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Javer, Nikita

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The relationship between gender composition on the board and company risk

A research report submitted by:

Nikita Javer

Student Number: 1055640

Cell: 081 714 3278

Email: njaver10@gmail.com

Ethics clearance number: CACCN/1205

Supervisor:
Andres Merino

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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.



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Nikita Javer Date

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Abstract

This research report explores the relationship between board gender diversity of JSE-listed firms and the firm's total and market risk. Board gender diversity is broken down into board composition, audit and risk committee composition and whether females are in key executive positions such as Chief Executive Officer, Chief Financial Officer and Chief Operating Officer. 60 financial companies listed on the JSE during the period 2004 and 2018 were selected. These financial companies exclude those companies which are in the financial services/banking sector which are listed on the JSE. The sample of companies were stratified into small, mid and large cap. Twenty companies within each cap were selected. The IRESS database was used for the data collection to obtain the integrated annual reports of these companies and their financial information. A panel regression model was used and the relationship between risk (measured by total risk and market risk) and board gender diversity were tested. The findings indicate that there is a relationship between the gender composition of the board and firm risk, but this relationship is not statistically significant. The research identified that there is no relationship between increases in gender diversity at the board level and lower company risk.

Keywords: Women directors, Board composition, Corporate governance, Gender diversity, Market risk and Total risk

1. Introduction

1.1 Context of study

Historically, women in business have been victims of many social injustices. Gender discrimination in the form of unequal pay and lack of representation in the workplace have been prevalent. These inequalities and discrimination have hindered females from participating in the strategic decision-making processes of firms (Schubert, 2006). However, improvements in South Africa through of legislative, regulative and social pressures have led to increases in women representation in the workplace, particularly in senior management positions. Improvements in the standard of education and skills have also played a significant role in the improvement of women representation in the workplace. More women are eligible to access managerial positions in firms by obtaining higher degrees, as the proportion of women in universities is equal to or greater than that of men (Davidson & Burke, 2012). In South Africa in 2017, it was found that on average 10,3% of men completed their post-school education while 18,9% of females gained similar qualifications (StatsSA, 2017). This indicates that more women in South Africa are qualifying for a post-school education and are more likely to attain managerial positions in firms suggested by Davidson and Burke (2012).

These improvements have aimed at tackling corporate governance issues and addressing the historical discrimination against women in the corporate field. In South Africa, legislation through the B-BBEE Codes promotes gender diversity by requiring a target of 25% representation of women on the board of all listed and public companies (DTI, 2018). The Employment Equity Act aims to achieve equity in the work environment by promoting equal opportunity and just treatment in order to correct the difficulties experienced by designated groups, such as females (SAICA, 2019). King IV suggests that the board of a company should be balanced and diverse (IoDSA, 2016). According to King IV, the board of a company should include different perspectives and approaches offered by members of different backgrounds with regards to knowledge, skill and experience, as well as age, culture, race and gender. All JSE-listed companies are required to comply with the principles in King IV as it is a JSE listing requirement (JSE, 2017). Complying with the relevant legislation and regulations, it is expected that firms will become good corporate citizens which may enhance firm value and the decision-making processes of firms (IoDSA, 2016).

Historically, investment and financing decisions were made by male directors as they occupied the majority of the senior management positions (Powell & Butterfield, 2002). Recently, there have been improvements in South Africa where gender equality is promoted through the implementation of legislation, regulations, through social pressures and the reduction of the

education gap between the genders. As a result of this, there has been an increase in women representation in the workplace, particularly in senior management positions. This led to research which aims to identify the impact of women in the decision-making processes of firms and whether, as a result of this, the risk profile of firms changes (Powell & Ansic, 1997). As the representation of women on the board increases, the risk-taking behavior of the firm may change and become more risk-averse. This is suggested by psychological and economic studies which have shown that women are more risk-averse than men when making financial and investing decisions (Charness & Gneezy, 2012; Levin, Snyder, & Chapman, 1988).

In a quantitative study in psychology performed by Barber and Odean (2001), the majority of men were found to be overconfident when making financing and investing decisions and this, in turn, resulted in them investing in non-value adding projects. This risk-taking behavior increases the probability of diminishing the value of the firm as a whole. As the risk-taking behavior between men and women is different, the inclusion of women on the board of firms or on the firm's audit and risk committee may reduce the firm's risk appetite or curtail risk-seeking behavior. This report investigates the relationship between gender composition of the board of directors and the market risk (β) and total risk (σ) of firms.

According to Lenard, Yu, York, and Wu (2014), gender diversity on the board of the firm also promotes good corporate social responsibility and it may enhance the firm's decision-making capabilities which, in turn, may increase the firm's value. Better decision making should enhance the firm's value and this may attract investors to purchase shares in the firm in order to receive returns from capital appreciation and dividends (Schubert, 2006).

It is clear that women have gained a growing representation in the workplace and in senior management positions (StatsSA, 2018; Thornton, 2018). These positions included the roles of the Chief Executive Officer (CEO), Chief Financial Officer (CFO), Chief Operating Officer (COO), members on the board of directors and on the majority of board committees of firms. As a result, when considering what impact women directors have on the board of the firms, it is critical to consider these positions which have a direct impact to the risk profile of firms.

The risks used for this study are market risk (β) and total risk (σ). The market risk represents the systematic risk of the firm which is the comparison of a firm's share price to the price movements of the entire stock market (Perryman, Fernando, & Tripathy, 2016). The total risk of the firm represents both the market and firm-specific risk (Ross, Westerfield, & Jordan, 2011). The volatility of a firm's share price is an indicator of the firm's risk. The value of the firm is dependent on the decisions made by the board of directors and key executive members

because they make the financing and investing decisions for the firm and these impacts its risks and returns. The board of directors consists of a diverse group of individuals, including female directors who are able to influence these decisions. These decisions, will ultimately, reflect through the share prices of the firm. Therefore, β and σ can reflect the impact which these decisions have on the firm's risk. Additionally, this will assist investors and other stakeholders when making investment decisions through observing the relationship between gender diversity on the board and the firms' risk profile.

1.2 Problem statement

Women representation in senior management positions has increased because of various pressures, however, the impact women have on the risk of the firm and its policies has not been comprehensively researched in South Africa (Willows & van der Linde, 2016). Evidence from StatsSA (2018) has shown that in South Africa, the percentage of unemployment among women was 29,5% in the second quarter of 2018, in comparison to 25,3% amongst men in terms of the official definition of unemployment. 43,8% of the total employment rate in the second quarter of 2018 related to women, and 32% of managerial positions held in South African businesses are held by women. Additionally, in a recent study performed by Grant Thornton International, the proportion of firms sampled across the world, which have at least one woman in a senior management position, improved from 66% in 2017 to 75% in 2018. The overall proportion of senior positions held by women decreased (Thornton, 2018). 80% of South African companies listed on the JSE have at least one woman in senior management and this represents the highest percentage of senior positions held by women in the last 10 years (Thornton, 2018). Women representation in senior executive positions around the world and in South Africa has been increasing over the years, so, it is important to determine whether this has led to better financing and investment decisions and has lowered the risk of firms that employ more women in their boards.

1.3 Purpose

The purpose of this report is to explore the relationship between board diversity of JSE-listed companies and the risk of those companies. The report looks into the relationship between women representation on the boards and the market risk (measured by beta (β)) and the total risk (measured by standard deviation (σ)) of the company. The study aims to provide a comprehensive understanding of the impact which women have, as members of the board, its committees and its senior management positions on the risk of firms.

1.4 Significance of the study

Stakeholders' expectations pressurize the board of directors to monitor and manage the risks of the firm (Sila, Gonzalez, & Hagendorff, 2016). As a result, this report provides critical insights into how the gender composition of the board contributes to minimizing the risk, considering that women are generally more risk averse than men (Charness & Gneezy, 2012; Levin et al., 1988).

Increasing women representation on the board may contribute to sound corporate governance and provide economic substance to gender diversity so that is not only a social experiment and an exercise to ensure compliance with the legislation in place (Bear, Rahman, & Post, 2010; Sila et al., 2016). It also can encourage companies which seek to balance risk and return to pay greater attention to gender diversity. This will assist current and potential investors with their investing decisions to match their risk appetite.

Thus, this report has extended the knowledge in the area under investigation through performing this research from a South African perspective. As all the companies selected in the sample are listed on the JSE and are South African residents, it takes into consideration the impact of the economic environment in South Africa, as well as the impact that the King IV principles has had on these companies.

1.5 Research question

The research question is:
How does gender diversity of the board impact the risk profile of JSE-listed firms as measured by their beta (β) and their standard deviation (σ)?

1.6 Assumptions, limitations and delimitations

This report will only focus on a sample of companies which are listed on the JSE. The findings from this report are, therefore, not generalizable to all firms in South Africa. Also, the directors' relevant industry knowledge, technical expertise, experience and individual risk appetite are not taken into account in the study, as these characteristics are difficult to obtain, measure and interpret. The findings from this report may not be applicable to countries other than South Africa. At present South African listed firms are required to comply with JSE listing requirements which forces them to implement the principles of King IV (JSE, 2017). Lastly, firms in the financial services industry have been excluded from the sample because these firms have to comply with stringent regulations and capital requirements.

1.7 Definition of Terms

The table below highlights some important definitions of terms that are referred to in this paper.

Table 1: Definition of terms

Term	Abbreviation	Definition
Beta	β	A measure which reflects the sensitivity of an individual share to fluctuations in the market, in this way measuring the share's non-diversifiable risk (Correia, Flynn, Uliana, Wormald, & Dillon, 2015).
Market risk		The macroeconomic factors which impact all companies and projects to different levels (Damodaran, 2006).
Risk		The expectation that the actual outcome of a project may be different from the expected outcome which can be either positive or negative (Correia et al., 2015).
Standard deviation	σ	The square root of the extent to which the expected returns from an investment deviate from the mean (Correia et al., 2015).

Chapter II contains a review of the literature in the field of gender diversity and risk. Chapter III explains the methodology which was adopted for this research paper. Chapter IV contains the analysis and interpretation of research results and the conclusion and recommendations for further research are included in Chapter V.

2. Chapter II: Literature review

2.1 Introduction

This chapter reviews prior literature which explores the relationship between the gender composition of the board and the firm's total and systematic risks. The concept of risk and the various types of risks will be highlighted. The different perceptions men and women have towards risk will also be discussed. This will contribute to developing an improved understanding of the dynamics of the board when considering risk from a gender perspective. This will then allow a connection to be drawn between the decisions made by a gender diverse board and how these can have an influence on the firm's total and systematic risks.

2.2 Gender inequality in the workplace

Gender inequality and discrimination in the workplace have dissociated females from engaging in making strategic decisions relating to the finances and investments of firms. This discrimination is caused by preconceived perceptions that men have the appropriate skills and attributes required for senior management positions to ensure that the firm has successful leadership (Powell & Butterfield, 2002). One of the reasons for this can be the belief that women are inferior as a result of deeply embedded cultural practices, beliefs and customs in South Africa (Wadesango, Rembe, & Chabaya, 2011). From stereotypical beliefs women are seen as incompetent and unsuitable for leadership positions (Haslam, Ryan, Kulich, Trojanowski, & Atkins, 2010). This contributes to the reasons why men occupy the majority of senior management positions in firms. Additionally, employers have the notion that women are generally more risk averse than men and further assume that senior management requires more risk-seeking individuals in order to generate higher returns for the firm (Schubert, 2006). These factors have contributed to gender discrimination in the workplace and, consequently, they can explain why many women have not been offered top management positions (Schubert, 2006).

