



Evaluating the relationship between the market reaction to directors' dealings and the information environment: Evidence from the JSE

A research report submitted by

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Declaration

I, Ushir Moonilal, declare that this research report is my own work, except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Commerce in Accountancy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Ushir Moonilal

Signed at Brackenhurst, Alberton

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Table of Contents

Declaration	i
Acknowledgements	ii
List of Tables	v
List of Figures	vi
Glossary of terms	vii
List of abbreviations.....	viii
Abstract	ix
Section 1: Introduction.....	1
1.2 Research problem.....	2
1.3 Assumptions, limitations, and delimitations	2
1.4 Research purpose.....	3
1.5 Research question.....	3
1.6 Research significance.....	5
Section 2: Literature review	6
2.1 Theoretical overview	6
2.2 Market reaction to director's dealings.....	9
Prior research on directors' dealings.....	9
2.3 Information environment.....	13
Section 3: Methodology	20
3.1. Event study methodology.....	20
3.2. Population and study sample.....	20
3.3 Data collection.....	22
3.4 Method	22
3.4.1 Research Question 1 (RQ1).....	22
3.4.2 Estimation and event window	25
3.3.3 Research Question 2 (RQ 2).....	27
3.5. Validity and reliability	29
3.5.1 Validity	29
3.5.2 Reliability	30
Section 4: Results.....	30
4.1 Event study results (RQ1)	30
4.1.1 Descriptive statistics.....	31
4.1.2 Empirical results.....	41
4.2 Regression results (RQ2)	48

4.2.1 Descriptive statistics.....	48
4.2.2 Empirical results.....	51
Analysis of models and normality of data.....	51
4.2.3 Regression statistics for models 1-6.....	53
4.2.4 Summary of results.....	62
Section 5: Conclusion.....	63
5.1 Review of study and concluding remarks	63
5.2 Areas of future research.....	65
References	68
Appendices	74
Appendix A	74
Appendix B	77
Appendix C	77
Appendix D	81
Regression results for sensitivity analysis.....	81

List of Tables

Table 1: Final sample of SENS announcements and director's dealings	30
Table 2: Analysis of directors' dealings of small companies.....	33
Table 3: Analysis of directors' dealings of medium companies	35
Table 4: Analysis of directors' dealings in large companies	37
Table 5: Tests of Normality for the CAARs and CAAVs calculated for small, medium and large companies.....	41
Table 6: Wilcoxon Signed-Rank Test results for CAARs of purchase and sale transactions...	43
Table 7: Wilcoxon Signed-Rank Test results for CAAVs of purchase and sale transactions ...	43
Table 8: Wilcoxon Signed-Rank test results for CAARs of small medium and large companies.....	44
Table 9: Wilcoxon Signed-Rank test results for CAAVs of small medium and large companies.....	44
Table 10: Summary of results.....	48
Table 11: Correlations for Model 1	48
Table 12: Correlations for Model 2	49
Table 13: Correlations for Model 3	49
Table 14: Correlations for Model 4	49
Table 15: Correlations for Model 5	50
Table 16: Correlations for Model 6	50
Table 17: Number of outliers identified and removed from initial sample	52
Table 18: Model summary for models 1 and 2 (small companies)	53
Table 19 Model summary for models 3 and 4 (medium companies).....	54
Table 20: Model summary for models 5 and 6 (large companies).....	54
Table 21: Coefficients for models 1 and 2 (small companies)	54
Table 22: Coefficients for models 3 and 4 (medium companies).....	55
Table 23: Coefficients for models 5 and 6 (large companies).....	55
Table 24: Summary of results.....	62

Appendices

Appendix B

Table B 1: VIF statistics of regression models 1-6	77
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Appendix C

Table C 1: Tests of normality for regression models 1-6	77
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Appendix D

Table D 1 : VIF statistics of regression models 1-6	81
Table D 2: Model summary for models 1 and 2 (small companies)	81
Table D 3: Model summary for models 3 and 4 (medium companies).....	81
Table D 4: Model summary for models 5 and 6 (large companies)	81
Table D 5: Coefficients for models 1 and 2 (small companies)	82
Table D 6: Coefficients for models 3 and 4 (medium companies).....	82
Table D 7: Coefficients for models 5 and 6 (large companies)	83

List of Figures

Figure 1: Timeline of the event study.....	25
--	----

Appendices

Appendix A

Figure 2: Development of CAAR for small companies	74
Figure 3: Development of CAAV for small companies	74
Figure 4: Development of CAAR for medium companies	75
Figure 5: Development of CAAV for medium companies.....	75
Figure 6: Development of CAAR for large companies.....	76
Figure 7: Development of CAAV for large companies	76

Appendix C

Figure 8: Normal Q-Q plot for model 1	78
Figure 9: Normal Q-Q plot for model 2	78
Figure 10: Normal Q-Q plot for model 3	79
Figure 11: Normal Q-Q plot for model 4	79
Figure 12: Normal Q-Q plot for model 5	80
Figure 13: Normal Q-Q plot for model 6	80

Glossary of terms

Term	Explanation
Directors' dealings	Transactions in which directors purchase or sell stock of the company of which they are employed (Pham and Ausloos, 2022).
Information asymmetry	A condition where one party has more or better information than another (Akerlof, 1970).
Information environment	The amount of information available about a firm (amount of information refers to all information at any given time that is relevant to determining security prices) (Zeghal, 1984).
Insider	According to the Financial Markets Act No.19 of 2012, insider means “any person who has inside information- a) through- (i) being a director, employee shareholder of an issuer of securities listed on a regulated market to which the inside information relates; or (ii) having access to such information by virtue of employment office or profession; or b) where such person knows that the direct or indirect source of the information was a person contemplated in paragraph (a)”.
Measurement approximation	In the context of this study, using analysts following, bid-ask spread and company size as measures of the information environment

	(Brown and Warner, 1985; Asthana and Mishra, 2001; Dang, Li and Yang, 2018)
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List of abbreviations

CAAR	Cumulative average abnormal return
CAAV	Cumulative average abnormal volume
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CHAIRMAN	Chairman of the board of directors
CS	Company secretary
ED	Executive director
INED	Independent non-executive director
JSE	Johannesburg Stock Exchange
NED	Non-executive director
SENS	Stock Exchange News Service

Abstract

Background: Directors' dealings are closely monitored as they may provide valuable information to the market about the company. However, the relationship between stock market reactions to directors' dealings and the information environment is underexplored in a developing country context such as South Africa.

Purpose: The purpose of this study is to first determine the market reaction to directors' dealings. Thereafter, this research will determine whether the market reaction to directors' dealings has any relationship with each company's information environment.

Method: The cumulative average abnormal returns (CAAR) and the cumulative average abnormal volume (CAAV) were calculated to measure the stock price and trading volume reaction to the directors' dealings. Thereafter, a regression analysis was performed using the CAAR and the CAAV as the dependent variables and the indicators for the information environment as independent variables to determine if there is a relationship between the stock price and trading volume reaction to directors' dealings and the company's information environment.

Results: The event study results show that directors' dealings trigger statistically significant abnormal returns for small companies during the anticipation and event window. Statistically significant abnormal volumes were present for medium and large companies during the post-event window. The regression results show a statistically significant relationship between abnormal returns and bid-ask spread for small companies as well as between abnormal returns and analyst following for medium companies. Furthermore, there is a statistically significant relationship between abnormal volume and company size for medium companies as well as between abnormal volume and analyst following in large companies.

Implications: The variation in significance across company sizes suggests that directors' trades convey differing levels of informational value depending on firm characteristics. This has important implications for market efficiency, corporate governance, and regulatory policy, particularly in emerging markets where transparency and investor confidence are critical.

Contribution: This research contributes to the existing literature on the information efficiency of markets and JSE event study literature. This research contributes to insights into the quality of the information environment and how each indicator of the information environment impacts investor perceptions and market outcomes.

