-execwomen	Percentage non-execcolour	TA	ROA	ROE	TOR	E	S	DTA
1	1	6.789	1.000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
	2	1.122	2.459	.00	.00	.00	.00	.00	.01	.16	.18	.00	.11	.03	.01
	3	1.054	2.538	.00	.00	.00	.00	.00	.08	.09	.04	.01	.12	.17	.02
	4	.787	2.937	.00	.00	.00	.00	.00	.46	.00	.00	.04	.03	.05	.08
	5	.616	3.319	.00	.00	.00	.02	.01	.10	.02	.16	.01	.04	.01	.49
	6	.479	3.766	.00	.00	.00	.21	.04	.00	.18	.22	.01	.03	.10	.02
	7	.421	4.017	.00	.00	.00	.00	.01	.02	.00	.05	.08	.35	.54	.11
	8	.385	4.201	.00	.00	.00	.11	.02	.13	.46	.23	.15	.00	.01	.08
	9	.171	6.296	.00	.08	.00	.25	.07	.04	.05	.06	.47	.23	.04	.10
	10	.126	7.343	.00	.07	.00	.39	.79	.00	.03	.03	.11	.00	.00	.05
	11	.047	12.067	.04	.83	.04	.01	.04	.09	.00	.01	.12	.06	.01	.03
	12	.004	40.689	.96	.00	.95	.00	.03	.07	.00	.01	.00	.03	.05	.00

Table 8- 5% trimmed mean, skewness and kurtosis (VAIC™)

Descriptives

			Statistic	Std. Error
VAIC	Mean		3.0323	.12597
	95% Confidence Interval for Mean	Lower Bound	2.7838	
		Upper Bound	3.2808	
	5% Trimmed Mean		2.8264	
	Median		2.6518	
	Variance		3.063	
	Std. Deviation		1.75010	
	Minimum		.02	
	Maximum		13.12	
	Range		13.10	
	Interquartile Range		1.05	
	Skewness		3.211	.175
	Kurtosis		14.193	.348

Extreme Values

			Number	Value
VAIC	Highest	1	178	13.12
		2	2	12.87
		3	59	11.85
		4	154	9.16
		5	138	9.03
	Lowest	1	193	.02
		2	35	.27
		3	90	.27
		4	43	.60
		5	86	.83

Descriptives

			Statistic	Std. Error
VAIC	Mean		2.8809	.07726
	95% Confidence Interval for Mean	Lower	2.7285	
		Upper	3.0334	
	5% Trimmed Mean		2.7869	
	Median		2.6518	
	Variance		1.092	
	Std. Deviation		1.04512	
	Minimum		.97	
	Maximum		7.67	
	Range		6.69	
	Interquartile Range		1.00	
	Skewness		1.675	.180
	Kurtosis		4.220	.357

Table 9- Histogram (VAIC™)