2.2.1 Glass ceiling

Oakley (2000) suggests that the lack of advancement of women in breaking the glass ceiling and obtaining senior management positions emphasizes the significance of women under-representation in the workplace. The "glass ceiling" is a phenomenon which explains the difficulty which women have in the workplace as they climb the ranks within the firms of their chosen professions (Chisholm-Burns, Spivey, Hagemann, & Josephson, 2017). This implies that women are at a disadvantage seeking higher positions in the place of work compared to lower positions, and these disadvantages become worse at a later stage in the individual's

career (Cotter, Hermsen, Ovadia, & Vanneman, 2001). Cotter et al. (2001) identified four requirements which are required for the glass ceiling to exist. The first condition is race or gender inequality. This is when minority groups are not given promotional opportunities. The second condition is that inequality exists at higher levels rather than lower levels. Thirdly, inequality exists in career advancing opportunities where information accessibility and relationships to create these opportunities are denied to women. The last condition is that inequality still exists throughout the period of the woman's employment, which increases the difficulty for her to reach senior management positions.

According to Samuelson and Zeckhauser (1988), when a firm performs well, there is no apparent need to change the firm or its management, so this results in a bias towards maintaining the status quo. This status quo involves keeping the same senior management team as they do well. The findings of Bruckmüller and Branscombe (2010) support this as they suggest that there has been a predominantly male history of leadership within firms and, as a result of this, there were more male appointments for leadership positions during the period of the firm's success and a glass ceiling for females who aimed to obtain these positions. Another example of the status quo is when men and women have significant differences between their risk appetite and preference, consequently, women are statistically discriminated against as they are not promoted to senior managerial positions in the analysis of risk management because of their risk aversion stereotype (Schubert, 2006). This stereotype will be discussed further in detail in sections 2.4 and 2.5.

2.2.2 Tokenism

Tokenism occurs where minorities are easily sidelined when they make up a smaller portion of a large group (Torchia, Calabrò, & Huse, 2011). This underrepresentation is referred to as tokenism (Kanter, 1977; Yoder, 1991). Kanter (1977) conducted a study on women working in a male-dominated workplace in order to investigate how the proportion of women within the workplace impacts the firm. The majority of the group were described as "dominants" (men) and the minority were described as "tokens" (women) (Kanter, 1977). She suggested that the "tokens" of the group will have very little impact on the firm's processes as they make up the minority and are not likely to have an influence on the decisions of firms. Kanter (1977) concluded that, when the proportion of the minority group increases, they earn the trust of the rest of the group which allows the firm to benefit from the resources and skills which the minority group provides.

When only one female is on the firm's board, that female is considered to be a token (Bourez, 2005; Branson, 2006; Konrad & Kramer, 2006). If a board member is appointed and she is the only female on the board, the insights and advice provided by her can be easily disregarded (Huse & Grethe Solberg, 2006). Kraiger and Ford (1985) suggest that the tokens' performance decreases as their representation decreases. This suggests that token female directors are unable to influence the effectiveness of the firm's board (Adams & Ferreira, 2009; Kanter, 1977). This is because the minority group will have difficulty in expressing their opinions and being heard (Brewer & Kramer, 1985; Nemeth, 1986). By introducing quota systems, women may be added to the board of directors as tokens and not as a result of their potential to add value so they have less influence (Burgess & Tharenou, 2002). This implies that they do not participate in the day to day decision-making of the firm.

Konrad, Kramer, and Erkut (2008) summarized the different effects women have on a firm, depending on how many women there are on the board. This was among one woman, two women and at least three women. If there is only one woman on the board, the woman on the board may have a possible impact but tokenism can still exist. If there are two women on the board, the situation usually improves, but, tokenism can still exist. Lastly, if there are at least three women on the board, a "critical mass" is reached and there is visible influence on the content and dynamics in the boardroom through more engagement with the board by these women. Konrad and Kramer (2006) suggest that in order to circumvent tokenism on the board of firms, it is imperative for these boards to have at least three female directors on a board. By having at least three or more women on the board of an average size, they are able to make a difference in enhancing the governance of the firm (Konrad & Kramer, 2006).

2.3 Applicable laws and regulations to promote equality

There has been an increase in women representation in the workplace in all developed countries (Davidson & Burke, 2012). According to Davidson and Burke (2012), the reasons for this is the industrialization of economies and the growth in service sectors which provide females with the opportunities to be in these positions. Due to mandatory legal and listing requirements to enforce gender quotas, there have been signs of growth of women representation in the workplace globally (Sila et al., 2016). Additionally, because of various stakeholder pressures, social equity and the enhancement of shareholder value, the need for board gender diversity has increased (Cotter et al., 2001; Fields & Keys, 2003). This has contributed to higher representation by women in senior management positions. However, the value of the firm may decrease because the implementation of gender quotas and adhering

to societal pressures may be costly as it may inappropriately motivate the firm to have more women representation (Campbell & Mínguez-Vera, 2008; Ellis & Keys, 2003).

Recently, there have been many countries in Europe which have enforced mandatory gender quotas on the board in order to promote gender equality of listed and government-controlled firms (Furlotti, Mazza, Tibiletti, & Triani, 2019). In South Africa, after the Apartheid regime, there has been applicable legislation and regulation passed in order for South African firms to improve employment equity in the workplace (Van der Zahn, 2004). These laws and regulations are the Employment Equity Act no. 55 of 1998 (RSA, 2004), the BBEEE Codes (DTI, 2018) and the King IV report on governance (IoDSA, 2016). The Employment Equity Act aims to attain equity in the work environment through promoting equal opportunity and just treatment in order to eradicate the difficulties experienced by designated groups (SAICA, 2019). “Designated groups” is defined as black people, women and those with disabilities (RSA, 2004). The BBEEE Codes relating to management control (boards) is South African legislation which passed a code which promotes gender diversity in the workplace by requiring a target of 25% representation of black women on the board of all listed and public firms (DTI, 2018). Additionally, the JSE listing requirements, such as the implementation of King IV suggests that the board of a firm should be balanced and diverse by including members of different genders on the firm’s board (IoDSA, 2016; JSE, 2017).

2.4 Risk

2.4.1 The concept of risk

Knight (1921) explored the concept of risk and uncertainty. He established that uncertainty can be distinguished from risk, as risk is a quantifiable measure of uncertainty. The distinction occurs where probabilities are known and ambiguity exists: this is considered to be risk. However, uncertainty relates to ambiguity about the probability distribution (Gysler, Brown Kruse, & Schubert, 2002). This distinction gives rise to a separate definition of uncertainty and risk. Markowitz (1952) defined risk as the variability of returns, and the risk of a single security is the variance of its returns. Uncertainty is a situation where the likelihood of events, as well as the probabilities of those events are not known (Arrow, 1964).

A firm experiences total risk which is the inherent risk of a firm’s operations as a result of external and internal attributes which impact the firm’s profitability (Jo & Na, 2012). According to Ross et al. (2011) the total risk of the firm is a combination of systematic (market risk) and unsystematic risk (firm-specific risk). Markowitz (1952) proposed to measure the risk which is associated to the return of each investment using the deviation from the mean of the return

distribution, the variance and, in the event of a portfolio, to measure the risk level using the covariance among all combinations within the investment portfolio. This model is based on the appropriate utility function which allows individuals to have subjective preference of ranking the assets and their combinations (Szegö, 2002). In the 1960s the concept of volatility, represented by β, was introduced (Szegö, 2002). Beta is a comparison of a firm's share price to the price movement of the entire stock market and measures the systematic risk of the firm (Perryman et al., 2016). The β represents the sensitivity of an individual share to changes in the stock exchange index as a whole where the market's beta is equal to 1 (Correia et al., 2015).

2.4.2 Risk and returns

The concepts of risk and return are always interrelated. According to the Markowitz mean-variance model, the projects in which an investor should invest, should be placed on the efficient frontier as it indicates the optimal combination of risk and return (Kalyagin, Koldanov, Koldanov, & Zamaraev, 2014). It is important for firms to invest on the efficient frontier to ensure that the project adds value to the firm. Return of assets is used as a proxy for the performance of a firm (Mehran, 1995). The assumption of risk and return is that riskier firms have a higher volatility in earnings (Bruna, Dang, Scotto, & Ammari, 2019). However, a higher volatility return on asset may possibly represent poor management ability and may not be linked to risk-taking decisions (Faccio, Marchica, & Mura, 2011); a lower profitability (return on asset) may also result in taking additional risk (Boubakri, Cosset, & Saffar, 2013).

2.4.3 Financing and capital expenditure decision-making and firm risk

Financial decision-making is an important tool in a firm as many elements which lead to business failure can be managed efficiently with strategies and financial decisions (López, Contreras, & Espinosa, 2012). The board of directors are responsible for making financing decisions for the firm. Insightful directors identify and use the right combination of debt and equity and this results in the decrease in the firm's cost of financing which maximizes the firm's net returns and contributes to an enhanced competitive advantage in the market (Abata, Migiro, & Akande, 2017). According to Goodwin-Stewart and Kent (2006), firms which have a higher percentage of long-term debt will cause the firm to have greater financial risk. These firms will be highly leveraged and are more likely to have debt covenants and a greater probability of going concern risks. If a firm has a higher leverage, this will increase the firm's financial risk as the likelihood of financial distress will increase (Friend & Lang, 1988). Additionally, if a firm has a high debt to equity ratio, there is a positive probability of bankruptcy and default risk, resulting in a higher risk of the firm which will reduce the value of the firm

(Hellwig, 1976).

Investment decision-making has an impact on the risk of the firm as it is linked to the level of risk the investment has. These decisions may involve a commitment of allocating resources to a certain project or activity (McConnell & Muscarella, 1985). This involves capital expenditure on property, plant and equipment for maintenance or the expansion of a firm (Bhana, 2008). The level of capital expenditure in the company represents the level of financing needed. This, in turn, may impact the financial risk of the company (Hamidi, Mansor, & Asid, 2017). Additionally, firms which have larger investment opportunities and growth may take on more risk (Guay, 1999).

2.5 Psychological and economic studies on gender risk appetite

In order to determine whether female directors make an impact on the risks of firms, it is vital to have an understanding of the similarities and differences between the risk appetites of the two genders. Several studies have examined gender differences in making financial and investing decisions, as well as gender attitudes towards risk (Barber & Odean, 2000; Levin et al., 1988; Powell & Ansic, 1997; Schubert, Brown, Gysler, & Brachinger, 1999).