Key words: Director's dealings, event study, information environment, JSE, regression

Section 1: Introduction

In financial markets, the actions and decisions of directors along with all publicly available information about a firm such as financial statements, corporate announcements and analyst reports, play a critical role in shaping the information environment (Lang, Lins and Miller, 2003 ; Frankel and Li, 2004; Sami and Zhou, 2008 ; Baik, Brockman, Farber and Lee, 2018; Bentley-Goode, Omer and Twedt, 2019) in the context of a firm (Mordant and Muller, 2003). Directors' dealings, in their employer's stocks, have been found to provide information to investors who in turn react to these signals (Dardas and Güttler, 2011a; Foley, Kwan, McInish and Philip, 2016). Understanding the market's reaction to directors' dealings is important because it can provide insights into whether market participants view directors' trades as credible signals. The reaction of the market to directors' dealings can provide valuable detail about the company information environment. In turn, this detail has important implications for the information efficiency of markets.

The company's information environment refers to the amount of information available about a firm (amount of information refers to all information at any given time that is relevant to determining security prices (Zeghal, 1984)). This study focuses on three indicators of the company information environment namely firm size, bid-ask spread and the number of analysts following a firm. Zeghal (1984) showed that firm size is positively related to the amount of information about a firm because larger firms generally allocate more resources to producing financial and non-financial information; Leuz and Verrecchia (2000) observe that bid-ask spread captures information asymmetry because when information asymmetry is minimal, investors are less concerned about adverse selection and are more willing to trade as a result which leads to lower bid-ask spreads; Lang and Lundholm (1996) find that firms with more informative disclosure policies have a higher analyst following.

It is evident from the existing literature that the company's information environment and the effect of directors' dealings on the stock price of a company have been studied largely in isolation from one another. For example, Dardas and Güttler (2011b) examine whether directors' dealings are informative but do not consider information-specific variables in their analysis while Baik et al. (2018) examine the relationship between managerial ability and the quality of the firm information environment but do not consider the relationship between directors' dealings and the information environment. Additionally, the research surrounding directors' dealings has been mostly concentrated in developed countries such as the United

States of America (Lakonishok and Lee, 2001); the United Kingdom (Ryan, 2005); Poland (Gurgul and Majdosz, 2007); Italy (Tardivo, Breciani and Fabris, 2011) and Canada (Morris and Boubacar, 2018). This study contributes to the existing literature by evaluating the relationship between directors' dealings and various indicators of the information environment of the firm in a developing country context (South Africa).

This will be done by, firstly establishing whether directors' dealings trigger abnormal returns and volumes of trading in the company's stocks by determining the cumulative average abnormal return (CAAR) and cumulative average abnormal volume (CAAV) using an event study. Thereafter, a regression to investigate the relationship between the market reaction and various indicators of the information environment will be employed/

1.2 Research problem

While prior studies have separately examined the impact of directors' dealings on market performance and the role of a firm's information environment in shaping investor behaviour, there remains a notable gap in understanding how these two dimensions interact—particularly in developing markets. Specifically, it is unclear to what extent the firm's information environment (as measured by firm size, bid-ask spread, and analyst following) moderates or influences the market reaction to directors' dealings in a developing country context, such as South Africa.

1.3 Assumptions, limitations, and delimitations

The delimitation of this study is that this study will only consider legal trades, as defined in the JSE guidelines paragraph 3.66. The guidelines state that a director may only deal in securities if they have advised the chairman (or one or more appropriate directors designated for this purpose) in advance and received clearance from the chairman or designated director. The sample includes only these approved trades, that are disclosed via the Stock Exchange News Service (SENS) announcements (JSE, 2023). This study's scope is limited to JSE-listed companies only. Additionally, this study focuses on three indicators of the company information environment specifically namely, firm size, bid-ask spread and the number of analysts following the firm.

Based on the guidance provided in McWilliams and Siegel (1997) which state that the inference of significance from event studies relies on the following assumptions: 1) markets are efficient

2) the event was unanticipated and 3) there were no confounding events, the study employs the following assumptions.

The JSE holds a presence of a semi-strong form efficient market as discussed in Section 2. The event was unanticipated and the information relating to directors' dealings has not been leaked before the anticipation period defined in Section 3.4.2. Regarding confounding events, this study checked for and removed all potential observations which were likely to have included a confounding event. Since this research uses SENS announcements to identify key dates for use in the event study, it is further assumed that the SENS announcements are complete in terms of directors' dealings. Lastly, the study assumes that the share price and trading volume data collected is complete and accurate.

Limitations of this study include that not all directors' dealings may be legal and may be reported however they would still impact the stock price. This study focuses solely on the JSE limiting the generalizability of the findings to other markets with different regulatory environments and market structures. Further, in instances where the results have been found to be statistically insignificant, the discussion has been limited to the direction of the relationship.

1.4 Research purpose

This study is predicated on the notion that, where companies have a strong information environment (i.e. there are low levels of information asymmetry), there is no new information to the market from directors' dealings. The purpose of this study is, therefore, to understand the impact of directors' dealings and determine whether the impact has any relationship with each company's information environment.

1.5 Research question

The research question for this study is as follows:

1.5.1. Research Question 1 (RQ1): Do directors' dealings trigger:

- statistically significant abnormal returns (RQ1.1) and
- statistically significant trading volumes (RQ1.2) of the company's stock in JSE-listed companies?

1.5.2 Research Question 2 (RQ2): Do the stock price and trading volume reactions to directors' dealings (identified in RQ1) have a significant relationship with indicators of each company's information environment, which are:

- the number of analysts following the company (RQ2.1)
- the bid-ask spread of the company's stock (RQ2.2)
- the size of the company (RQ2.3)

To answer these RQs the study uses the following testable hypotheses. Each hypothesis has been numbered using a convention that links it to the relevant RQ.

RQ1: Do directors' dealings trigger:

- **statistically significant abnormal returns (RQ1.1) and**
- **statistically significant trading volumes (RQ1.2) of the company's stock in JSE-listed companies?**

H1.1. Directors' dealings will trigger statistically significant **abnormal returns** of the company's stock in a sample of companies on the JSE.

H1.2. Directors' dealings will trigger statistically significant **abnormal volumes** of the company's stock in a sample of companies on the JSE.

RQ2: Do the stock price and trading volume reactions to directors' dealings (identified in RQ1) have a significant relationship with indicators of each company's information environment, which are:

- **the number of analysts following the company (RQ2.1)**
- **the bid-ask spread of the company's stock (RQ2.2)**
- **the size of the company (RQ2.3)**

H2.1.1. The stock **price** reaction to directors' dealings will have a significant relationship with the **number of analysts** in a sample of companies on the JSE.

H2.1.2. The trading **volume** reaction to directors' dealings will have a significant relationship with the **number of analysts** in a sample of companies on the JSE.

H2.2.1. The stock **price** reaction to directors' dealings will have a significant relationship with the **bid-ask spread** in a sample of companies on the JSE.

H2.2.2. The trading **volume** reaction to directors' dealings will have a significant relationship with the **bid-ask spread** in a sample of companies on the JSE.

H2.3.1. The stock **price** reaction to directors' dealings will have a significant relationship with the **company size** in a sample of companies on the JSE.

H2.3.2. The trading **volume** reaction to directors' dealings will have a significant relationship with the **company size** in a sample of companies on the JSE.

1.6 Research significance

This research contributes to the existing literature on the information efficiency of markets (Fama, 1970; Shiller, 2014; Kelly, 2014). Understanding the market reaction to directors' dealings and the relationship with the information environment provides insights into the quality of the information environment and how each indicator of the information environment impacts investor perceptions and market outcomes. These insights can inform discussions on corporate disclosure policies, regulatory policies, and investor decision-making processes.

This research further establishes its significance because it is evident from the prior research (discussed in further detail in Section 2) that the company's information environment and the effect of directors' dealings on the stock price of a company have been studied largely in isolation from one another. For example, Dardas and Güttler (2011b) examine whether directors' dealings are informative but do not consider information-specific variables in their analysis while Baik et al. (2018) examine the relationship between managerial ability and the quality of the firm information environment but do not consider the relationship between directors' dealings and the information environment.