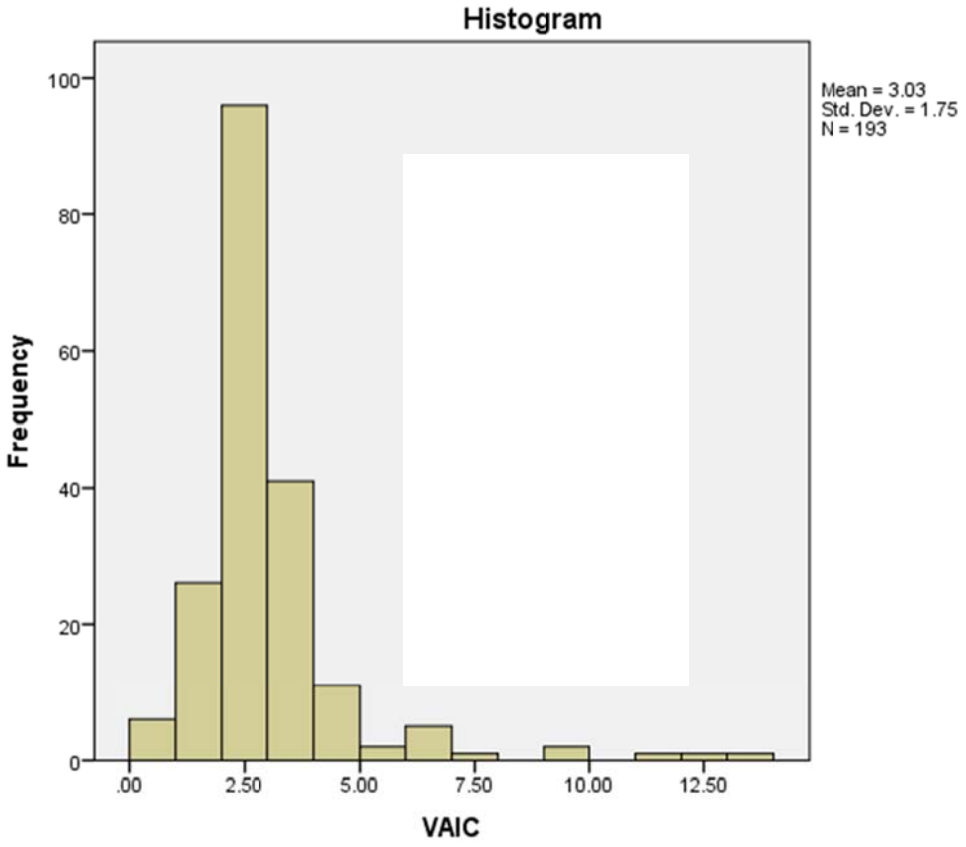


Table 10- 5% trimmed mean, skewness and kurtosis (MAR)

Descriptives

			Statistic	Std. Error
MAR	Mean		-.028488	.0298702
	95% Confidence Interval for Mean	Lower Bound	-.087404	
		Upper Bound	.030428	
	5% Trimmed Mean		-.034304	
	Median		-.027316	
	Variance		.172	
	Std. Deviation		.4149695	
	Minimum		-1.4482	
	Maximum		2.1806	
	Range		3.6289	
	Interquartile Range		.3613	
	Skewness		.706	.175
	Kurtosis		6.131	.348

Table 11- 5% trimmed mean, skewness and kurtosis (Trimmed data MAR)

Extreme Values

			Case Number	Value
MAR	Highest	1	144	2.1806
		2	111	1.7210
		3	162	1.1651
		4	158	.8611
		5	184	.8384
	Lowest	1	35	-1.4482
		2	85	-1.3124
		3	1	-1.1712
		4	181	-1.0102
		5	76	-.8446

Descriptives

			Statistic	Std. Error
MAR	Mean		-.035397	.0216043
	95% Confidence Interval for Mean	Lower Bound	-.078024	
		Upper Bound	.007230	
	5% Trimmed Mean		-.031075	
	Median		-.027316	
	Variance		.085	
	Std. Deviation		.2922571	
	Minimum		-.7517	

Maximum	.7520	
Range	1.5037	
Interquartile Range	.3257	
Skewness	-.295	.180
Kurtosis	.332	.357

Table 12- Histogram (Trimmed data MAR)