It is a well-known stereotype that women are more risk-averse than men. Men and women understand the concept of 'risk' differently (Schubert, 2006). His study showed that men are concerned with the probability of the risk occurring, while women are concerned with what the future outcome of the decision is. Men are more inclined to select options which are riskier when the options include probabilities relating to monetary outcomes, whereas women select options based about their emotions on the potential outcome (Fehr-Duda, De Gennaro, & Schubert, 2006). In another study, it was shown that men seem to be overconfident when making financial decisions as compared to women because men tend to be more used to making investments (Barber & Odean, 2001). Due to this overconfidence, men tend to invest larger monetary amounts in risky assets compared to women who tend to lean away from making larger investments (Levin et al., 1988; Powell, Schubert, & Gysler, 2002). These studies suggest that women are more risk-averse when making financial and investing decisions (Charness & Gneezy, 2012; Levin et al., 1988). Eckel and Grossman (2008), Sapienza, Zingales, and Maestripieri (2009), Gneezy, Niederle, and Rustichini (2003) and Hogarth, Karelaia, and Trujillo (2012) have also implied that women are more risk averse and are less likely to engage in competition.

Table 2 summarizes prior studies performed which highlight the differences and similarities between gender risk appetites which may indicate whether female directors will influence the

investing and financing decisions of the firm. In the majority of the studies, the assumption that women are more risk averse than men is supported.

Table 2: Prior research on gender differences and similarities on risk appetite

Author	Conclusion
(Kahneman & Tversky, 1996; Levin et al., 1988; Powell & Butterfield, 2002; Powell & Ansic, 1997)	Women tend to avoid risk compared to men when gambling.
(Barber & Odean, 2000; Beyer, 1997; Estes & Hosseini, 1988; Gervais & Odean, 2001; Lundeberg, 1994; Stinerock, 1991; Zinkhan, 1991)	Men are more overconfident than women, taking into account their individual characteristics when making decisions which involve risk. Men take greater risks than women.
(Dittmar, 1992; Furnham, 1984)	Women appear to be more afraid of losses in general, especially when dealing with tangible losses. This indicates that women are more risk averse when it involves losing a tangible item, such as money.
(Schubert, Brown, Gysler, & Brachinger, 1999)	There are no differences when investment decisions are made.
(Powell & Ansic, 1997)	In an experiment performed on ambiguity averse behavior in unfamiliar situations compared to familiar situations, women are more uncertainty-averse compared to men, regardless of the costs associated, framing or familiarity.

Therefore, gender differences on the board of the firm may influence the decisions made by the board which, as a result, affect the risk of the firm. However, in some studies, these differences do not have any influence on the risk of the firm. The next section explains in detail how the gender composition of the board may influence the risk-taking behavior of the firm.

2.6 Gender composition of the board and risk-taking behavior

The board of directors are required to make financial, operating and investing decisions on behalf of the firm. In order for the firm to generate value, correct decisions are required. These decisions are made by the board of directors, as well as by certain delegated committees of the firm. Berger, Kick, and Schaeck (2014) suggest that diversity of the board could contribute to a more meticulous decision-making process as a heterogeneous board will be influenced by different experiences and viewpoints. Joo (2012) suggests that diversity on a board does not only relate to gender or racial justice issues but also it contributes to improved management decision-making and increases shareholder wealth. Women (like external stakeholders, cultural minorities and foreigners) offer a different viewpoint on matters which is complex. This allows for a more detailed analysis in the decision-making process. On the contrary, Janis (1982) suggests homogeneous boards are more likely to engage in group-thinking and will come up with similar strategies on the board. This can assist the firm in remedying information biases when formulating strategies and solving problems (Westphal & Milton, 2000). This may result in unbalanced decisions and will affect the risk-taking of the firm as heterogeneous boards may have conflicting ideas which affect the co-operation of the board and may hinder the decision-making ability of the firms (Berger et al., 2014).

Female directors make significant contributions to boards as they all may have unique backgrounds and characteristics which allow them to stand out from the conventional director (Daily & Dalton, 2003). According to Daily and Dalton (2003), women provide different viewpoints, experiences and approaches when working and their contributions can improve the board's discussions through their communication skills which may enhance the decision-making process of the board. Female directors are likely to impact the decision-making processes of the board as there are differences in the risk appetite of men and women. The findings of Adams and Ferreira (2009) and Campbell and Mínguez-Vera (2008) suggest that women ask more probing questions. This improves the communication on the board to aid with decision-making (Konrad et al., 2008). This suggests that there is a possibility that gender composition on the board can explain the risk-taking behavior of a firm (Bruna et al., 2019; Lenard et al., 2014; Loukil & Yousfi, 2016; Sila et al., 2016). Therefore, it is important to have a balance of both men and women on the board. This also applies to having too many women on the board as there will be a lack of diversity because of the insufficient male representation and this may result in a reduction of board effectiveness (Bear et al., 2010).

A problem arises if a specific gender dominates the board of a firm: men may neglect good risk management strategies by making riskier decisions instead of diversifying the firm's risk,

and women may make decisions which are not risky enough to maximize the value of the firm (Schubert, 2006). Conflicts may also arise between male and female directors on the board which will hinder the board's decision-making capacity and decrease the firm's value (Jackson, Joshi, & Erhardt, 2003). Additionally, the appointment process of a firm may vary based on their risk appetite. Firms with a conservative approach to risk may appoint female managers who are risk averse and firms with a higher risk profile may appoint fewer risk averse managers (Adams & Ferreira, 2009; Atkinson et al., 2003; Johnson & Powell, 1994). This may also affect the balance of the board, and thus, its decision-making capacity.

Studies also show that there is a direct relationship between gender composition on the board and the company's reputation. Gender diversity signals to investors that the company values employing and empowering women (Bear et al., 2010). Risk management strategies are required to be company specific and have to be based on the relationship between the company's value and its risky future returns (Schubert, 2006). Schubert (2006) suggests that men have a competitive advantage in analyzing risk when they tend to be less risk averse than women which results in more positive longstanding results relating to innovation and capturing new markets. He also suggests that women have a competitive advantage with regards to risk management, diversification, having an integrated perspective and communicating within the firms. From a competitive advantage point of view, women are more risk-averse compared to men, and are less willing to be exposed to competition (Gneezy et al., 2003; Hogarth et al., 2012). This may then lead to the company being unable to compete with its competitors, resulting in a decrease in firm value as it may lose market share. Therefore, Schubert (2006) proposed combining the strengths of both men and women in order to maximize the value of the firm as a whole.

However, in a study conducted by Maxfield, Shapiro, Gupta, and Hass (2010) it was found that male and female managers are not different from each other when making financial and investment decisions as their risk appetite were the same. Even though male and female managers may apply different business strategies, this does not have a major influence on their performance (Powell & Ansic, 1997). According to Powell and Ansic (1997), the differences between the genders relating to risk inclination are linked to the differences in decision strategy which may result from underlying differences in motivation. Additionally, the findings of Matsa and Miller (2013) indicate that there was no change in the company's leverage after introducing gender quotas on the boards in Norway, which suggests that having more females on the board does not necessarily result in less risky behavior. A study conducted on 30 Tunisian-listed firms from 1997 to 2010 by Loukil and Yousfi (2016) found that there was no significant relationship between gender diversity on the board and the

inclination to take strategic or financial risk, but, they did find that women have a perception of risk which results in risk-averse or risk avoidance behavior. A study performed on 1960 US firms between 1996 to 2010 by Sila et al. (2016) found that company risk is negatively related to the probability of the appointment of female directors. A more recent study conducted on a sample of French companies which made up the SBF 120 index between 2006 to 2010 by Bruna et al. (2019) found no evidence to support the assumption that women on the board have an impact on the risk taking of the firm.

On the contrary, further studies have found that there is a relationship between gender diversity on the board and firm risk. Farrell and Hersch (2005) found an inverse relationship between firm risk and female directors, and an empirical study performed by Lenard et al. (2014) from 2007 to 2011, on companies on the RiskMetrics database, found that the higher proportion of women on the board, the more the firm's risk will reduce the unpredictability of the stock's market returns.

2.7 Managerial positions on the board and decision-making

According to Adams, Almeida, and Ferreira (2005), executives' characteristics only impact corporate results when these individuals have an influence over the firm's financing and investing decision-making. The key managerial positions of a firm are the CEO, CFO and COO positions. These managerial positions allow these executives to make decisions for the firm, as well as to manage the firm's risk (Berezinets, Ilina, & Muravyev, 2011; Hermalin & Weisbach, 1998). Faccio, Marchica, and Mura (2016) investigated how the gender of CEOs relates to making corporate decisions involving risk-taking. Their findings showed that female CEOs generally make less risky financing and investing decisions compared to male CEOs (Faccio et al., 2016). According to Chaffin, Gamache, and McNamara (2014), many studies investigated how other chief officers impact the effectiveness of the strategies of the firm such as CFOs and COOs. COOs have the responsibility to ensure all of the firm's operating processes are efficient and effective and as a result, the COO has an imperative role in the implementation of the firm's strategies (Chaffin et al., 2014). If women perform these managerial roles on the board of the firm, they are very likely to impact the decision-making of the firm and consequently, the firm's risks.

2.8 Audit and risk committee and risk management

From a business environment perspective, firms are faced with a variety of risks, as a result, management must have ways to identify and mitigate these risks (Soltanizadeh, Rasid, Golshan, Quoquab, & Basiruddin, 2014). Consequently, it is important for directors to have

good risk management strategies in place. Risk management is a process of organizing a firm's portfolio of businesses in a manner in which the level and composition of risks and returns is at its optimal (Schubert, 2006). This should lead to maximizing the value of the company (Meulbroek, 2002).

In South Africa, risk management takes place at the board and at the audit and risk committee level (IoDSA, 2016). This committee sets out and implements risk management policies for the firm. The risk management responsibilities of these committees are to ensure the effectiveness of the firm's assurance activities, including external assurance, internal audit, to oversee the finance function and to oversee the risk governance of the firm (IoDSA, 2016). According to the IoDSA (2016), the King IV report, the board of directors of a firm should determine and agree on the nature and extent of the risk which the firm will be willing to accept by considering the firm's risk appetite (the propensity to take accept suitable levels of risk) and the limit of the possible loss a firm can tolerate. However, in recent literature, there are doubts associated with how effective audit committees are in managing risk (Yatim, 2010).

According to Yatim (2010), risk management is the main focus for board committees such as the audit, finance or risk management committees. The composition of these boards is important as the members of the board make the decisions which impact the firm's risk profile, such as, if there are more risk-takers on the committee, the firm will take on more risky projects and if there are fewer risk-takers on the committee, the firm will take on fewer risky projects. This indicates that women on these committees are likely to exercise their influence on the decisions made by these committees which may impact the risk of the firm. This is further supported by Adams and Ferreira (2009) as they suggested that females are more likely to form a part of monitoring committees which improves the corporate governance of the firm.

2.9 Corporate social responsibility and gender diversity

Corporate social responsibility assumes that a firm's relationship with its stakeholders decreases both the systematic and unsystematic risk to the firm (Freeman, 2010; Godfrey, 2005; Waddock & Graves, 1997). Numerous studies provide evidence that gender diversity on the board has a positive impact on the corporate governance and the performance of the firms (Berezinets et al., 2011). Bear et al. (2010), as well as Furlotti et al. (2019) have found that a firm's investment in corporate social responsibility improves as the number of women on the board increases. Also, board diversity is promoted as it provides for a better understanding of the industry and the market; it increases creativity and innovation which assists the board with problem-solving and it incorporates different perspectives when making

decisions for the firm (Lenard et al., 2014). This is further substantiated by Galbreath (2011) who showed that women on the board are positively linked to economic growth and social approachability. Lenard et al. (2014) suggest that women have better relationships with stakeholders who effectively represent the values of society at large. Additionally, they are believed to be more ethical and transparent which are key characteristics to have, as this can reinforce stakeholder trust (Adams & Funk, 2012).