Additionally, the research surrounding directors' dealings has been mostly concentrated in developed countries such as the United States of America (Lakonishok and Lee, 2001); the United Kingdom (Ryan, 2005); Poland (Gurgul and Majdosz, 2007); Italy (Tardivo et al., 2011) and Canada (Morris and Boubacar, 2018).

This research is particularly relevant in a South African context, given the director's dealing at Transaction Capital in 2022, which sent signals to the market and resulted in at least one asset management firm taking a short position on the stock (Ambekar, 2023). This significant market reaction to directors' dealings warrants an updated analysis of the market reaction to directors' dealings. This study contributes to the existing literature by evaluating the relationship between the market reaction to directors' dealings and various indicators of the company's information environment in a developing country context (South Africa).

The rest of this study is organised as follows: Section 2 discusses prior literature; Section 3 discusses the method; Section 4 discusses the results and analysis, and Section 5 concludes.

Section 2: Literature review

The literature presented below provides an overview of relevant studies on the stock market reaction to directors' dealings and the relationship of the information environment with these reactions. This review is divided into three parts: 1) Theoretical overview 2) Prior research on directors' dealings and stock market reactions to new information and 3) Prior research on the information environment including indicators of the information environment such as analyst following, bid-ask spread and firm size.

2.1 Theoretical overview

Market efficiency

The concept of market efficiency was introduced by Fama (1965), which establishes that stock prices that fully reflect all publicly available information in an efficient market are known as the semi-strong form of market efficiency. The weak form of market efficiency dictates that stock prices reflect all historical information while the strong form of market efficiency assumes that all available public and private information is reflected in a stock's market price and that no individual has monopolistic access to any information relevant to the stock price (Fama, Fisher, Jensen and Roll, 1969; Finnerty, 1976).

Market efficiency is relevant to this study as legal directors' dealings are publicly disclosed to the market in accordance with the JSE listing requirements 3.65-3.74. As such, it would be assumed that, based on a semi-strong form of market efficiency, the information relating to the directors dealing would be incorporated into the stock price and there would be a related price adjustment.

The efficiency of stock markets has been subject to years of empirical testing and there has been particular interest in the JSE as an emerging market. Initial investigations into the efficiency of the JSE was done by Gilbertson and Roux (1977). After evaluating the results of statistical tests and trading rule simulations on share price movements, along with an analysis of mutual fund portfolios, the assumption of the JSE as an efficient market was upheld. Philpott and Firer (1994) highlight that the JSE is not an efficient market given the large, common, and frequently persisting share price anomalies. However, "pockets of efficiency" exist given that no price anomalies were found for certain pairs of shares suggesting a weak-form efficiency.

Smith, Jefferis and Ryoo (2002) used multiple variance test ratios to investigate whether eight African markets followed random walks and concluded that only the JSE followed a random walk and therefore weak form efficient. Furthermore, a study by Zhang, WU, Chang and Lee (2012) examining data from January 2000 till April 2011 across five countries, identified South Africa as one of three markets in which the weak form efficient market hypothesis was upheld.

Thompson and Ward (1995) conduct an extensive review of the efficiency of the JSE. The review covered various studies which used a variety of different methodologies over different periods. They were unable to draw a clear conclusion due to different testing methods yielding different results. However, they tended towards concluding that the JSE is a weak-form and semi-strong form efficient.

Event studies by Okeahalam and Jefferis (1999) and Robertson, Page and Smit (1999) found the JSE to be semi-strong form efficient. This finding was further supported by Glass and vd M. Smit (1995). Bhana (1994) reviewed the efficiency of the JSE using a scale from perfectly efficient to outright inefficiency. The finding that the only group of investors who are able to consistently outperform the market are company officers who trade on inside information implies the presence of a semi-strong form efficient market on the JSE. Jefferis and Smith (2004) employed an additional test of evolving efficiency to test the efficiency of seven indices. Four of the seven indices including the All Share Index were found to be efficient. The evidence suggests that larger indices rank higher up the efficiency scale than smaller indices. Heymans and Santana (2018) corroborated this result highlighting the efficiency of the All-Share index as well as the Top 40 index. Given that the All-Share index consists of companies that represent approximately 99% of companies listed on the JSE main board, these results suggest that the JSE overall is semi-strong form efficient.

The extensive research into the JSE has provided mixed results and the exact level of market efficiency of the JSE has not been definitively determined. However, sufficient evidence exists showing that the JSE is informationally efficient which is appropriate for this study. The findings of the JSE as a weak form efficient market (Philpott and Firer, 1994; Thompson and Ward, 1995; Smith et al., 2002; Zhang et al., 2012) suggest that the market would likely react once the information surrounding the dealings is disclosed, stock prices would adjust leading to abnormal returns. Alternatively, the finding of the JSE as a semi-strong form efficient market (Bhana, 1994; Glass and vd M. Smit, 1995; Okeahalam and Jefferis, 1999; Robertson et al., 1999; Jefferis and Smith, 2004; Heymans and Santana, 2018) suggests that the stock price

would not react to directors' dealings until the information is disclosed. Once publicly available the market would adjust relatively quickly to the information making it unlikely that abnormal returns would be earned. This study assumes the presence of a semi-strong form efficient market which is supported by Bhana (1994); Glass and vd M. Smit (1995); Okeahalam and Jefferis (1999); Robertson et al. (1999); Jefferis and Smith (2004) and Heymans and Santana (2018).

Role of the information environment

Zeghal (1984) explains that the information environment refers to the amount of information available about a firm (the amount of information refers to all information at any given time that is relevant to determining security prices). The information environment constitutes all the mechanisms that influence the availability, dissemination and interpretation of information, such as size, availability of resources and corporate governance and reporting. The information environment plays a crucial role in shaping the stock market's reaction to events such as directors' dealings by influencing the flow and quality of information available to investors (Piotroski and Wong, 2012). In simpler terms, the information environment influences the level of information asymmetry, which influences the stock market's reaction to events. This level of influence is what makes the information environment a vital aspect of all companies. Information asymmetry arises when different market participants possess different levels of information about a company (Akerlof, 1970). Akerlof (1970) highlights the impact of information asymmetry on the market. He notes that in a market infiltrated by information asymmetry, average prices become distorted because of the premium that buyers factor in because of low quality. This adjustment in prices results in reduced transaction volumes because sellers who are not willing to sell at undervalued prices are driven out of the market. Consequently, there is an overall decrease in market activity and liquidity which are vital components of a healthy economic market. These findings highlight the impact of information asymmetry and how it can lead to market inefficiency. Furthermore, the findings underscore the importance of the factors that influence and can potentially reduce information asymmetry such as the information environment to ensure maximum market efficiency and transparency.

Information asymmetry forms part of information economics and is the main foundation of signalling theory (Stiglitz, 2002) which is one of the main theories upon which directors' dealings and insider trading research is based along with market efficiency (Lorie and Niederhoffer, 1968; Seyhun, 1986; Meulbroek, 1992; Chakravarty and McConnell, 1999;

Lakonishok and Lee, 2001; Mordant and Muller, 2003; Etebari, Tourani-Rad and Gilbert, 2004; Neill, Mehdi and Watts, 2008; Wang, Shin and Francis, 2012). Consequently, the information environment, which influences the level of information asymmetry is an appropriate area of research for this study.

2.2 Market reaction to director's dealings

Prior research on directors' dealings

The investment community shows strong interest in trading by insiders, driven by the belief that insiders possess valuable information about a company's future prospects (Lorie and Niederhoffer, 1968; Bonaimé and Ryngaert, 2013; Nanda and Barai, 2020). Knowledge of these trades is thought to provide insights into a company's likely performance in the future (Lorie and Niederhoffer, 1968). The subject of trades by insiders has been studied in many ways, with research being conducted on both illegal and legal insider trading.