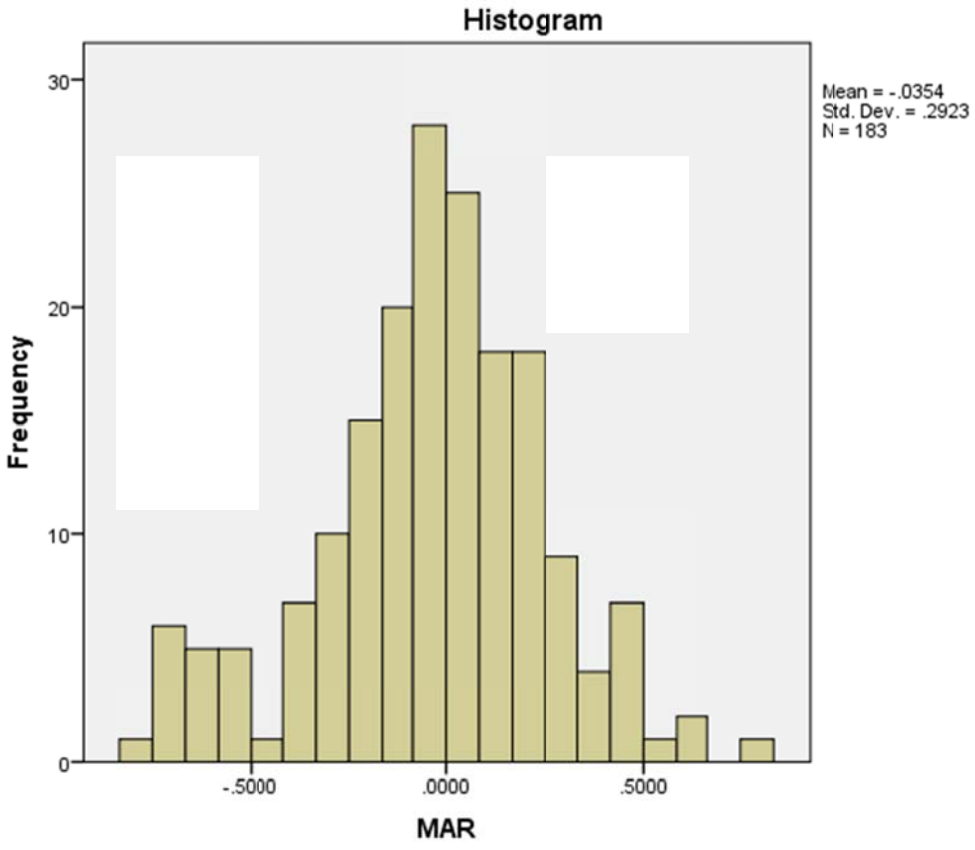


Table 13- Comparing groups (VAIC™)

Women on the board

Mann-Whitney test (Ranks)		
Womenboard		N
VAIC	0	43
	1	150
	Total	193

Test Statistics[a]	
	VAIC
Asymp. Sig. (2-tailed)	.219

Directors of colour on the board

Mann-Whitney test (Ranks)		
Colourboard		N
VAIC	0	12
	1	181
	Total	193

Test Statistics[a]	
	VAIC
Asymp. Sig. (2-tailed)	.794

Table 14- Comparing groups (MAR)

Women on the board

Group Statistics				
Womenboard		N	Mean	Std. Deviation
MAR	1	145	-.052472	.2981837
	0	38	.000366	.3111047

Independent Samples Test										
		Levene's Test for Equality		t-test for Equality of Means						
									95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MAR	Equal variances assumed	.900	.344	-.964	181	.337	-.0528379	.0548313	-.1610287	.0553529

Directors of colour on the board

Group Statistics

Colourboard		N	Mean	Std. Deviation
MAR	1	173	-.051979	.3007509
	0	10	.139788	.2502124

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MAR	Equal variances	1.265	.262	-1.976	181	.050	-.1917672	.0970644	-.3832905	-.0002440

Table 15- VAIC™Ranking

Test of parallel lines- Key independent variables

PLUM VAICranking WITH Size

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	104.861			
General	104.814	.047	1	.829

The null hypothesis states that the location parameters (slope

a. Link function: Logit.

PLUM VAICranking WITH Percentagenonexecwomen

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	151.012			
General	150.905	.107	1	.743

The null hypothesis states that the location parameters

a. Link function: Logit.

PLUM VAICranking WITH Aveage

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	398.108			
General	397.604	.504	1	.478

The null hypothesis states that the location parameters (slope

a. Link function: Logit.