A study conducted by Mercer Investment Consulting indicated that 46% of organizational investors consider the corporate social responsibilities of a firm when they make investment decisions and McKinsey reports indicate that these investors are willing to pay a premium of 12%-14% for firms which are good corporate citizens (Bear et al., 2010; Fombrun & Pan, 2006). Studies have shown that firms which have a higher proportion of women on the board have higher levels of benevolent giving (Wang & Coffey, 1992; Williams, 2003), improved working conditions (Bernardi, Bosco, & Vassill, 2006; Johnson & Greening, 1999) and greater levels of environmental accountability (Post, Rahman, & Rubow, 2011). More diverse boards also have improved relationships with their suppliers, customers and personnel, all of which will enhance the firm's value (Ellis & Keys, 2003).

2.10 Determinants of decision-making

2.10.1 Board characteristics

The characteristics of the board of a firm has an impact on the risk the firm is exposed to. The characteristics of the board which are to be discussed in the following sections are the size of the board as the risk depends on how many people are on the board and how consensus is reached, the number of committees the board has, as this determines how many committees will impact the decision-making processes of the firm and the independence of directors who will consider decisions made by the firm from a stakeholder perspective, instead of a shareholder perspective.

2.10.2 Size of the board

Larger boards have more shared knowledge and information about the processes which affect the value of the firm (Berezinets et al., 2011). According to Dalton, Daily, Johnson, and Ellstrand (1999), a larger board may perform better when providing advisory functions to the board. The disadvantages of large boards are the costs of co-ordination and "free-rider" issues (Jensen, 1993). Harris and Raviv (2006) suggest that there is a trade-off between the benefit of greater expertise which a diverse directorship brings and the cost of the "free-rider" issue

in order to determine the ideal number of external directors on the board. According to Yermack (1996), smaller boards are more effective than larger boards as he found an inverse relationship between the board size and firm value. Wang (2012) identified that smaller boards tend to make riskier decisions than companies with larger boards. This is because larger boards have a greater degree of compromise which, in turn, reduces the firm's risk.

2.10.3 Size of the firm

According to Lenard et al. (2014), the size of the firm impacts the firm's risk as larger and older firms tend to be more diverse which, in turn, reduces the firm's risk compared to smaller firms. Colquitt, Hoyt, and Lee (1999) found that larger firms were more likely to implement integrated risk management systems than are smaller firms. The size of the firm impacts the number of female directors appointed, as well as the risk profile of the firm (Catalyst, 2003). Catalyst (2003) suggests that larger firms are more likely to appoint female directors compared to smaller firms as one of the reasons may be that larger firms have more diverse personnel and thus, it is important to have diverse leadership.

2.11 Synthesis of literature review

The board of directors are responsible for making the financing, investing and operating decisions for the firm. The decisions made present risks such as risks relating to returns on investments (Markowitz, 1952), default risks and going concern risks (Goodwin-Stewart & Kent, 2006; Hellwig, 1976). Risk can be measured using beta and the standard deviation of the firm. As women representation on the board increases, the influence of women has an impact on the risk appetite of the firm as a whole, based on the risk averse characteristics of the female directors. If the board of a firm is diverse, different viewpoints and suggestions can be taken into account before a decision is made (Berger et al., 2014). In the event of gender diversity, women are more risk averse compared to men from an investing and financing decision-making perspective (Charness & Gneezy, 2012; Levin et al., 1988). Women would make decisions which are less risky. This indicates that women can implement good risk management practices and diversify the firm's risks (Schubert, 2006). Additionally, the effect of the contributions which women have made to the firm can be seen through the managerial positions which they hold, as these positions allow the individual to exert her influence over the firm's financing and investment decisions (Adams et al., 2005). However, a very risk-averse appetite may be detrimental to the value of the firm as less risky decisions can reduce the competitive advantage of the firm which, in turn, impact the value of the firm as it loses market share (Gneezy et al., 2003; Hogarth et al., 2012). Thus, it has been suggested that the gender composition of the board must be balanced as having too many women or too many

men can diminish the value of the firm (Brewer & Kramer, 1985; Nemeth, 1986). This will contribute to maximizing the value of the firm as a whole as both the strengths of men and women is combined (Schubert, 2006).

3. Chapter III: Methodology

The objective of this report is to determine the relationship between gender diversity on the board of JSE-listed firms and their total risks (σ) and market risks (β). The report uses a quantitative statistical approach to answer this research question. The aim of quantitative research is to establish, confirm or to validate relationships (Leedy & Ormrod, 2014). This study uses panel regression models to explore the relationship between board composition and risk.

3.1 Research question

How does gender diversity of the board impact the risk profile of JSE-listed firms as measured by their beta (β) and their standard deviation (σ)?

3.2 Sample and data

This report is based on data over 15 years from the financial years between 2004 to 2018. The sample of this study compromises of 60 non-financial sector companies listed on the JSE during the period of interest. The firms which may have subsequently delisted from the JSE have been included in the analysis up to the date of suspension or delisting, whichever is earlier. This created an unbalanced panel, however this inclusion eliminates survivorship bias. The same approach has been followed in a prior study by Sila et al. (2016). The population of listed companies on the JSE in 2004 was stratified into three strata, based on the market capitalization of the company in order to prevent size bias. The three strata are large market capitalization, medium market capitalization and small market capitalization in terms of the JSE classification (JSE, 2019). 20 companies within each stratum have been selected at random to ensure each company has an equal chance of being selected.

Firms in the financial services industry have been be excluded from the analysis because financial services companies have to comply with stringent laws and regulations which will impact the risk-taking behavior of those companies (Lenard et al., 2014; Sila et al., 2016). In South Africa, the “twin-peak” regulatory model has been established in the banking sector. One of these regulatory bodies is the Prudential Authority whereby its responsibility is to ensure the overall stability and management of systemic risk (de Villiers, Govender, & Madumo, 2020). This promotes and improves the safety and soundness of markets and banks. In addition, women in the financial services sector are also considered to be less risk-averse compared to women in the non-financial sector (Sapienza et al., 2009). As such, this study did not include companies within the financial services industry.

The board composition information required for this study has been obtained from the annual financial reports of the selected companies (Annual Integrated Reports) and the financial information of companies was obtained from the IRESS database. The data obtained were recorded in a Microsoft Excel Spreadsheet.

3.3 Model and data analysis

Pooled Ordinary Least Squares (OLS) regression and Panel data regression were used in the study. Panel data is more appropriate to identify and measure effects which are not apparent in cross-sections or pure time series data. Panel data provides more informative data, includes more variability and reduces the collinearity of variables. It also allows for more freedom and efficiency as the underlying dynamics of the data are not complicated by aggregation bias (Baltagi, 2008; Bond, 2002). This approach has been used and adapted from previous empirical research which investigated the relationship of gender diversity and company risk (Bruna et al., 2019; Lenard et al., 2014; Sila et al., 2016). The analysis was performed using the statistical package STATA Version 15.

The following regression models were used:

Equation 1:
This model tested whether a relationship exists between women on the board and the market risk (β) of the company:

$$\beta_{it} = a_i + \gamma_1(BCOMP)_{it} + \gamma_2(ARCOMP)_{it} + \gamma_3(CEO)_{it} + \gamma_4(CFO)_{it} + \gamma_5(COO)_{it} + \gamma_6(SIZE)_{it} + \gamma_7(BSIZE)_{it} + \gamma_8(BIND)_{it} + \gamma_9(WIND)_{it} + \gamma_{10}(NUMCOM)_{it} + \gamma_{11}(CAPEX)_{it} + \gamma_{12}(ROA)_{it} + \gamma_{13}(LEV)_{it} + \gamma_{14}(GFC)_{it} + \varepsilon_{it}$$

Equation 2:
This model tested whether a relationship exists between women on the board and the total market risk (σ) of the company:

$$\sigma_{it} = a_i + \gamma_1(BCOMP)_{it} + \gamma_2(ARCOMP)_{it} + \gamma_3(CEO)_{it} + \gamma_4(CFO)_{it} + \gamma_5(COO)_{it} + \gamma_6(SIZE)_{it} + \gamma_7(BSIZE)_{it} + \gamma_8(BIND)_{it} + \gamma_9(WIND)_{it} + \gamma_{10}(NUMCOM)_{it} + \gamma_{11}(CAPEX)_{it} + \gamma_{12}(ROA)_{it} + \gamma_{13}(LEV)_{it} + \gamma_{14}(GFC)_{it} + \varepsilon_{it}$$

Where:

- i represents the cross-sections
- t represents the period in time

- α represents a constant
- ε represents the error term
- γ represents the coefficient of the independent variables
- β (beta) is the non-diversifiable risk/systematic risk of the firm
- σ (standard deviation) measures the total risk of the firm

Table 3: Variables and their measurement

Variable	Symbol	Calculation method
Beta	β	β represents the market risk of the company. The slope of the percentage change in weekly share prices of a company compared to the percentage change in weekly share prices of the market (Harrington, 1983). The proxy of the market will be the JSE.
Standard deviation	σ	σ represents the total risk of the company. The square root of the variance of the company's the percentage change in weekly share prices over the year (Correia et al., 2015). The formula of σ is $\sqrt{\sum(x-\bar{x})^2/n}$.
Board composition	BCOMP	Number of female directors on the board/Total directors on the board (Sila et al., 2016).
Audit and risk committee composition	ARCOMP	Number of female directors on the audit and risk committee/Total directors on the risk and audit committee (Sila et al., 2016).
Chief Executive Officer	CEO	This represents whether a female is in a CEO position within a given financial period. This is denoted by "1" if a female is in a CEO position and "0" if a male is in a CEO position.
Chief Financial Officer	CFO	This represents whether a female is in a CFO position within a given financial period. This is denoted by "1" if a female is in a CFO position and "0" if a male is in a CFO position.
Chief operating officer	COO	This represents whether a female is in a COO position within a given financial period. This is denoted by "1" if

		a female is in a COO position and “0” if a male is in a COO position.
Size of the firm	SIZE	Natural logarithm of market value of equity (Lenard et al., 2014).
Board size	BSIZE	Number of directors on the board (Sila et al., 2016).
Board independence	BIND	Number of independent directors/Number of directors (Sila et al., 2016).
Independence of women directors	WIND	Number of independent women/Total number of independent directors.
Number of committees	NUMCOM	Number of committees on the board (Coles, Daniel, & Naveen, 2008; Linck, Netter, & Yang, 2008).
Capital expenditure	CAPEX	Capital expenditure – Sale of property/ Total assets (Sila et al., 2016).
Return on assets	ROA	Earnings before interest and tax/Average total assets (excluding intangible assets)
Leverage	LEV	Total liabilities divided by shareholder’s equity (Sila et al., 2016).
Global financial crisis	GFC	This represents whether the period falls in the Global Financial Crisis period from 2007 to 2009. This is denoted by “1” if it falls within this period and “0” if it does not fall within this period.