Insider trading regulations in South Africa

The Financial Markets Act No. 19 of 2012 section 78 (1) (a), defines insider trading as “An insider who knows that he or she has inside information and who deals directly or indirectly or through an agent for his or her own account in the securities listed on a regulated market to which the inside information relates or which are likely to be affected by it”. More generally, insider trading refers to the trading of a company's stock based on material non-public information (Meulbroek, 1992; Cornell and Sirri, 1992; Chakravarty and McConnell, 1999; Nanda and Barai, 2020).

The JSE listing requirements rules 3.63 to 3.74 contain the regulations implemented by JSE relating to directors' dealings to avoid the exploitation of inside information by directors. The regulations require that the details of all transactions made by a director and/or company secretary be announced by the JSE via the SENS announcements including but not limited to the details of the transaction such as the value, number of shares and nature of the transaction. According to rules 3.67 and 3.69, a director must not be given clearance to deal and may not deal in any securities during a closed period as defined or at any time when they are in possession of price-sensitive information in relation to those securities (JSE, 2023). These rules help regulate directors' trading behaviour and prevent them from obtaining an unfair advantage through the use of inside information.

To further enhance transparency and investor confidence, the JSE listing requirements enforce strict disclosure requirements which mandate that companies publicly disclose material information that could impact their stock prices including directors' dealings. The disclosure requirements in rule 3.65 state that a director's trade must be reported to the issuer by no later than 3 business days after the trade has occurred. The issuer is then required to announce the trade by no later than 24 hours after the receipt of the information from the director. By ensuring that material information is publicly available, it reduces the likelihood of insiders gaining an unfair advantage. The enforcement of these regulations helps prevent illegal insider trading which improves stock price informativeness and reduces the level of information asymmetry between insiders and outside investors by reporting the trading activities of insiders, otherwise known as directors' dealings, to the market (Ojah, Muhanji and Kodongo, 2020). This is supported by Etebari et al. (2004) who conducted a study in New Zealand which shows that trades requiring immediate disclosure earn insignificant returns compared to trades for which delayed disclosure is allowed.

Signalling theory

The research surrounding directors' dealings often draws on signalling theory and information asymmetry which suggests that directors, who have access to private information about a company, signal this information to the market through their trading activities (John and Lang, 1991). Directors' dealings are viewed as informative signals and multiple studies investigate the profitability of directors' dealings as signals by calculating the abnormal returns earned by directors on their trades, the majority of which have consistent findings. The magnitude of the abnormal returns varies across studies as they are often influenced by factors such as the directors' role, transaction and company characteristics and geographical location.

The findings of studies relating to illegal insider trading show mixed results. Meulbroek (1992) and Cornell and Sirri (1992) find that insider trading has a significant correlation with stock price run-ups suggesting that insider trades affect price discovery differently from non-insider trades. The findings of Meulbroek (1992) and Cornell and Sirri (1992) further showed that illegal insider trading increased stock price accuracy and market liquidity. The illegal trades result in price adjustments that bring the stock closer to its "true value" by reflecting the non-public material information on which the trade is based (Meulbroek, 1992). However, these adjustments are caused by trades made by insiders who have an information advantage over outsider investors. This is further evidenced by Jarrell and Poulsen (1989) who find that 40%

of the total price increase linked to successful tender offers occurs before the first public announcement of a bid or related event suggesting that individuals with knowledge about the event may be trading on this information prior to the announcement causing the stock price to rise. This finding again illustrates that insiders are using their informational advantage for their benefit at the expense of outsiders which creates an unfair market environment.

In contrast, Chakravarty and McConnell (1999) analysed the trading activity of a confessed illegal insider trader and found that they were unable to distinguish the price effects of the informed purchases from the effects of the non-informed purchases. Given that the trades were illegally informed, they would not have been subject to any form of regulation or disclosure, which makes it possible that the results of the market reaction to the trades vary because of the trade-specific characteristics such as value or company specific characteristics such as size as opposed to knowledge of the trades occurring (Neill et al., 2008). The results of these studies highlight the issue of information asymmetry in financial markets which can lead to unfair advantages for those with superior levels of information. To avoid eroding trust and investor confidence in financial markets, regulators were prompted to implement regulations to reduce the information advantage of insiders and create a fairer market environment.

Mordant and Muller (2003) conducted the initial investigation of directors' dealings on the JSE and found that directors can earn abnormal returns from the trades. Jaffe (1974) found that shares traded and held for 8 months can earn abnormal returns of 1.4%. The findings of Finnerty (1976) report excess returns for both purchases and sales of 8.3% and 4.8% respectively when held for 12 months. Seyhun (1986) highlights that while abnormal profits are possible from insider trades, trading costs and firm size affect the magnitude of the abnormal profits, with small firms earning the highest abnormal returns but experiencing the highest trading costs suggesting that insiders only choose to exploit information when the expected value exceeds the costs of trading. Lakonishok and Lee (2001) confirm these findings highlighting that the performance of aggregate insider activities is related to firm size, and extensive insider purchases outperform extensive insider sales by 7.4%. In contrast, Neill et al. (2008) finds directors' sales to be more profitable than directors' purchases in Australia. Their findings which show that trades that are smaller in transaction value and within small-cap companies generally earn the largest abnormal returns appear to confirm those of Seyhun (1986) further highlighting the variations in abnormal returns that exist due to certain characteristics. Wang et al. (2012) examine directors' dealings with CEOs and CFOs in the United States of America and their findings that CFOs earn statistically significantly higher

abnormal returns than CEOs highlight how the position of the insider can affect the abnormal returns generated by their trades.

The research surrounding the abnormal volumes related to directors' dealings has not been as in-depth as the studies related to abnormal returns. This is because abnormal returns are inherently associated with firm valuation, investment profitability and market efficiency. While abnormal returns can indicate the market reaction to new information or changes in investor sentiment making them more favourable measures to be used in studies, abnormal volumes indicate heightened trading activity, which may also indicate the market reaction to an event even if the price does not immediately move.

Studies by Hiemstra and Jones (1994) and Chen, Hong and Stein (2001) investigate the relationship between stock prices and volume. Their findings support those of Gallant, Rossi and Tauchen (1993) which indicates a positive relationship between stock prices and trading volume, as the results show that a large price movement generates increased trading volume. The existence of this positive relationship suggests that trading volume can contain some level of information in a similar way that stock prices do. This is further evidenced by Pan and Poteshman (2006) who found evidence of informed trading in the options market and consequently, that option trading volume contains information about future stock price movements. The effect of informed trades on trading volumes has been proposed by Givoly and Palmon (1985) as the “leading indicator hypothesis” which suggests that insider trades act as a leading indicator or signal of future events within the company which investors attempt to mimic based on the belief that insiders are better informed which results in increased trading volumes. The notion of increased trading volume because of directors’ dealings is further confirmed by Lorie and Niederhoffer (1968); Chang and Suk (1998); Bonaimé and Ryngaert (2013); and Nanda and Barai (2020). Additionally, abnormal volumes may be useful in detecting information leakage and illegal insider trading as Meulbroek (1992) demonstrates through the finding that most of the abnormal volumes experienced on insider trading days constitute illegal insider trading volume. In a model presented by Easley and O'hara (1987), informed investors can vary the quantity of their trades, producing different effects on stock prices, and undermining market efficiency. This finding suggests that monitoring trading volumes can provide further insights into possible manipulation that may occur by informed investors (Easley and O'hara, 1987).

The findings of the prior research show that the price reaction (abnormal returns) associated with directors' dealings can vary due to a variety of factors such as the holding period, firm size or insider position. Furthermore, the prior studies relating to the volume reaction (abnormal trading volume) provide an array of evidence of the relationship between stock price and the influence of informed trading on trading volume. Nanda and Barai (2020) (discussed further in Section 2.3) report that insider transactions significantly impact price, return and volume but there is no relationship between abnormal price and abnormal volume. This result suggests that the price reaction to directors' dealings is independent of the volume reaction to directors' dealings which underscores the importance of this study investigating both the price reaction and volume reaction.