PLUM VAICranking WITH Percentagenonexeccolour

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	182.789			
General	182.701	.088	1	.767

The null hypothesis states that the location parameters

a. Link function: Logit.

Test of parallel lines- Control variables

PLUM VAICranking WITH TA

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	415.737			
General	415.408	.329	1	.566

The null hypothesis states that the location parameters (slope

a. Link function: Logit.

PLUM VAICranking WITH ROA

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	387.542			
General	385.827	1.714	1	.190

The null hypothesis states that the location parameters

a. Link function: Logit.

PLUM VAICranking WITH ROE

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	397.272			
General	397.152	.121	1	.728

The null hypothesis states that the location parameters (slope

a. Link function: Logit.

PLUM VAICranking WITH TOR

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	420.385			
General	411.503	8.882	1	.003

The null hypothesis states that the location parameters

a. Link function: Logit.

PLUM VAICranking WITH Industry R

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	20.170			
General	19.001	1.168	1	.280

The null hypothesis states that the location parameters (slope

a. Link function: Logit.

PLUM VAICranking WITH Industry S

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	18.776			
General	18.629	.146	1	.702

The null hypothesis states that the location parameters

a. Link function: Logit.

PLUM VAICranking WITH Industry E

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	21.071			
General	18.626	2.445	1	.118

The null hypothesis states that the location parameters (slope

a. Link function: Logit.

PLUM VAICranking WITH Industry DTA

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	370.306			
General	370.101	.205	1	.651

The null hypothesis states that the location parameters

a. Link function: Logit.

Table 16- VAIC™Ranking (Size)

Univariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	104.920			
Final	104.861	.059	1	.808

Link function: Logit.

Pseudo R-Square

Cox and	.000
Nagelkerk	.000
McFadden	.000

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	-.606	.429	1.993	1	.158
	[VAICranking = 2.00]	.773	.431	3.215	1	.073
Location	Size	.010	.041	.056	1	.813

Link function: Logit.

Multivariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	424.054			
Final	371.714	52.340	7	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.238
Nagelkerke	.267
McFadden	.123

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	.272	.586	.215	1	.643
	[VAICranking = 2.00]	2.011	.605	11.061	1	.001
Location	Size	-.034	.049	.500	1	.479
	TA	.000	.000	3.211	1	.073
	ROA	8.816	1.885	21.876	1	.000
	ROE	2.006	.730	7.555	1	.006
	IndustryR	.344	.344	1.001	1	.317
	IndustryE	.297	.387	.589	1	.443
	IndustryS	0[a]			0	
	DTA	2.570	1.285	3.998	1	.046

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Table 17- VAIC™Ranking (Aveage)

Univariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	402.449			
Final	398.108	4.341	1	.037

Link function: Logit.

Pseudo R-Square

Cox and	.022
Nagelkerk	.025
McFadden	.010

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	2.062	1.341	2.364	1	.124
	[VAICranking = 2.00]	3.465	1.357	6.523	1	.011
Location	Aveage	.053	.025	4.302	1	.038

Link function: Logit.

Multivariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	424.054			
Final	371.545	52.509	7	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.238
Nagelkerke	.268
McFadden	.124

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	1.779	1.481	1.442	1	.230
	[VAICranking = 2.00]	3.519	1.500	5.508	1	.019
Location	Aveage	.024	.029	.681	1	.409
	TA	.000	.000	2.171	1	.141
	ROA	8.717	1.882	21.458	1	.000
	ROE	2.053	.728	7.943	1	.005
	IndustryR	.278	.350	.631	1	.427
	IndustryE	.294	.386	.579	1	.447
	IndustryS	0[a]			0	
	DTA	2.534	1.294	3.835	1	.050

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Additional analyses

```
PLUM VAICranking WITH Aveage IndustryR IndustryE IndustryS
```