For the panel regression analysis, the fixed effects model and the random effects model were estimated. The fixed effects model controls for the time-invariant characteristics of the companies in the panel. This is done to remove any bias which may affect the predicting capacity of the model. The random effects model, on the other hand, assumes that individual observed heterogeneity is uncorrelated with the independent variables. As a result of this, there is no need to control for time-invariant characteristics (Torres-Reyna, 2007). To evaluate the suitability of each of the models, the Hausman (1978) test was conducted. The results of these tests are detailed in section 4. In addition, to evaluate the suitability of using pooled regression models or panel regression models, the Breusch-Pagan Lagrangian Multiplier test was performed.

3.3.1 Independent variables

Risk management takes place at the board and audit and risk committee level (IoDSA, 2016). The independent variables which capture gender diversity at these levels are the board

composition (BCOMP), and the audit and risk committee composition (ARCOMP). The BCOMP represents the percentage of women on the board (Sila et al., 2016). The ARCOMP represents the percentage of women on the audit and risk committee. These committees set out and implement risk management policies (IoDSA, 2016).

Individuals who are in chief managerial positions are able to make financing and investing decisions for the firm as a whole (Sila et al., 2016). According to Hermalin and Weisbach (1998), CEOs have a great deal of impact when it comes to managing the firm's risk. This also applies to CFOs and COOs as they are in chief managerial positions and are actively involved in developing and implementing the firm's decision making processes (Chaffin et al., 2014; Ojeka et al., 2019). These variables are explanatory variables in the equation in section 3.3.

3.3.2 Control variables

Size of the firm (SIZE) represents the natural logarithm of the market value of the firms, which is a proxy for the size of the company (Lenard et al., 2014). Lenard et al. (2014) stated that SIZE should be controlled for, as larger and older firms tend to be more diversified which, in turn, reduces their risk compared to smaller companies.

Board size (BSIZE) impacts the risk-taking behavior of the firm. Wang (2012) identified that smaller boards tend to make riskier decisions compared to firms with larger boards. This is because larger boards have a greater degree of compromise which, in turn, reduces the firm's risk.

Independent directors are those who do not have an interest, association or relationship with the company (IoDSA, 2016). Recent studies suggest that independent directors are more effective when monitoring the risk management of the firm (Berezinets et al., 2011; Byrd & Hickman, 1992). This may suggest that independent directors can enhance the risk management of firms, consequently, reducing the risk of the firm. As such, the independent female board composition (BIND) and proportion of female independence of total independence (WIND) was controlled for.

The following company characteristics are also controlled for:

- Number of committees (NUMCOM) was controlled as the greater the number of committees on the board, the more complex the company is (Coles et al., 2008; Linck et al., 2008);

- Capital expenditure (CAPEX), because represents how much a company is investing in fixed assets to maintain and grow the business. The level of capital expenditure in the company represents the level of financing which may impact the financial risk of the company (Hamidi et al., 2017); and
- Return on Assets (ROA) as it represents the return on capital deployed in the business (Sila et al., 2016). The assumption is that riskier firms have a higher volatility in returns (Bruna et al., 2019).
- Leverage (LEV) was controlled for because it is a measure of firm complexity and financial risk. If a company has high leverage, this will increase the company's financial risk as the probability of financial distress will increase (Friend & Lang, 1988).

The data obtained included the period of the global financial crisis (GFC). The global financial crisis occurred during mid 2007 and ended in 2009 (Rudd, 2009). This was controlled for because the crisis increased the risk profile of companies as the companies' financial risk increased (Cukierman, 2013). The global financial crisis started in the United States and had a ripple effect worldwide through the global financial system (Cevik, Dibooglu, & Kenc, 2016). According to Cevik et al. (2016), emerging economies were affected by this crisis as seen in a decline in capital and trade channels. During that period of financial constraints and economic reduction, it was vital to understand the decision-making processes of firms in order to inform policy makers and to improve the understanding of businesses (McGuinness, 2015). The global financial crisis increased the risk profile of firms as the firm's financial risk increased (Cukierman, 2013), as a result of the financial constraints and trade reductions.

3.4 Reliability and validity

The study followed the methodology of prior studies carried out to identify the impact of gender diversity on risk (Lenard et al., 2014; Sila et al., 2016). The models used have been adapted from Sila et al. (2016). To ensure the validity of the models, several diagnostic tests have been performed such as tests for multicollinearity and heteroscedasticity. Multicollinearity occurs when there is a perfect or linear relationship among two or more independent variables (Gujarati, 2009). Multicollinearity was measured using the variance inflation factor (VIF) (UCLA, 2006). The VIF shows how the variance of an independent variable is inflated by the presence of multicollinearity (Gujarati, 2009). The models have also been tested for heteroscedasticity. Heteroscedasticity occurs when the standard errors of a variable monitored over a specific amount of time are non-constant (Gujarati, 2009). The test used to determine whether the models had heteroscedasticity was the Breusch-Pagan-Godfrey/Cook-Weisberg test (Williams, 2015). If heteroscedasticity was found, robust estimators were applied to the models (Gujarati, 2009; White, 1980).

4. Chapter IV: Analysis and interpretation of results

4.1 Data

The sample consisted of 60 companies, of which 45 companies were listed on the JSE throughout the period of the study (2004-2018). 15 companies delisted during that period. From the large cap firms, all companies were listed throughout the period. From the mid cap firms four companies delisted during the period and of the small cap firms eleven companies delisted during the period of interest. This resulted in a total of 871 observations. Appendix 1 contains the names of the companies used in the study, as well as the periods for which data were available for each company.

4.2 Descriptive statistics

Table 4 shows the descriptive statistics for all the variables. The mean for β is 0,641 and the mean for σ is 0,049. There is much of variability in the sample for β as indicated by the maximum of 5,374 and a minimum of -1,450. The average BCOMP is 15,489% with the highest being 60% and the average ARCOMP is 17,432% with the highest being 75%. This indicates that a majority of women on the board of the firms were on the audit and risk committees. The percentage of females in the ARCOMP was greater than those in BCOMP. The percentage of periods during the timeframe of the study in which females were appointed as CEOs, CFOs and COOs were 5%, 8% and 0% respectively. The data show that there were no female COOs during the period and that not many firms in the sample actually had COOs as there were only 283 instances of COOs recorded over the period of the study across all the companies.

The average BSIZE was 13,29, the highest being 38 (Anglo American Plc in 2017 and 2018) and the lowest being 4 (Cashbuild Ltd in 2004 and Don Group Ltd in 2005). The BSIZE of the large cap firms ranges between 8 and 38, the mid cap firms range between 6 and 26 and the small cap firms range between 4 and 19. The average BIND (number of independent/number of directors) was 47,956% of which the average WIND (number of women independent/total independent) was of 19,706%. The highest WIND was 100% which implies that all independent directors were females. The lowest WIND is 0%, from the data captured: this is usually the case when there are no females on the board (when BCOMP is 0%).

The average NUMCOM is 4.53 with the highest being 9 and the lowest being 1. From the data captured, the NUMCOM increased on a year-on-year basis and this may be the result of the

implementation of King IV. According to King IV, the board of directors should ensure that the duties of the board and the balance of power should be delegated to committees and sub-committees (IoDSA, 2016). The average SIZE is 22.803 with the highest being 28.0456 and the lowest being 12.221. The SIZE of the large cap ranges between 28.05 to 21.41, the mid cap ranges between 25,60 to 12,22 and the small cap which ranges between 23,91 to 16,20. The average ROA is 12,422% and it has extreme ranges between -71,950% to 124,608%. The average LEV is 1,182 which suggests that on average, the firms within the sample finance their operations through debt rather than equity. The average CAPEX is 6,718% with an extreme range between -147,589% to 38,76%.

Table 4: Descriptive statistics of variables

Variables	**Mean**	**SD**	**Max.**	**Min.**
β	0,641	0,607	5,374	-1,450
σ	0,049	0,029	0,349	-0,036
BCOMP	15,489%	11,311%	60%	0%
ARCOMP	17,432%	17,621%	75%	0%
CEO	5%	-	-	-
CFO	8%	-	-	-
COO	0%	-	-	-
BSIZE	13,29	4,538	38	4
BIND	47,956%	17,880%	90,91%	0%
WIND	19,706%	16,159%	100%	0%
NUMCOM	4,53	1,627	9	1
SIZE	22,803	2,583	28,0456	12,221
ROA	12,422%	12,735%	124,608%	-71,950%
LEV	1,182	2,248	41,292	-29,935
CAPEX	6,718%	7,622%	38,766%	-147,589%

Table 5.1 contains analysis relating to the composition of the board over the 15-year period. 15% of firms did not have any female directors on the board, and 85% of firms had female directors on the board. 33% had at least 3 female directors on the board and 10% had at least 5 female directors on the board. 27% of the firms had only 1 female director on the board,

which may indicate that these women are just tokens (Bourez, 2005; Branson, 2006; Kanter, 1977; Konrad & Kramer, 2006; Yoder, 1991). In order to overcome tokenism, the board should have at least three minority directors on an average board size (Konrad & Kramer, 2006). In the data provided, 33% of firms had at least 3 female directors on the boards which indicates that only a small portion of firms may not have token directors on the board.

When breaking down this analysis between the period 2004 to 2018, it can be noted that the number of firms which did not have any females on the board decreased from 45% in 2004 to 2.22% in 2018. The firms which have only one female on the board decreased by almost half as the difference between 2004 and 2018 is 16,11%. In 2018, the majority of the firms have at least one female on the board (97,78%) whereas in 2004, 55% of the sample had at least one female. In 2018, the firms which have at least three females on the board represent 64,44% of the sample. This increased by 52,77% over the 15-year period. Firms which have at least 5 females on the board increased from 1,67% to 26,67% in 2018, this indicates a major improvement over the 15-year period.

The sample was stratified into large cap, mid cap and small cap firms. In Appendix 6 it can be seen the descriptive statistics of this stratification show that larger and older firms (large cap) employ more women on the board as the large cap firms have BCOMP and ARCOMP means of 17% and 19% which are higher than the means of mid cap and small cap firms have. This is consistent with the results of Catalyst (2003) who suggested that larger firms are more likely to appoint female directors than to smaller firms.

Graph 1 indicates how the BCOMP and ARCOMP have changed over the period from 2004 to 2018. The average yearly change of BCOMP over the period is 10% with the average yearly change of ARCOMP over the period being 17%. The total percentage change from 2004 to 2018 for BCOMP is 264,90% and the total percentage change from 2004 to 2018 for ARCOMP is 686%. From this graph, it can infer that majority of firms within the sample started with very few females occupying director positions on the board and on the audit and risk committee, it subsequently then increased gradually over the years. Graph 2 shows the sum of female CEOs, CFOs and COOs each year. The highest number of female CEOs was when CEOs were appointed to the boards in 2013 when 5 CEOs were appointed, the number of CEOs dropped to 2 between 2013-2018. The highest number of female CFOs was in 2012 and 2015 when 6 companies had appointed female CFOs. A possible reason that is there are such a low number of female CEOs, CFOs and COOs in leadership positions could be a result of the glass ceiling phenomenon as there has been a predominantly male history of leadership during the past and women may have a difficulty to obtain such positions (Bruckmüller &

Branscombe, 2010). In Graph 3, average total risk remained relatively constant throughout the 15 year period, whereas, it can be seen that the average beta fluctuated during this period.