2.3 Information environment

As discussed in Section 2.1, the information environment influences information asymmetry which ultimately defines the market reaction to events, which in the context of this study is directors' dealings. The relevance of the information environment to directors' dealings is further highlighted by Dang, Foerster, Li and Tang (2021) who note that both the intensity and profitability of trades by insiders depend on a firm's information environment. The information environment is made up of various mechanisms that influence the amount of information available about a company. This study uses 3 indicators of the information environment namely, analyst following, bid-ask spread and firm size. These indicators are chosen because of their strong association with the availability and quality of information. This can be seen in the study by Shores (1990) which considered the association between interim information and security returns surrounding earnings announcements, where firm size, the number of financial analysts, and the bid-ask spread were all used as proxies for the interim information environment.

Prior research

There is limited research which examines the relationship between the market reaction to directors' dealings and the information environment given that the majority of the research within this area is focused on the informativeness of directors' dealings because of the increased levels of information asymmetry. In examining the relationship between directors dealings and market characteristics of price and volume, Ryan (2005) and Nanda and Barai (2020) provide insights into how directors' dealings impact stock characteristics such as price, return and volume while Ryan (2005) also considers the information environment of firms. The studies

are conducted in different contexts with Ryan (2005) based in the United Kingdom and Nanda and Barai (2020) in India.

Ryan (2005) examines the relationship between the ability of directors' dealings to trigger company price/ trading volume activity and the richness of a firm's information environment using trading data from the London Stock Exchange. The study addresses both the price and trading volume impact of directors' dealings because directors' dealings can potentially communicate different dimensions of the news content of such trades. It is reported that "Price changes reflect changes in the aggregate markets' average beliefs, while trading volume is the sum of all individual investors' trades. Thus, trading volume preserves differences among individual investors that are cancelled out in the averaging process that determines equilibrium prices. Given these differences, it is possible that directors' trades may generate significant trading volume movements but less significant price changes and vice versa" (Ryan, 2005, p.334). Similarly, Nanda and Barai (2020) considers the effect of insider transactions on stock characteristics of price, return and volume. They aim to establish if insider trading affected stock characteristics such as price, return and volume.

Nanda and Barai (2020) report that insider trades consisting of both purchase and sale transactions significantly impact stock characteristics of price, return and volume while Ryan (2005) finds that the ability of directors' trades to trigger economically significant price changes and trading volume activity diminishes in situations of increased analyst following and firm size but is not related to the information content of a firm's financial statements. The results suggest that increased analyst following, and firm size may have an impact on the stock characteristics of price and volume. This further suggests that the company information environment (the firm size and analyst following indicators specifically) may have a relationship with the market impact of directors' dealings which this study aims to investigate.

Indicators of the company information environment

The indicators of the information environment in this study are firm size, number of analysts following the firm and bid-ask spread. These indicators are chosen because of their strong association with the availability and quality of information. This can be seen in the study by Shores (1990) which considered the association between interim information and security returns surrounding earnings announcements, where firm size, the number of financial analysts, and the bid-ask spread were all used as proxies for the interim information environment. A more transparent information environment implies lower levels of information

asymmetry and subsequently improved market efficiency. This implication is confirmed by Frankel and Li (2004).

Analyst following

Analyst following is widely recognised in financial literature as an indicator of the information environment of a firm. Analysts are generally seen as responsible for the collection and production of information evidenced by Brennan and Hughes (1991) and Bhushan (1989) who equate analyst following with the economy-wide amount of information gathering in their models of stock splits and disclosure respectively. By disclosing information to the public through their reports, analysts can reduce the information asymmetry between insiders and outside investors. Additionally, the monitoring of firms by analysts encourages the acquisition of information by outsiders which further improves the information environment (Dang et al., 2021). The importance of analysts is further enhanced by Fishman and Hagerty (1992) who show that the absence of analysts gives insiders a monopoly over price-sensitive information allowing them to benefit from informational advantages (Ellul and Panayides, 2018). It is on this basis that analyst coverage is associated with the information environment. Yu (2008) found that increased analyst coverage has stronger effects on earnings management thereby resulting in more accurate information for investors. This suggests that analyst following may also be indicative of the quality of the company information environment. Furthermore, He and Lin (2015) investigate the value relevance of comprehensive income reporting in China and apply analyst following as the proxy for the firm information environment. They find that analyst following contributes to reducing information asymmetry and increasing information preciseness. Wang (2019) investigates the information environment from the perspective of the relative information content of analyst recommendations and insider trades. Their findings indicate that analysts may have relative informational expertise in industry-specific information as opposed to firm-specific information when compared to insiders. However, the industry expertise does not preclude them from having firm-specific information which would contribute to reducing information asymmetry and improving the information environment. Soltes (2014) notes that analysts acquire firm-specific information through private communications with management, which occur closer to the time when analysts publish their reports. This reinforces that analysts can provide more information about firms to the market and ultimately improve the information environment. Leece and White (2017) find that analysts tend to herd towards stocks with more opaque information environments and greater information asymmetry. This behaviour results in these stocks having a greater analyst

following and subsequently being reported on more frequently which reduces the information asymmetry associated with those stocks, which once again, highlights the contribution of analysts to the information environment. Collectively, these studies show the association between analyst following and the company information environment which underscores why it is a suitable indicator for this study.

Previous empirical studies show an association between analyst following and profitability of a varying degree. Frankel and Li (2004) investigate the effect of analyst coverage on the profitability of insider trades. They find that increased analyst following is associated with reduced profitability of insider trades and reduced insider purchases. Ellul and Panayides (2018) confirm these findings however their research extends more broadly into how interactions between analysts and insiders impact price discovery and liquidity. Dang et al. (2021) investigates analysts, information and insider trading, their results confirm those of Chan and Hameed (2006) which shows that the number of analysts following a stock is positively associated with market returns. These results suggest the analyst following may have an impact on the market reaction which this study aims to investigate.

Bid-ask spread

The bid-ask spread is used as a measure of information asymmetry as empirical studies show a positive relationship between the bid-ask spread and measures of information asymmetry. A wider bid-ask spread reflects greater information asymmetry among market participants while a narrower spread reflects less informational imbalance (Chung, McInish, Wood and Wyhowski, 1995). Glosten and Milgrom (1985) model how the bid-ask spread is affected by the presence of traders with different levels of information and show that the spread increases with the degree of information asymmetry. They suggest that losses suffered in trades by insiders are recouped by market makers widening the spread. The subsequent trading volume and price volatility are shown to be significant determinants of the spread. Venkatesh and Chiang (1986) support this finding showing that the market makers spread can be used to test for an increase in information asymmetry before an anticipated event. Three groups of announcements are studied, and the results indicate that the market maker will suspect a nonroutine announcement with an increase in information asymmetry when more than 10 days are separating the second announcement from the first.

Kim and Verrecchia (1994) report that more information asymmetry at the time of announcements increases bid-ask spreads as market makers widen the spread to protect

themselves from informed trades. Their results are shown to be robust as Tung (2000) confirm their findings for earnings announcements of NASDAQ firms and Gregoriou, Ioannidis and Skerratt (2005) show a similar sentiment of market makers increasing the spread due to increased information asymmetry in the United Kingdom. Moreover, Leuz and Verrecchia (2000) utilise the bid-ask spread as a proxy for information asymmetry given their observation that when information asymmetry is minimal, investors are less concerned about adverse selection and are more willing to trade resulting in lower bid-ask spreads.

Despite previous studies which utilise measures other than the bid-ask spread such as unsystematic risk, institutional holdings and insider ownership as proxies for information asymmetry, these are indirect measures and not completely satisfactory (Chung et al., 1995). The studies discussed in this section highlight how the bid-ask spread is an indicator of the distribution of information in the market which makes the bid-ask spread a suitable indicator for the company information environment.