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	2.045	1.346	2.310	1	.129
	[VAICranking = 2.00]	3.450	1.361	6.421	1	.011
Location	Aveage	.051	.026	3.938	1	.047
	IndustryR	.115	.327	.124	1	.725
	IndustryE	.070	.353	.040	1	.842
	IndustryS	0[a]			0	

Link function: Logit.

a. This parameter is set to zero because it is redundant.

```
PLUM VAICranking WITH Aveage TA
```

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	1.260	1.381	.832	1	.362
	[VAICranking = 2.00]	2.692	1.393	3.735	1	.053
Location	Aveage	.035	.026	1.724	1	.189
	TA	.000	.000	4.508	1	.034

Link function: Logit.

```
PLUM VAICranking WITH Aveage ROA
```

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	2.196	1.408	2.432	1	.119
	[VAICranking = 2.00]	3.842	1.428	7.241	1	.007
Location	Aveage	.044	.027	2.798	1	.094
	ROA	10.302	2.059	25.031	1	.000

Link function: Logit.

```
PLUM VAICranking WITH Aveage ROE
```

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	1.939	1.381	1.970	1	.160
	[VAICranking = 2.00]	3.521	1.399	6.330	1	.012
Location	Aveage	.042	.026	2.512	1	.113
	ROE	3.905	.930	17.618	1	.000

Link function: Logit.

```
PLUM VAICranking WITH Aveage DTA
```

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	2.075	1.344	2.384	1	.123
	[VAICranking = 2.00]	3.487	1.360	6.571	1	.010
Location	Aveage	.051	.026	3.920	1	.048
	DTA	1.375	1.173	1.373	1	.241

Link function: Logit.

	Model fitting sig.	Aveage sig
Aveage DTA IndustryR IndustryE IndustryS	.207	0.064
Aveage DTA	0.06	0.048
Aveage IndustryR IndustryE IndustryS	0.215	0.047

Table 18- VAIC™Ranking (Percentagenonexecwomen)

Univariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	151.680			
Final	151.012	.669	1	.414

Link function: Logit.

Pseudo R-Square

Cox and [illegible]	.003
Nagelkerk	.004
McFadden	.002

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	-.580	.215	7.285	1	.007
	[VAICranking = 2.00]	.802	.219	13.411	1	.000
Location	Percentagenonexecwomen	1.001	1.251	.641	1	.423

Link function: Logit.

Multivariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	424.054			
Final	371.974	52.080	7	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.237
Nagelkerke	.266
McFadden	.123

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	.683	.407	2.821	1	.093
	[VAICranking = 2.00]	2.420	.442	30.029	1	.000
Location	Percentagenonexecwomen	.682	1.340	.259	1	.611
	TA	.000	.000	2.742	1	.098
	ROA	8.828	1.888	21.874	1	.000
	ROE	2.038	.730	7.791	1	.005
	IndustryR	.344	.344	.998	1	.318
	IndustryE	.335	.390	.738	1	.390
	IndustryS	0[a]			0	
	DTA	2.575	1.283	4.026	1	.045

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Table 19- VAIC™Ranking (Percentagenonexeccolour)

Univariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	182.792			
Final	182.789	.003	1	.956

Link function: Logit.

Pseudo R-Square

Cox and	.000
Nagelkerk	.000
McFadden	.000

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	-.713	.267	7.112	1	.008
	[VAICranking = 2.00]	.666	.267	6.234	1	.013
Location	Percentagenonexeccolour	-.043	.793	.003	1	.956

Link function: Logit.