Table 5.1: Percentage of females on the board

Number of females on the board	Percentage of firms
No females on the board	15%
Only 1 female on the board	27,07%
1 or more females on the board	85%
3 or more females on the board	33%
5 or more females on the board	10%

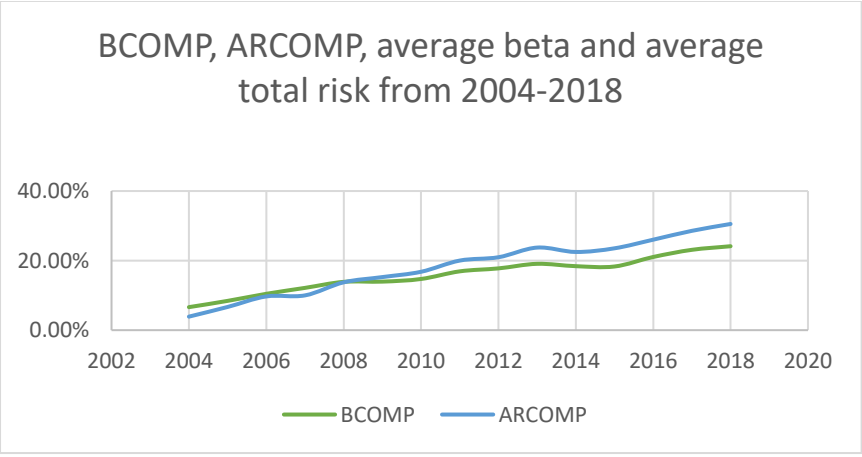
Author's computations

Table 5.2: Percentage of females on the board in 2004 vs 2018

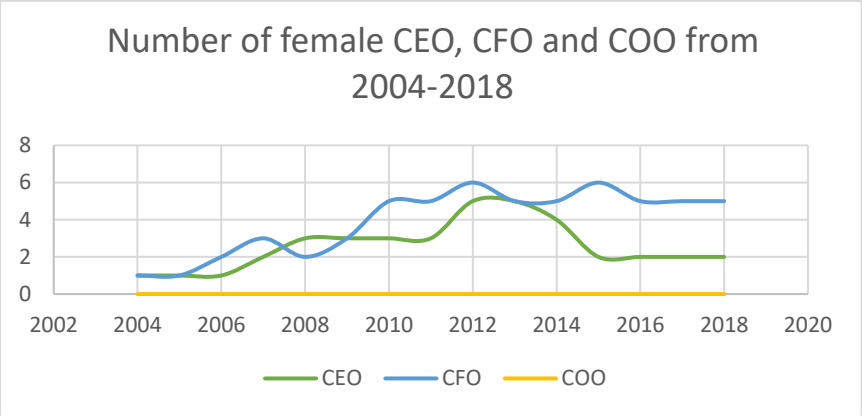
	Years	
Number of females	**2004**	**2018**
None	45,00%	2,22%
only 1	31,67%	15,56%
1 or more females on the board	55,00%	97,78%
3 or more females on the board	11,67%	64,44%
5 or more females on the board	1,67%	26,67%

Author's computations

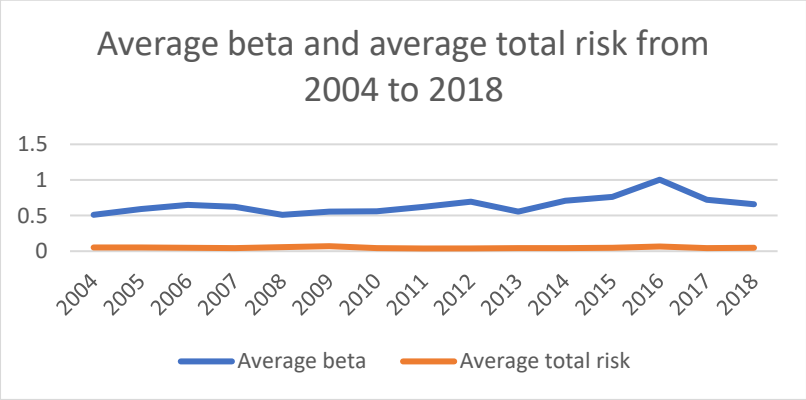
Graph 1: The BCOMP and ARCOMP over the 15-year period between 2004 and 2018



Graph 2: The number of female CEO, CFO and COO over the 15 years period between 2004 and 2018



Graph 3: Average beta and average total risk over the 15 years period between 2004 and 2018



4.3 Regression diagnostics tests

Regression diagnostics tests were carried out by performing pooled OLS, random effects panel data and fixed effects panel data regressions. The decision regarding which panel data model to use depends on the assumptions made about the error term of the models. As mentioned in section 3.3, the random effects model assumes that individual heterogeneity is random while the fixed effects model ignores the effect of time-variant characteristics in order to assess the effect of the independent variables on the dependent variable (Gujarati, 2009). The Hausman test was used in order to identify which model was better to use (Gujarati, 2009). According to Gujarati (2009) using the Hausman test, the null hypothesis is that there is no autocorrelation between the error term and the independent variables. When autocorrelation was present, the fixed effects model was used for statistical inference. This

occurs when a significant p value is obtained. When the null hypothesis of the Hausman test was not rejected, the random effects model was used. The results of this test are presented in Appendix 2 which shows that for equation 1 (β Beta), the random effects model was more suitable and that for equation 2 (σ Standard Deviation) the fixed effects model was more suitable. The results using the random effects model and the fixed effects models are presented in tables 6 and 7.

Heteroscedasticity was tested using the Breush-Pagan test and the Cook-Weisberg test. This test inspects whether there are any unequal variances in the error terms (Gujarati, 2009). The results of heteroscedasticity are presented in Appendix 4. When heteroscedasticity was detected, robust estimators were used in order to account for it (Gujarati, 2009; White, 1980).

Multicollinearity occurs when there is a perfect or linear relationship among two or more independent variables (Gujarati, 2009). The correlation matrix in the Appendix 7, shows the correlations among the variables. In order to test for multicollinearity, the VIF test was performed. The highest VIF value in the study's variables was 3,18 which is well below the standard benchmark of 10 (Chatterjee & Hadi, 2015). The VIF values are in Appendix 5.

4.4 Regression results

Table 6 shows the results for equation 1, using a pooled OLS regression, a random effects model and the between effects model, and Table 7 shows the results for equation 2 using a pooled OLS regression, a fixed effects model and a between effects model. The between effects model further analyses the results of the panel regressions by estimating the regressions using cross-sections of the data only. This identifies the effect of the independent variables on the dependent variable as a result of differences among the companies that make up the panel.

In order to determine whether there was enough variability in the panel to justify the use of panel regression, the Breusch and Pagan Lagrangian Multiplier test was performed. The Breusch and Pagan Lagrangian Multiplier test confirmed the appropriateness of using a panel regression to complement the pooled regression findings (see Appendix 3). The results of the regressions are discussed in section 4.5

Table 6: The results of equation 1 (β)

	Pooled OLS regression		Random effects		Between effects	
	Coefficient	Robust standard error	Coefficient	Standard error	Coefficient	Standard error
BCOMP	-0,261	0,284	-0,538	0,341	0,462	1,118
ARCOMP	0,235	0,156	0,168	0,157	0,418	0,544
CEO	0,133	0,087	0,075	0,112	0,029	0,336
CFO	0,171**	0,075	0,098	0,08	0,171	0,328
BSIZE	0,017**	0,007	0,004	0,006	0,025	0,019
BIND	0,003	0,117	-0,098	0,154	0,109	0,367
WIND	0,165	0,159	0,064	0,188	0,006	0,662
NUMCOM	0,045***	0,012	0,051***	0,016	0,037	0,059
SIZE	0,072***	0,012	0,064***	0,015	0,070**	0,034
ROA	-0,512**	0,237	-0,391***	0,15	-1,363*	0,778
GFC	-0,025	0,039	-0,049	0,038	0,402	0,721
LEV	-0,027***	0,01	-0,020**	0,008	-0,041	0,045
CAPEX	0,879***	0,183	0,621***	0,233	1,592	1,445
R^2	0,2608					
rho			0.3913			
F-statistic	0.0000		0.0000		0.0005	

Asterisks indicates significance at the 1% (***), 5% (**) and 10% (*) level

Table 7: The results of equation 2 (σ)

	Pooled OLS regression		Fixed effects		Between effects	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
BCOMP	-0,023	0,014	-0,012	0,018	0,047	0,048
ARCOMP	0,013*	0,007	0,013	0,008	-0,008	0,023
CEO	-0,002	0,004	-0,006	0,006	-0,017	0,014
CFO	0,012***	0,004	0,000	0,004	0,019	0,014
BSIZE	0,000	0,000	0,000	0,000	-0,001	0,001
BIND	-0,007	0,006	-0,003	0,008	-0,005	0,016
WIND	0,002	0,008	0,008	0,010	-0,026	0,028
NUMCOM	0,001	0,001	0,001	0,001	0,001	0,003
SIZE	-0,002***	0,000	-0,005***	0,001	-0,001	0,001
ROA	-0,050***	0,008	-0,011	0,008	-0,121***	0,033
GFC	0,013***	0,002	0,011***	0,002	-0,014	0,031
LEV	-0,003***	0,000	-0,001***	0,000	-0,007***	0,002
CAPEX	-0,021*	0,012	-0,024**	0,012	0,025	0,062
R^2	0,192					
rho			0.4569			
F-statistic	0.0000		0.0000		0.0001	

Asterisks indicates significance at the 1% (***), 5% (**) and 10% (*) level

4.5 Discussion of regression results

4.5.1 Board composition (BCOMP)

BCOMP has an inverse relationship with β and σ as indicated by the negative coefficients in the pooled regression model. It also has an inverse relationship with β in the random effects model and has an inverse relationship with σ in the fixed effects model. However, it has a positive relationship in the between model. This is an indicator that more women on the board have a positive effect on the market (systematic) risk of companies and indicates that more women on the board leads to a reduction in the total risk of the companies. However, this variable is insignificant in all the models for both dependent variables.

This may be a result of women being more risk averse compared to men which was suggested by psychological and economic studies performed by Charness and Gneezy (2012) and Levin et al. (1988). They suggested that women are more risk-averse compared to men when making financial and investing decisions. This resulted in female directors making an impact on the decision-making processes of the firm and expressing their risk appetite. However, the actual relationship between BCOMP and both risks (β and σ) is insignificant. For both equation 1 and 2, the pooled regression, fixed effects model and random effects models show that there

is no significant relationship between BCOMP and the risks (β and σ) of the firm as it is below the 10% significance level. This agrees with the evidence found by Sila et al. (2016) and Bruna et al. (2019) where they did not find any significant evidence to support the hypothesis that women on the board have an impact on the risk-taking of the firm. The insignificant relationship can be as a result of not having enough women on the board. This may result in female directors not being able to exercise their influence on the firm's decision-making policies (Kanter, 1977). This is evident as the mean of women on the board across the sample over a 15-year period was 15% and it further implies that women are in the minority on the board of directors. Additionally, only 33% of firms in the sample had at least 3 female directors on the board which implies that tokenism may be prevalent in the companies in the sample selected. This could further explain why BCOMP has no influence on the board.

4.5.2 Audit and risk committee composition (ARCOMP)

ARCOMP has a positive relationship with β in the pooled, random effects and the between effects models. This indicates that women on the audit and risk committee have a positive effect on the market risk of the companies. However, this variable is insignificant in all of the models.