Size

Firm size is recognised as an indicator of the information environment because of its relationship with information asymmetry and the availability of firm-specific disclosures. Zeghal (1984) investigate the effect of firm size on the informational content of the financial statements. Their findings highlight firm size as an indicator of the amount of information available about a firm given the inverse relationship between firm size and the informational content of their financial statements. This relationship is explained by the availability of information about firms prior to the announcement of the financial statements. Economies of scale allow larger firms to allocate more resources to producing information allowing for more publicly available information and reducing the informational content of their financial statements. A study by Asthana and Mishra (2001) examines the effects of the sizes of announcing and non-announcing firms on information transfers. They report that the disclosures by large firms should contain more relevant information for other firms in the same industry group suggesting that information transferred in an industry is positively related to the announcing firm's size. Zadeh and Eskandari (2012) review risk disclosures and investigate the firm-specific characteristics which can influence the level of disclosure. Although there are several firm-specific characteristics which can influence the level of disclosure, their study reviews literature focused on firm size and theories, measurement of firm size and the importance of firm size on the level of risk disclosure. They find that firm size can influence

the level of risk disclosure and there is a positive relationship between firm size and the level of risk disclosure indicating that information availability varies with firm size thus making firm size a suitable indicator for the company information environment.

Previous empirical research suggests that besides the level of information asymmetry which exists between insiders and outside investors, there may be other factors, such as firm size, which fall within the information environment, that influence the abnormal returns generated and consequently the market reaction to directors' dealings. Mordant and Muller (2003) investigate the profitability of directors' stock dealings on the JSE and show that directors can earn abnormal returns from their stock transactions. However, they conclude that the bulk of the outperformance does not result from the fact that the director traded in the share but rather as a result of the influence of the market effects of size, value and resources. Cheuk, Fan and So (2006) find that insiders in Hong Kong can earn abnormal profits from both buying and selling activities, however, the magnitude and duration of abnormal profits depend significantly on firm-specific and transaction-specific factors. Neill et al. (2008) find that profits arising from directors' trades in Australia appear to be negatively related to transaction value and firm size, specifically within small-cap companies.

Interaction between the indicators of the information environment

Brent and Addo (2012) conduct a systematic review of information asymmetry and firm characteristics which produces the finding that larger firms are more efficient at minimising information asymmetry suggesting that large firms have a better information environment. This is supported by Bhushan (1989) and O'Brien and Bhushan (1990) who find that analyst following is positively related to firm size because of the higher concentration of institutional investors in larger firms and consequently an improved information environment. Gregoriou et al. (2005) provide further evidence of these interactions noting that larger company stocks are more liquid, traded more frequently and have their performance more closely monitored by analysts reducing the risk of the stock and incidence of potential information asymmetry resulting in a lower bid-ask spread. The knock-on effect of these interactions strengthens the suitability of firm size as an indicator of the information environment.

Chung et al. (1995) further highlights why analyst following, and bid-ask spread are suitable indicators for the information environment by providing insights into the production of information, information asymmetry and the bid-ask spread. Their findings suggest that the extent of information asymmetry and consequently the bid-ask spread is deduced by market

makers observing how many analysts are following a stock. This is based on the idea that a stock with greater information asymmetry generates more analyst following because the value of private information is higher with greater information asymmetry. Similarly, financial analysts consider the profit potential of a stock using the bid-ask spread based on the assumption that a stock with a wider spread has a greater level of information asymmetry. The interaction between the market makers, who set the bid-ask spread and analysts ultimately results in the creation of information for the market which positively contributes to the information environment of companies. This reinforces the suitability of analyst following, discussed above, and the bid-ask spread as indicators of the information environment.

Synthesis

The majority of the prior research discussed in Section 2.2 indicates that there is a price and volume reaction to directors' dealings of varying degrees. The findings of this prior research are robust, given that the studies were conducted over different periods and in a variety of contexts with different market and regulatory factors. However, despite its robustness, the prior research remained focused on the informativeness of directors' trades for outside investors. This study aims to further investigate the efficiency of the market and the signalling effect of directors' dealings in the emerging market context of the JSE by determining whether the directors' dealings trigger statistically significant abnormal returns and volumes in a company's stock.

Sections 2.2 and 2.3 present an array of research which considers the relationship and influence of information asymmetry on trades by insiders, however, the research has not presented evidence of a relationship between the market reactions of these trades and the information environment itself. This study aims to address this gap by investigating whether a statistically significant relationship exists between the market reaction to directors' dealings and the indicators of the information environment discussed in Section 2.3.

Section 3: Methodology

3.1. Event study methodology

The seminal study conducted by Ball and Brown (1968) examined the relationship between accounting earnings and stock prices. Ball and Brown (1968) considered whether accounting income numbers contain value-relevant information for investors and whether stock prices efficiently reflect this information. It was one of the first papers to employ empirical methods to test accounting theories and introduced the event study methodology. Their findings suggest that accounting income numbers contain value-relevant information in that if the actual income differs from the expected income, the market typically has reacted in the same direction. This provides empirical evidence which supports the semi-strong form of market efficiency (Fama et al., 1969). This study will follow the event study methodology employed by Ball and Brown (1968) and seeks to contribute to the existing literature on the efficient market hypothesis by evaluating the market's reaction to directors' dealings and the adjustment of trading price and volume to reflect new information.

This is a quantitative study whose method follows the seminal event study of Ball and Brown (1968). This study uses an event study methodology to evaluate the relationship between the stock price and trading volume reaction to directors' dealings and the company's information environment. Event studies have been used in similar studies such as Mordant and Muller (2003), Ryan (2005), Cheuk et al. (2006), Wang et al. (2012) and Nanda and Barai (2020). The cumulative average abnormal returns (CAAR) and the cumulative average abnormal volume (CAAV) were calculated to measure the stock price and trading volume reaction to the directors' dealings. Both the CAAR and CAAV were calculated to measure the price reaction and the volume reaction given their independence from one another as discussed in Section 2.2. Thereafter, a regression analysis was performed using the CAAR and the CAAV as the dependent variables and the indicators for information environment (see Section 3.4.2) as independent variables to determine if there is a relationship between the stock price and trading volume reaction to directors' dealings and the company's information environment.

3.2. Population and study sample

The population for this research has been defined as all on-market directors' dealings for companies on the JSE as reported in the SENS announcements between 1 January 2022 and 31 December 2023. Consistent with Ryan (2005), a two calendar-year period is used to ensure that sufficient historical data can be collected for the estimation period, given the differing financial

year ends. The period begins on the 1st of January 2022, as 2022 is the first year in which the South African economy displayed pre-pandemic levels of operating with minimal business and economic disruption due to the COVID-19 pandemic. According to StatsSA, the South African economy took almost two years to recover from the worst of the Covid-19 pandemic and in the first quarter of 2022, the South African gross domestic product (GDP) rebounded to its pre-pandemic levels. Additionally, the 2-year period minimised the risk of having two directors' trades that had different relationships with each of the indicators of the information environment caused by the trades occurring at different phases of the economic cycle. This approach helps ensure that the observed relationships of the market reaction to the directors' dealings and their relationship with the information environment are not confounded by changes in the economic cycle.

The sample for this study includes directors' dealings from 90 companies comprising 30 small companies, 30 medium companies and 30 large companies on the JSE. The reason for this is to ensure that the population of the JSE is adequately represented within the data collected and further to ensure the robustness and generalisability of the findings across companies of different sizes. This is important given the findings in Section 2 which highlight that the market reaction to directors' dealings may vary across companies of different sizes and that company size can serve as an indicator of the information environment. The companies were stratified by size according to their market capitalisation and categorised as small, medium, or large companies. The average market capitalisation of each company over the period was compared to the average market capitalisation of the small, medium and large cap index over the event period to mitigate short-term fluctuations and ensure a more stable index value. Companies with a market capitalisation smaller than or equal to the small, medium, or large-cap index were categorised as small, medium or large respectively. The 90 companies were selected from the pool of companies which reported on-market directors' dealings. Within each size category (small, medium and large), 30 companies were selected based on the presence of directors' dealings during the event window. Off-market transactions reported in the SENS announcements have been excluded from the sample. Although off-market transactions such as the acceptance of stock in terms of a company remuneration policy are still reported in the SENS announcements, these transactions occur outside of the JSE and do not have an impact on the stock characteristics of price and volume which is the focus of this research.