Multivariate analysis

Case Processing Summary

		N	Marginal Percentage
VAIC ranking	1.00	64	33.2%
	2.00	64	33.2%
	3.00	65	33.7%
Valid		193	100.0%
Missing		0	
Total		193	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	424.054			
Final	372.072	51.982	7	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.236
Nagelkerke	.266
McFadden	.123

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	.493	.441	1.249	1	.264
	[VAICranking = 2.00]	2.230	.469	22.570	1	.000
Location	Percentagenonexeccolour	-.356	.869	.168	1	.682
	TA	.000	.000	3.131	1	.077
	ROA	8.681	1.885	21.210	1	.000
	ROE	2.090	.729	8.221	1	.004
	IndustryR	.321	.346	.862	1	.353
	IndustryE	.301	.386	.608	1	.435
	IndustryS	0[a]			0	
	DTA	2.583	1.286	4.036	1	.045

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Table 20- VAIC™Ranking (Key independent variables)

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	424.054			
Final	418.280	5.774	4	.217

Link function: Logit.

Pseudo R-Square

Cox and Snell	.029
Nagelkerke	.033
McFadden	.014

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[VAICranking = 1.00]	2.204	1.398	2.487	1	.115
	[VAICranking = 2.00]	3.616	1.414	6.543	1	.011
Location	Size	-.023	.043	.282	1	.595
	Aveage	.058	.027	4.716	1	.030
	Percentagenonexecwomen	1.632	1.524	1.148	1	.284
	Percentagenonexeccolour	-.462	.969	.227	1	.634

Link function: Logit.

Table 21- VAIC™Ranking (10 categories)

10 Categories VAICranking

	Test of Parallel Lines[a]		Parameter Estimates	
	Sig.		Sig.	
Size	0.017	✗	0.345	✗
Aveage	0.57	✓	0.006	✓
Percentagenonexecwomen	0.307	✓	0.224	✗
Percentagenonexeccolour	0.959	✓	0.973	✗

Table 22- MAR (Size)

Univariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.039[a]	.002	-.004	.3014069

a. Predictors: (Constant), Size

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.026	1	.026	.281	.597[b]
	Residual	16.443	181	.091		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), Size

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.078	.072		-1.078	.282
	Size	.004	.007	.039	.530	.263

a. Dependent Variable: MAR

Multivariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.394[a]	.155	.116	.2828169

a. Predictors: (Constant), DTA, Size, Industry E, ROE, TOR, ROA, Industry S, TA

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.551	8	.319	3.987	.000[b]
	Residual	13.917	174	.080		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), DTA, Size, Industry E, ROE, TOR, ROA, Industry S, TA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.182	.091		-2.005	.046
	Size	-.001	.007	-.013	-.174	.862
	TA	.000	.000	.053	.677	.499
	ROA	.950	.213	.342	4.451	.000
	ROE	-.026	.095	-.022	-.277	.782
	TOR	.041	.028	.114	1.477	.142
	Industry E	-.020	.054	-.030	-.378	.706
	Industry S	.072	.052	.108	1.392	.166
	DTA	.275	.188	.108	1.462	.146

a. Dependent Variable: MAR

Industry ('R) excluded

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions								
				(Constant)	Size	TA	ROA	ROE	TOR	Industry E	Industry S	DTA
1	1	4.656	1.000	.00	.00	.01	.01	.01	.01	.01	.01	.01
	2	1.079	2.077	.00	.00	.07	.00	.02	.00	.24	.18	.00
	3	.903	2.270	.00	.00	.00	.31	.13	.00	.00	.05	.14
	4	.760	2.475	.00	.00	.56	.01	.00	.05	.05	.03	.01
	5	.551	2.906	.00	.01	.05	.01	.39	.03	.02	.05	.35
	6	.433	3.278	.00	.00	.11	.23	.06	.13	.25	.39	.00
	7	.431	3.287	.00	.00	.03	.37	.29	.00	.13	.19	.32
	8	.151	5.556	.03	.20	.09	.05	.09	.62	.18	.07	.12
	9	.034	11.654	.96	.79	.08	.00	.01	.16	.12	.04	.04

a. Dependent Variable: MAR

Table 23- MAR (Aveage)

Univariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.034[a]	.001	-.004	.3014631

a. Predictors: (Constant), Aveage

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.019	1	.019	.214	.644[b]
	Residual	16.449	181	.091		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), Aveage