ARCOMP has a positive relationship with σ in the pooled and fixed effects model, however it has a negative effect in the between model. ARCOMP was significant at the 10% level as indicated in the pooled model with σ. This indicates that women on the audit and risk committee have a positive effect on the total risk of the companies however, this variable is not significant in any of the models.

The relationship between ARCOMP and both risks (β and σ) is positive in all models used to determine the significance of the relationship. The insignificance of the relationship can be explained through the average ARCOMP being 17,43%, which indicates that women directors on the audit and risk committee are minorities which could indicate tokenism. Women on this committee may have difficulty impacting the decision-making processes within this committee as a result of being a minority group (Brewer & Kramer, 1985; Nemeth, 1986). However, ARCOMP is significant at the 10% level for σ in the pooled regression model. The audit and risk committee on the board conducts the risk management processes of the firm (IoDSA, 2016). The audit and risk committee oversees the finance function and oversees the risk governance of the firm (IoDSA, 2016). This committee oversees both internal and external risk, which can explain why ARCOMP has an impact on σ which includes both the systematic and unsystematic risk of the firm. The hypothesis is that women are more risk averse

compared to men (Charness & Gneezy, 2012; Levin et al., 1988). This finding suggests that through higher female composition, the risk of the firm will be reduced as women are considered to be better in risk management, diversification and have a strong integrated perspective and communication. However, this result is not what would be expected as the findings indicate that when the ARCOMP increases, the σ increases.

4.5.3 Chief Executive Officer (CEO)

The CEO position allows the individual to have an impact over the firm's financing and investing decision-making processes (Adams et al., 2005). From the results obtained, the presence of female CEOs leads to an increase in β as β has a positive coefficient for the pooled model, random effects model and the between effects model. However, for the σ, CEO variable has an inverse relationship as it has a negative coefficient for the pooled model, fixed effects model and the between effects model.

This implies that when there is a female CEO appointed, the market risk increases, however the total risk of the firm decreases. This is consistent for σ but not for β, as when the CEO is a female, the σ of the firm decreases which implies that there is less total risk. However, when the CEO is a female, there is a direct relationship with β. Though, the relationship is insignificant as the female CEO does not have a significant influence on either β and σ of the firms in any of the models. This may be a result of insufficient female CEOs in the sample as there was an average of 5% female CEOs in the sample. According to Faccio et al. (2016), female CEOs generally make less risky financing and investing decisions compared to male CEOs.

4.5.4 Chief Financial Officer (CFO)

CFO has a positive relationship with β in the pooled model, random effects model and the between effects model. The pooled model shows the relationship is significant at the 5% level. However, for the random effects and the between effects model, there was no significant relationship between CFO and β.

CFO has a positive relationship with σ in the pooled model, fixed effects model and the between effects model. The pooled model shows the relationship is significant at the 1% level. However, for the fixed effects model and the between effects model, there was no significant relationship between CFO and σ.

For both β and σ, the female CFO has a direct impact on the risks of the firm. This is a result of CFOs becoming more involved in developing and implementing strategic, investing and financing decision-making processes of the firm (Ojeka et al., 2019). This implies that when a female is in a CFO position, the market risk and the total risk of the firm increases. This is inconsistent with psychological and economic studies which found that women are more risk averse compared to men suggested by Charness and Gneezy (2012) and Levin et al. (1988). However, a possible explanation of the risks of the firm not decreasing is that there could possibly be no gender differences as a result of the appointment processes when females are employed in a male dominated work environment, (Atkinson, Baird, & Frye, 2003; Johnson & Powell, 1994; Niederle, Segal, & Vesterlund, 2013). Prior research has found that male and female managers are not different when making financial and investment decisions as their risk appetite were the same (Maxfield et al., 2010). This may imply that the stereotype that women are risk averse is false and male and female CFOs think similarly to each other when making financing and investing decisions, consequently, female CFOs do not have a significant influence on the risks of firms. This insignificant relationship could be a result of underrepresentation of female CFOs as there are only an average of 8% of females in the entire sample across the period of interest.

4.5.5 Board size (BSIZE)

BSIZE has a direct relationship with β which is represented through the pooled, random and between effects model. BSIZE has a significant relationship with β at the 5% level for the pooled model. The relationship between BSIZE and β is direct which implies that β increases as BSIZE increases. This is inconsistent with the findings of Wang (2012) who found that smaller boards tend to make riskier decisions compared to companies with larger boards. A possible reason for the increase in β with an increase in BSIZE is due to many directors performing monitoring functions. Berger et al. (2014) suggests that heterogeneous boards can have conflicting ideas which may result in inefficient managerial tasks performed and may hinder the decision-making of the firm. Additionally, larger boards in the sample may have "free-rider" issues which may result in further conflict on the board (Jensen, 1993). BSIZE does not have a significant relationship with the σ of the firm.

4.5.6 Number of committees (NUMCOM)

NUMCOM has a direct relationship with β as shown in the pooled model, random effects model and the between effects model. NUMCOM is significant at the 1% level for both the pooled and random effects models for β. The relationship between NUMCOM and β is positive which

implies that, as the number of committees increases, the β of the firm increases. This is inconsistent with Harrison (1987) who suggested that having more committees on the board will improve the effectiveness of the firm's risk management. However, it is consistent with the findings of Coles et al. (2008) who suggested that the greater number of committees on the board, the more complex the firm, which may cause the risk of the firm to increase. NUMCOM does not have any significant relationship with the σ of the firm.

4.5.7 Firm size (SIZE)

SIZE has a positive relationship with β in the pooled model, random effects model and the between effects model. This relationship is significant at the 1% level for the pooled model and random effects model and it is significant at the 5% level for the between effects model.

SIZE has a negative relationship with σ in the pooled model, fixed effects model and the between effects model. This relationship is significant at the 1% level for the pooled model and the fixed effects model. It is however, not significant in the between effects model.

According to Lenard et al. (2014), larger and older firms tend to be more diverse compared to smaller firms, resulting in larger firms having lower risks. The relationship between the SIZE of the firm and β is positive which implies that when SIZE increases, β increases and vice versa. As a result, the results for β shows an inconsistency with the findings of Lenard et al. (2014). However, the results of σ is consistent with the findings of Lenard et al. (2014) as σ and SIZE has a negative relationship suggesting that larger firms are more likely to implement integrated risk management systems than to smaller firms (Colquitt et al., 1999) and are more diverse (Lenard et al., 2014).

4.5.8 Return on Assets (ROA)

ROA has an inverse relationship with β as represented in the pooled model, random effects model and the between effects model. ROA and β has a significant relationship at the 5% level for the pooled model, at the 1% level for the random effects model and at the 10% level for the between effects model.

ROA has an inverse relationship with σ as shown in the pooled model, fixed effects model and the between effects model. ROA has a significant relationship with σ at the 1% level for the pooled model and at a 1% level for the between effects model.

ROA has a negative relationship with both β and σ. This implies that when the risk decreases, the ROA increases and vice versa. This may be an indicator of good management as, with the reduction of risk, this can lead to potentially greater returns.

4.5.9 Global Financial Crisis (GFC)

GFC and σ have a direct relationship in the pooled model and the fixed effects model but an inverse relationship in the between effects model. This relationship is very significant at the 1% level in both the pooled regression and the fixed effect model, but it is insignificant for the between effects model. The relationship between GFC and σ is positive which implies that the σ of the firm increased during those periods of the crisis. This is consistent the findings of Cukierman (2013) as he suggested that many firms' risk profiles increased as a result of the financial constraints within the firms. During this period, emerging economies were affected as they had limited capital and limited access to trade channels (Cevik et al., 2016), which may have affected the firms' operations. GFC did not have a significant relationship with β as the level of significance is below 10% for the pooled model, random effects model and the between effects model which is inconsistent with the findings of Cukierman (2013).

4.5.10 Leverage (LEV)

LEV and β have an inverse relationship as shown in the pooled model, random effects model and the between effects model. The relationship is significant at the 1% level for the pooled regression, the 5% level for the random effects model and it is insignificant for the between effects model.

LEV and σ has an inverse relationship as shown in the pooled model, fixed effects model and the between effects model. This relationship is significant at the 1% level for the pooled model, the fixed effects model and the between effects model.

The relationships between LEV and both β and σ are negative which implies that when LEV increases, the risks decrease. This is inconsistent with the literature which suggests that an increase in leverage (increase in long-term debt) will increase the firm's risks (Friend & Lang, 1988; Goodwin-Stewart & Kent, 2006; Hellwig, 1976).

4.5.11 Capital expenditure (CAPEX)

CAPEX and β have a direct relationship as indicated through the pooled model, random effects model and the between effects model. The relationship between CAPEX and β is significant

at the 1% level for the pooled model and the random effects model. It is insignificant in the between effects model.

CAPEX and σ has an inverse relationship as indicated in the pooled model and the fixed effects model, it however, has a direct relationship in the between effects model. The relationship between CAPEX and σ is significant at the 10% level in the pooled model and at the 5% level in the fixed effects model. It is insignificant in the between effects model.

According to Hamidi et al. (2017), CAPEX represents the level of financing required for a firm to commence with the investment decisions and it may affect the financial risk of the firm. The positive relationship is consistent with the findings of Hamidi et al. (2017), as the increase in CAPEX will result in a higher risk to the firm. However, the negative relationship in the random effects model for β is inconsistent with Hamidi et al. (2017).

4.6 Conclusion on analysis of results and interpretation

The models above show that BCOMP, ARCOMP, CEO and CFO do not support the theme that gender diversity on the board impacts the risks (β and σ) of the firm as none of the independent variables are significant below the 10% level in panel regression results (fixed, random and between effects models). Some variables are significant in the pooled OLS models, however, the results of the pooled model are not robust as the Breush and Pagan Langarian Multiplier test confirmed the appropriateness of using the panel models.

The results are consistent with Sila et al. (2016) and Bruna et al. (2019) as they found no evidence supporting the statement that gender diversity on the board reduces the risk of a firm. A possible reason for the insignificant relationship could be a result of not having sufficient female directors on the board as evidenced in the descriptive statistics, on the audit and risk committee and in managerial positions as the average BCOMP, ARCOMP, CEO and CFO are very low. Additionally, not many firms in the sample had at least three females on the board and as a result of this, tokenism can still exist in these firms.

5. Chapter V: Conclusion and areas for further research

5.1 Conclusion

The objective of this report was to investigate the relationship between gender composition of the board and the risks (β and σ) of the firm. This report contributes to the literature by exploring the impact that women in corporate leadership positions have on South African firms. This was done by obtaining 15 years of data of 60 JSE listed firms and using a panel regression analysis to investigate the relationship between gender composition of the firm and the firm's risks.