After adjusting for confounding events, the data collection indicates 247 SENS announcements relating to dealings from large companies, 173 announcements from medium companies, and

162 announcements from small companies. The expected, abnormal and cumulative abnormal returns have been determined for all events within the sample.

3.3 Data collection

To answer RQ 1, the following data were collected.

- The daily stock price and trading volume data were collected for each company within the sample from 90 days prior to each event date to 5 days after each event date (see estimation and event window for further details).
- The company-specific beta, the annual return on the 10-year retail government bond and 3-year return on the JSE All Share Index were also collected to calculate the expected return.
- The JSE sector index values were obtained to check for confounding events.

To answer RQ 2, the following data was collected.

- The market capitalisation of each company within the sample for the 2022 and 2023 years of assessment.
- The bid-ask spread was collected for each day from the anticipation window to the post-event window (see estimation and event window for further details).
- The average number of analysts following the firm over the period of 1 January 2022 to 31 December 2023.
- The total revenue of each company within the sample for the 2022 and 2023 years of assessment (for the purposes of sensitivity analysis).

All this data was collected from the EquityRT database apart from the risk-free rate and the 3-year return on the JSE All Share Index which was obtained from the RSA Retail Bonds and Satrix website respectively.

3.4 Method

3.4.1 Research Question 1 (RQ1)

RQ1: Do directors' dealings trigger:

- statistically significant abnormal returns (RQ1.1) and

- statistically significant trading volumes (RQ1.2) of the company's stock in JSE-listed companies?

The method used to address RQ 1 is as follows.

An event study method was used to answer RQ1. The analysis used in this study follows that of Ball and Brown (1968); Nkongho and Makina (2020) and Nanda and Barai (2020) by calculating a t-test with a significance level of 0.05 to test whether the CAAR and CAAV calculated for each director's dealing are statistically significant.

The abnormal return was calculated as follows:

$$AR_{i,t} = R_{i,t} - ER_{i,t} \quad (\text{Equation 1})$$

- where $AR_{i,t}$ is equal to the abnormal return of stock i on day t;
- $R_{i,t}$ is equal to the actual return of stock i on day t
- $ER_{i,t}$ is equal to the expected return for firm i on day t.

The actual return for day t was expressed as a percentage and computed as follows:

$$\frac{(R_{i,t} - R_{i,t-1})}{R_{i,t-1}} \quad (\text{Equation 2})$$

The expected return ($ER_{i,t}$) was calculated using the market model as follows:

$$ER_{i,t} = R_f + \beta_i (R_{m,t} - R_f) \quad (\text{Equation 3})$$

Where:

- $R_{m,t}$ is the return on the JSE All Share Index (ALSI) on day t,
- R_f is the risk-free rate defined as the annual return on the 10-year retail government bond.
- β_i is the beta coefficient for each specific firm i.

Given that we are dealing with a short event period and daily data, more sophisticated return-generating models such as the Fama and French 3-factor model are unlikely to add to the results (Brown and Warner, 1985; Kothari, 2001).

The JSE All Share index was used because it best represents the return of the market as the index consists of companies that represent approximately 99% of companies listed on the main board of the JSE by market capitalisation (JSE, 2024).

Given that the daily abnormal returns were calculated, the ALSI and the risk-free rate used in the expected return formula above were converted to daily rates to enable the calculation of a daily expected return.

The abnormal volume ($AV_{i,t}$) was calculated as follows:

$$AV_{i,t} = RV_{i,t} - EV_{i,t} \quad (\text{Equation 4})$$

where $RV_{i,t}$ is equal to the actual trading volume of firm i on day t and $EV_{i,t}$ is equal to the expected trading volume of firm i on day t .

The expected volume ($EV_{i,t}$) was determined as follows:

$EV_{i,t}$ = the average volume traded over the estimation window from $t-90$ to $t-6$. (see estimation window below)

The abnormal returns and abnormal volumes were calculated daily for each SENS announcement related to directors' dealings for each company within the sample. These abnormal returns and abnormal volumes were then used to calculate the cumulative abnormal returns and cumulative abnormal volumes respectively.

The stock price and trading volume reaction to directors' dealings were measured using the cumulative average abnormal return (CAAR) and the cumulative average abnormal volume (CAAV) respectively over the event window. The abnormal returns and volumes are assumed to reflect the stock market's reaction to the arrival of new information being the directors' dealings (Wolmarans and Sartorius, 2009). This method is consistent with Cheuk et al. (2006), Dardas and Güttler (2011a), Wang et al. (2012) and Nanda and Barai (2020).

The CAAR were calculated as follows:

$$CAAR = \sum_{t=1}^T \frac{1}{N} \sum AR_{i,t} \quad (\text{Equation 5})$$

Where N is equal to the number of observations within the sample, T is the number of days post the event date and $AR_{i,t}$ is the abnormal return for firm i on day t .

The cumulative average abnormal returns were calculated for the anticipation window (being five days prior up to one day before the SENS announcement of the director's dealing), the event date and five days post the event date.

The CAAV was calculated as follows:

$$CAAV = \sum_{t=1}^T \frac{1}{N} \sum AV_{i,t} \quad (\text{Equation 6})$$

where N equals the number of observations in the sample, T is the number of days post the event date and $AV_{i,t}$ is equal to the abnormal volume of firm i on day t.

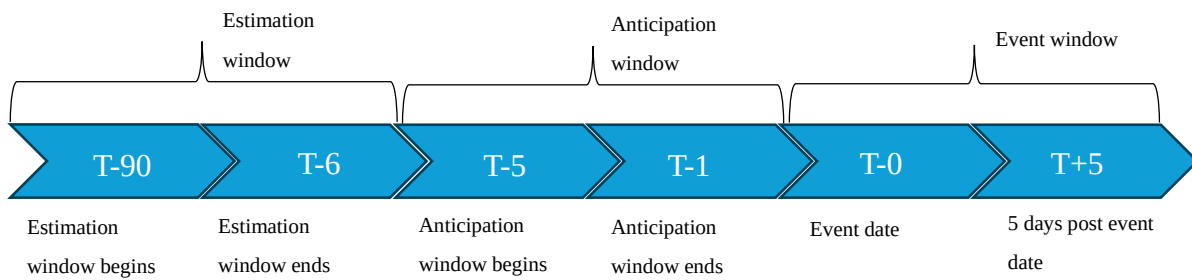
The cumulative average abnormal volumes were calculated for the anticipation window (being five days prior up to one day before the SENS announcement of the director's dealing), the event date and five days post the event date.

The CAARs and the CAAVs were tested using non-parametric tests to identify if they were significantly different from 0. The use of non-parametric tests has been shown in numerous successful studies to improve statistical rigour (Corrado, 1989; Zivney and Thompson, 1989; Corrado and Zivney, 1992; Campbell and Wesley, 1993; Corrado and Truong, 2008) and is suitable when the data is not normally distributed. The Wilcoxon signed-rank test has been performed as it considers both the sign and magnitude of the abnormal returns (McWilliams and Siegel, 1997). The test is more advanced than a signed non-parametric test as it measures the extent to which the returns deviate from the median value in addition to comparing whether the abnormal returns are significantly different to zero (as is done with a sign test) (Gladyssek, 2012).

3.4.2 Estimation and event window

The timeline of the entire event period consists of three periods, namely the estimation window, the anticipation window and the post-event window as shown in Figure 1 below. The estimation window is an 84-day period starting from 90 days (t-90) before the event and ending 6 days (t-6) before the event. The anticipation window is 5 days starting from 5 days (t-5) before the event and ending 1 day (t-1) prior to the event. The anticipation window is included to detect the existence of an anticipation effect before the announcement (Wai Kong Cheung, 2011). The event window is 5 days from t-0 to t+5. The timeline is illustrated in Figure 1 below.