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.147	.230		-.640	.523
	Aveage	.002	.004	.034	.462	.263

a. Dependent Variable: MAR

Multivariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.394[a]	.155	.116	.2828172

a. Predictors: (Constant), DTA, Industry E, ROE, Aveage, TA, ROA, TOR, Industry S

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.551	8	.319	3.987	.000[b]
	Residual	13.917	174	.080		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), DTA, Industry E, ROE, Aveage, TA, ROA, TOR, Industry S

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.156	.233		-.667	.506
	Aveage	-.001	.004	-.013	-.173	.863
	TA	.000	.000	.052	.681	.497
	ROA	.948	.212	.342	4.461	.000
	ROE	-.024	.094	-.020	-.258	.797
	TOR	.041	.028	.115	1.492	.138
	Industry E	-.020	.054	-.031	-.380	.705
	Industry S	.071	.053	.106	1.352	.178
	DTA	.279	.189	.110	1.473	.142

a. Dependent Variable: MAR

Industry ('R) excluded

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions								
				(Constant)	Aveage	TA	ROA	ROE	TOR	Industry E	Industry S	DTA
1	1	4.706	1.000	.00	.00	.01	.01	.01	.01	.01	.01	.01
	2	1.076	2.091	.00	.00	.08	.00	.02	.00	.24	.17	.00
	3	.905	2.281	.00	.00	.00	.33	.13	.00	.00	.04	.14
	4	.780	2.456	.00	.00	.58	.00	.00	.04	.04	.04	.03
	5	.537	2.960	.00	.00	.08	.01	.40	.03	.01	.08	.36
	6	.434	3.295	.00	.00	.15	.38	.13	.12	.16	.23	.03
	7	.429	3.313	.00	.00	.00	.24	.26	.01	.23	.31	.26
	8	.130	6.020	.01	.01	.02	.03	.05	.78	.28	.09	.16
	9	.004	33.762	.99	.98	.07	.00	.00	.00	.03	.04	.00

a. Dependent Variable: MAR

Table 24- MAR (Percentagenonexecwomen)

Univariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.049[a]	.002	-.003	.3012722

a. Predictors: (Constant), Percentagenon-execwomen

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.040	1	.040	.443	.506[b]
	Residual	16.428	181	.091		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), Percentagenon-execwomen

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.024	.035		-.690	.491
	Percentagenon-execwomen	-.140	.210	-.049	-.666	.263

a. Dependent Variable: MAR

Multivariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.400[a]	.160	.121	.2820248

a. Predictors: (Constant), DTA, Percentagenon-execwomen , Industry ('R), ROE, TA, TOR, ROA, Industry S

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.629	8	.329	4.132	.000[b]
	Residual	13.840	174	.080		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), DTA, Percentagenon-execwomen , Industry ('R), ROE, TA, TOR, ROA, Industry S

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.195	.056		-3.461	.001
	Percentagenon-execwomen	-.202	.201	-.071	-1.005	.317
	TA	.000	.000	.058	.790	.430
	ROA	.929	.212	.335	4.379	.000
	ROE	-.017	.094	-.014	-.176	.861
	TOR	.042	.028	.116	1.502	.135
	Industry ('R)	.024	.053	.039	.445	.657
	Industry S	.100	.059	.148	1.703	.090
	DTA	.277	.188	.109	1.476	.142