Based on psychological and economic studies, women are considered to be more risk-averse than men (Charness & Gneezy, 2012). Hence, with more women representation on the board, the assumption was that women would have an impact on the risk-taking of the firm and that this might result in a decrease in risks. However, the findings of this report show that there is no significant relationship between gender composition of the board, the audit and risk committee composition and the managerial positions which females hold in the firm: the risks as measured by β and σ of the firm. Additionally, the results can be explained by looking at the appointment processes of firms. Firms with a conservative approach to risk may appoint female managers who are risk averse and firms with a higher risk profile may appoint fewer risk averse managers (Adams & Ferreira, 2009; Atkinson et al., 2003; Johnson & Powell, 1994). This conclusion is consistent with prior studies. Bruna et al. (2019) performed a study on French companies and found no significant relationship between gender composition on the board and the risk on these firms, Sila et al. (2016) who performed a study on US firms and found that a board with a larger composition of female directors is no more or less risk-taking than a male-dominated board and Loukil and Yousfi (2016) found that there was no significant relationship between gender diversity on the board and the predisposition to take strategic or financial risk. There may be an instance of reverse causality in that firms will hire staff (both men and women), based on the risk profile of the firm. This implies that risky firms will hire more risk takers while more conservative firms will hire employees who have a lower risk-taking appetite (Sila et al., 2016). As a result, hiring more women on the board will not necessarily lead to a change in the β or the σ of firms.

In South Africa, there are gender quotas enforceable through B-BBEE Codes which require at least a 25% female representation of the board of the firm (DTI, 2018) and to maintain a balanced and diverse board which includes gender diversity in terms of King IV, with which listed firms on the JSE have to comply (IoDSA, 2016; JSE, 2017). Even though there are gender quotas enforced by the B-BBEE Codes and the JSE listing requirements, women

representation on the board is still low. According to Brewer and Kramer (1985) and Nemeth (1986), if there are only a few females on the board or on a committee, this is insufficient for the females to make an impact because minority groups have difficulty expressing their opinion on the board or committee. Additionally, many firms in the sample had less than three female directors on the board which may result in these firms only having token directors. According to Kanter (1977), token directors do not make an impact on the decision-making policies of the firm. Therefore, in order to determine whether female directors have an influence on the firm's risk profile, it is necessary to ensure that there are sufficient women for them to have an impact.

5.2 Areas for further research

This research report did not take into account the directors' relevant industry knowledge, technical expertise, experience and individual risk appetite as these variables are not easy to measure. Education being the cause of the fundamental differences. These relate to the fact that women and men currently both have the same opportunities and thus there is no significant relationship between female composition of the board and risk. Future research can try to obtain data relevant to the individual characteristics of directors to explore further the relationship between gender composition on the board and the firm's risks. Additionally, this report considered the impact of both executive and non-executive female directors on the board. Further research can possibly explore the impact which only executive female directors have on the risk of the firms as these directors can be in a position to exert more influence on the decision-making policies of the firm.

Also, financial service sector firms were not taken into account as a result of the stringent regulations and capital requirements. A study can be performed on these firms with the consideration that females in the financial services sector are considered to be less risk-averse than to females in the non-financial sector (Sapienza et al., 2009). The culture within the firm should be identified and measured. This is because the culture of the firm links to how the risk-taking processes within the firm are conducted, and this may vary from sector to sector.

It may also be possible to do a case study in order to analyze the board dynamics of firms with male dominated boards, and of boards with more female directors. This approach may identify more clearly the impact women have on the decisions of the firms, and whether or not these decisions affect the risk profile of those companies. In particular, decisions such as the level of Corporate Social Investment (CSI) should be considered as there can be a link between

the CSI practices of the firm and the risk of the firm. A wider set of CSI metrics may be able to explain the link between firm characteristics and risk better.

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7. Appendices

Appendix 1

Table showing the financial data available from the 20 large cap companies selected

Company name	Financial data available														
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Exxaro Resources Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Naspers Ltd -N-	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Tiger Brands Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Imperial Logistics Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Barloworld Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Bidvest Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Lonmin Plc	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Sappi Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Harmony Gm Co Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Remgro Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Impala Platinum Hlgs Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Telkom Sa Soc Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Arcelormittal Sa Limited	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Mtn Group Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Anglo American Plat Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Sasol Limited	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Anglogold Ashanti Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Compagnie Fin Richemont	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Bhp Group Plc	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Anglo American Plc	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Table showing the financial data available from the 20 mid cap companies selected

Company name	Financial data available																	
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Trencor Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Oceana Group Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Datatec Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Dimension Data Hldgs Plc	√	√	√	√	√										
Pick N Pay Stores Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Afgri Limited	√	√	√	√	√	√	√	√	√	√					
Northam Platinum Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Clicks Group Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Ceramic Industries Ltd	√	√	√	√	√	√	√	√	√						
Tongaat Hulett Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Shoprite Holdings Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Omnia Holdings Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Mediclinic Internat Ltd	√	√	√	√	√	√	√	√	√	√	√	√			
Netcare Limited	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Drd Gold Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
City Lodge Hotels Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
African Oxygen Limited	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Reunert Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Tsogo Sun Holdings Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Nampak Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Table showing the financial data available from the 20 small cap companies selected

Company name	Financial data available														
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Eoh Holdings Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Securedata Holdings Ltd	√	√	√	√	√	√	√	√	√	√					
Dorbyl Ltd	√	√	√	√	√	√	√	√							
Ucs Group Ltd	√	√	√	√	√	√	√								
Bytes Technology Grp Ltd	√	√	√	√											
W B Holdings Ltd	√	√													
Beige Holdings Limited	√	√	√	√	√	√	√	√	√	√	√	√			
Comair Limited	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Don Group Ltd	√	√	√	√	√	√	√	√	√	√					
Transpaco Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
La Group Ltd Ord	√	√													
Rex Trueform Group Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Frontrange Limited	√	√													
Kap Industrial Hldgs Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Idion Technology Hldgs	√	√													
Phumelela Game Leisure	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Metair Investments Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Cashbuild Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Merafe Resources Ltd	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Astrapak Limited	√	√	√	√	√	√	√	√	√	√	√	√	√		

Appendix 2

Results for the Hausman test: β

Test: Ho: difference in coefficients not systematic

chi2(13) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 14.70
Prob>chi2 = 0.3265

Random effects model used

Results for the Hausman test: σ

Test: Ho: difference in coefficients not systematic

chi2(13) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 85.71
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Fixed effects model used

Appendix 3

Results for the Breusch and Pagan Langarian multiplier test: β

Test: Var(u) = 0
chibar2(01) = 617.84
Prob > chibar2 = 0.0000

Results for the Breusch and Pagan Langarian multiplier test: σ

Test: Var(u) = 0
chibar2(01) = 312.61
Prob > chibar2 = 0.0000

Appendix 4

Results for Breusch-Pagan test for heteroscedasticity: β

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Beta

chi2(1) = 0.32
Prob > chi2 = 0.5734

Results for Breusch-Pagan test for heteroscedasticity: σ

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Standard deviation

chi2(1) = 75.19
Prob > chi2 = 0.6295

Appendix 5

Results for VIF: β

Variable	**VIF**	**1/VIF**
BCOMP	3,18	0,314918
WIND	2,33	0,429467
ARCOMP	2,03	0,492638
Size	1,79	0,557379
NUMCOM	1,52	0,657855
BSIZE	1,52	0,658373
BIND	1,32	0,75896
CFO	1,22	0,818826
CEO	1,19	0,83795
ROA	1,15	0,867268
CAPEX	1,09	0,919095
LEV	1,06	0,946307
GFC	1,05	0,953471
Mean VIF |	1,57	

Results for VIF: σ

Variable	VIF	1/VIF
BCOMP	3,18	0,314918
WIND	2,33	0,429467
ARCOMP	2,03	0,492638
Size	1,79	0,557379
NUMCOM	1,52	0,657855
BSIZE	1,52	0,658373
BIND	1,32	0,75896
CFO	1,22	0,818826
CEO	1,19	0,83795
ROA	1,15	0,867268
CAPEX	1,09	0,919095
LEV	1,06	0,946307
GFC	1,05	0,953471
Mean VIF	1,57	

Appendix 6

Table showing descriptive statistics of large cap, mid cap and small cap firms

Large Cap Firms

	BCOMP	ARCOMP	BSIZE	BIND	WIND	NUMCOM	SIZE	ROA	LEV	CAPEX
Mean	0,173	0,191	16,130	0,532	0,204	5,370	24,930	0,132	0,847	0,072
Standard Error	0,005	0,010	0,277	0,011	0,007	0,070	0,070	0,008	0,038	0,003
Standard Deviation	0,091	0,165	4,791	0,189	0,124	1,210	1,214	0,147	0,665	0,045
Range	0,429	0,667	30,000	0,909	0,545	7,000	6,626	1,966	3,346	0,347
Minimum	0,000	0,000	8,000	0,000	0,000	2,000	21,419	-0,719	0,040	-0,005
Maximum	0,429	0,667	38,000	0,909	0,545	9,000	28,046	1,246	3,385	0,342

Mid Cap Firms

	BCOMP	ARCOMP	BSIZE	BIND	WIND	NUMCOM	SIZE	ROA	LEV	CAPEX
Mean	0,143	0,161	12,246	0,481	0,208	4,373	22,347	0,134	1,849	0,069
Standard Error	0,007	0,010	0,197	0,010	0,011	0,106	0,141	0,006	0,181	0,003
Standard Deviation	0,122	0,169	3,272	0,165	0,186	1,767	2,341	0,107	3,014	0,050
Range	0,462	0,667	20,000	0,800	1,000	8,000	13,376	0,929	41,234	0,294
Minimum	0,000	0,000	6,000	0,000	0,000	1,000	12,221	-0,263	0,058	-0,003
Maximum	0,462	0,667	26,000	0,800	1,000	9,000	25,597	0,666	41,292	0,291

Small Cap Firms

	BCOMP	ARCOMP	BSIZE	BIND	WIND	NUMCOM	SIZE	ROA	LEV	CAPEX
Mean	0,145	0,169	10,551	0,402	0,172	3,512	20,329	0,100	0,776	0,057
Standard Error	0,009	0,014	0,218	0,011	0,012	0,089	0,117	0,008	0,163	0,009
Standard Deviation	0,127	0,199	3,134	0,153	0,173	1,284	1,688	0,119	2,341	0,125
Range	0,600	0,750	15,000	0,833	0,667	6,000	7,714	1,246	33,445	1,864
Minimum	0,000	0,000	4,000	0,000	0,000	1,000	16,196	-0,420	-29,935	-1,476
Maximum	0,600	0,750	19,000	0,833	0,667	7,000	23,910	0,826	3,509	0,388

Author's computations

Appendix 7

Table showing the correlation matrix of the variables

	σ	β	BCOMP	ARCOMP	BSIZE	BIND	WIND	NUMCOM	SIZE	ROA	LEV	CAPEX
σ	1											
β	.188***	1										
BCOMP	-0,029	.137***	1									
ARCOMP	0,008	.127***	.631***	1								
BSIZE	-.104***	.359***	0,055	0,035	1							
BIND	-0,030	.159***	.379***	.326***	-0,061	1						
WIND	-0,029	.141***	.750***	.658***	.120***	.321***	1					
NUMCOM	-.081**	.376***	.318***	.177***	.362***	.259***	.276***	1				
SIZE	-.168***	.567***	.163***	.143***	.604***	.261***	.161***	.508***	1			
ROA	-.224***	0,006	0,011	-.078**	0,058	-.075**	-0,032	-0,042	.188***	1		
LEV	-.106***	-.151***	-.096***	-0,041	0,018	0,009	0,022	0,032	-.111***	-0,066*	1	
CAPEX	0,017	.115***	-0,033	-0,024	.088**	-0,003	-0,043	.102***	0,049	.240***	-0,041	1

Asterisks indicates significance at the 1% (***), 5% (**) and 10% (*) level