a. Dependent Variable: MAR

Industry ('R) excluded

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions								
				(Constant)	Percentagenon-execwomen	TA	ROA	ROE	TOR	Industry ('R)	Industry S	DTA
1	1	4.586	1.000	.01	.01	.01	.01	.01	.01	.01	.01	.01
	2	1.068	2.072	.00	.00	.04	.00	.00	.01	.14	.18	.03
	3	.907	2.249	.00	.02	.07	.32	.11	.00	.01	.01	.09
	4	.822	2.362	.00	.00	.61	.01	.05	.02	.00	.07	.03
	5	.544	2.905	.00	.06	.05	.00	.26	.02	.00	.07	.49
	6	.442	3.220	.00	.06	.04	.53	.50	.01	.00	.02	.15
	7	.336	3.692	.00	.74	.13	.08	.00	.14	.02	.07	.01
	8	.191	4.900	.01	.01	.01	.01	.04	.45	.71	.49	.07
	9	.104	6.628	.97	.10	.05	.03	.02	.35	.10	.08	.13

a. Dependent Variable: MAR

Table 25- MAR (Percentagenonexeccolour)

Univariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.083[a]	.007	.001	.3005976

a. Predictors: (Constant), Percentagenon-execcolour

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.114	1	.114	1.259	.263[b]
	Residual	16.355	181	.090		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), Percentagenon-execcolour

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.000	.043		.009	.993
	Percentagenon-execcolour	-.151	.134	-.083	-1.122	.263

a. Dependent Variable: MAR

Multivariate analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.401[a]	.160	.122	.2818865

a. Predictors: (Constant), DTA, Percentagenon-execcolour, Industry E, ROE, TA, ROA, TOR, Industry S

b. Dependent Variable: MAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.643	8	.330	4.157	.000[b]
	Residual	13.826	174	.079		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), DTA, Percentagenon-execcolour, Industry E, ROE, TA, ROA, TOR, Industry S

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.156	.067		-2.311	.022
	Percentagenon-execcolour	-.143	.132	-.079	-1.087	.279
	TA	.000	.000	.064	.863	.390
	ROA	.917	.213	.331	4.306	.000
	ROE	-.011	.095	-.009	-.119	.905
	TOR	.039	.028	.108	1.391	.166
	Industry E	-.016	.053	-.024	-.302	.763
	Industry S	.079	.052	.117	1.512	.132
	DTA	.267	.188	.105	1.422	.157

a. Dependent Variable: MAR

Industry ('R) excluded

Collinearity Diagnostics[a]

Model		Eigenvalue	Condition Index	Variance Proportions								
				(Constant)	Percentagenon-execcolour	TA	ROA	ROE	TOR	Industry E	Industry S	DTA
1	1	4.544	1.000	.00	.01	.01	.01	.01	.01	.01	.01	.01
	2	1.078	2.053	.00	.00	.08	.00	.02	.00	.24	.17	.00
	3	.913	2.231	.00	.01	.00	.32	.12	.00	.00	.05	.13
	4	.759	2.447	.01	.00	.63	.01	.00	.05	.06	.03	.01
	5	.538	2.906	.00	.02	.06	.00	.30	.03	.00	.10	.46
	6	.438	3.220	.00	.01	.11	.56	.36	.04	.03	.06	.13
	7	.422	3.281	.00	.00	.03	.02	.14	.11	.31	.44	.11
	8	.238	4.374	.00	.64	.08	.02	.00	.22	.16	.11	.01
	9	.069	8.130	.98	.31	.00	.06	.04	.54	.18	.05	.14

a. Dependent Variable: MAR

Table 26- MAR (Key independent variables)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.096[a]	.009	-.013	.3027652

a. Predictors: (Constant), Percentagenon-execcolour, Size, Aveage, Percentagenon-execwomen

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.152	4	.038	.415	.798[b]
	Residual	16.317	178	.092		
	Total	16.469	182			

a. Dependent Variable: MAR

b. Predictors: (Constant), Percentagenon-execcolour, Size, Aveage, Percentagenon-execwomen

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.077	.240		-.321	.749
	Size	.004	.007	.043	.547	.585
	Aveage	.001	.005	.013	.162	.871
	Percentagenon-execwomen	-.020	.252	-.007	-.081	.936
	Percentagenon-execcolour	-.147	.163	-.081	-.904	.367