Figure 1: Timeline of the event study



This estimation window in event studies conducted by Cheuk et al. (2006), Firth, Leung and Rui (2011) and Gregory, Tharyan and Tonks (2013) which investigates the effect of insider trading on returns is more than 200 days. However, studies by Eyssell and Arshadi (1993) and Bajo (2010) which study the effects of insider trading on volume use shorter estimation windows of 100 days and 66 days respectively. Given that this study investigates the stock price and trading volume reaction to directors' dealings, a shorter estimation window of 90 days is used which is similar to Nanda and Barai (2020). The anticipation window begins 5 days before the event date because 5 days is the maximum amount of time allowed between the transaction date and the announcement of the transaction. The JSE listing requirements paragraph 3.65 require that the trade is reported to the company no later than three business days after the dealing and the company is required to announce the information no later than 24 hours after the receipt of such information (JSE, 2023).

T-0 is the day of the SENS announcement because before that the trade is not known to the market. The short event window of 5 days is optimal for this study because it allows for the focus to remain on the initial market reaction to the event without the influence of other events in subsequent trading days. Additionally, it has been empirically demonstrated by Ryngaert and Netter (1990) that a shorter event window will usually capture the significant effect of an event. Several studies utilise a short event window to capture the initial market reaction such as early studies by Dyckman, Philbrick and Stephan (1984) and Brown and Warner (1985) which examine the use of daily stock returns in event studies and both utilise an event window of 5 days after the event date. The event window is shorter than that of Kumar and Halageri (2011) however, their study considered the impact of a stock split announcement on stock prices which would illicit a different reaction over a different period compared to the announcement of a director's dealing.

3.4.3 Research Question 2 (RQ 2)

RQ2: Do the stock price and trading volume reactions to directors' dealings (identified in RQ1) have a significant relationship with:

- the size of the company (RQ2.1)
- the bid-ask spread of the company's stock (RQ2.2)
- the number of analysts following the company (RQ2.3)

The method used to answer RQ2 is as follows.

In line with Thalassinos, Maditinos and Paschalidis (2012) and Nanda and Barai (2020) a regression analysis was employed to determine the relationship between the stock price and trading volume reaction to directors' dealings and the company's information environment. The indicators for the information environment were the independent variable while the CAAR and the CAAV were the dependent variable.

The indicators for the company information environment are defined as follows: Firm size is defined as the natural log of market capitalisation and is termed 'SIZE'. The bid-ask spread is defined as the natural log of the median of the difference between daily closing bid and ask prices divided by their midpoint and is termed 'BID-ASK' (Barth, Cahan, Chen and Venter, 2017). The number of analysts is defined as the number of analysts producing recommendations for our sample of firms per EquityRT and this variable will be termed 'ANA'. The CAAR and CAAV will be obtained from the calculations performed for RQ1 (see data analysis section 3.5.1).

The following models were used:

$$CAAR_{jit} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 BID-ASK_{i,t} + \alpha_3 ANA_{i,t} + \epsilon_1 \quad (\text{Equation 7})$$

$$CAAV_{jit} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 BID-ASK_{i,t} + \beta_3 ANA_{i,t} + \epsilon_2 \quad (\text{Equation 8})$$

where CAAR and CAAV are the natural log of the cumulative average abnormal return and volume respectively for event j in company i at time t . SIZE, BID-ASK and ANA are the indicators for the company information environment for company i at time t as defined in section 3.4.2. $\alpha_1, \alpha_2, \alpha_3$ and $\beta_1, \beta_2, \beta_3$ are the coefficients of the variables. ϵ_1 and ϵ_2 are the error terms. The CAAR, CAAV, market capitalisation and bid-ask spread were transformed using

the natural logarithm to enhance the normality of the data set to ensure the assumptions are met for the model to produce reliable results.

Each regression model was repeated three times using the data collected for small, medium and large companies respectively thus resulting in 6 regression models in total. Each model was run independently. The models are denoted as follows: Models 1 and 2 relate to the CAAR and CAAV of small companies respectively; Models 3 and 4 relate to the CAAR and CAAV of medium companies respectively; Models 5 and 6 relate to the CAAR and CAAV of large companies respectively.

The chosen model was derived from the model used by Ryan (2005) which incorporated firm size, number of analysts and absolute values of cumulative abnormal returns as dependent variables while price and trading volume movements driven by directors' trades served as independent variables. The model used in this study was adapted to its current version for reasons highlighted in section 2.

A correlation matrix consisting of the Pearson correlation coefficient was presented to indicate the strength and direction of the relationship between the indicators as defined in section 3.4.2 and the CAAR and CAAV respectively.

The coefficients calculated from the regression equation were used as a measure of the relationship between the stock price and trading volume reaction to directors' dealings and the information environment. A t-test with a 0,05-significance level was used to determine whether the coefficient is statistically significant. A coefficient with a p-value of less than 0,05 is statistically significant.

Sensitivity tests

A sensitivity test was conducted to ensure that the regression models used in this study are robust to different measurement approximations of company size. This is an important test given the range of literature which uses different measures such as market capitalisation used in Kothari, Shanken and Sloan (1995), Ryan (2005), Linck, Netter and Yang (2008) and Hou, Xue and Zhang (2020). In contrast studies by Titman and Wessels (1988), Hart and Oulton (1996) and Gabaix, Landier and Sauvagnat (2014) utilise revenue or sales as a measurement of firm size. Additionally, the findings of Dang et al. (2018) which suggests that the sign and significance of the predictor variables may change when different measurement approximations are used as well as the size of the reported R-squared values which further

underscores the importance of this test. The test entailed reperforming the regression analysis using the natural logarithm of revenue as a measurement approximation for company size. The sensitivity test allowed for an evaluation of whether the model results are consistent across the different measurement approximations and ultimately improve the robustness and confidence of the findings of this study (Wooldridge, 2015).

3.5. Validity and reliability

3.5.1 Validity

RQ1: The validity of the conclusions drawn from this study is dependent on accurately determining the abnormal returns and abnormal volumes linked with the event.

Confounding events were checked for in the following manner and companies with confounding events were excluded to improve the validity of findings:

Additional confounding events were identified by comparing the actual returns of a firm to the index return of the industry that the firm operates in and where returns of the firm deviate significantly from returns of the industry index is indicative of a possible confounding event. A significant deviation is defined as a return that is greater than three standard deviations from the mean index return as 99.7% of observations lie between the mean and three standard deviations (Mishra, Pandey, Singh, Gupta, Sahu and Keshri, 2019). Events that were identified using the above method were checked for confounding events by investigating whether there were any SENS announcements released related to company actions that would influence the stock characteristics other than the event, such as earnings announcements, dividend declarations or corporate action announcements such as mergers or divestitures. The process was repeated for small, medium and large companies respectively and events identified to be impacted by confounding events were excluded from the sample.

The trading restrictions imposed by the JSE listing rules in paragraphs 3.63-3.74 help address the issue of confounding events by prohibiting directors' trading during closed periods (see section 2). Given that directors will be unable to trade during these periods, there is a reduced likelihood of abnormal returns and volumes being calculated which have been influenced by the events which take place during closed periods such as earnings announcements.

RQ2: To ensure reliable results and high internal validity, the assumptions of regression must be tested. This study tests for 1) an approximately linear relationship between variables, 2) multicollinearity, 3) homoscedascity, and 4) normality (Osborne and Waters, 2002).

Linearity was tested using scatter plots of the residuals, multicollinearity was tested using the VIF statistic and Pearson correlation to ensure that the degree of multicollinearity was sufficiently low to perform the regressions (Shrestha, 2020). The Breusch Pagan test for heteroscedasticity was used to confirm the absence of heteroscedasticity which indicates homoscedasticity (Klein, Gerhard, Büchner, Diestel and Schermelleh-Engel, 2016). Data was tested for normality using the Kolmogorov-Smirnov test and the normal Q-Q plot to verify that the data followed a normal distribution (Osborne and Waters, 2002; Yazici and Yolacan, 2007).

3.5.2 Reliability

The reliability of the SENS announcements and stock price and volume data was ensured by using a reputable database (EquityRT) when extracting the data.

Section 4: Results

The research results will be presented and discussed for the purposes of answering the research questions of the study. Section 4.1 discusses the results of the event study relating to RQ1 while section 4.2 discusses the results of the regression analysis relating to RQ2.

4.1 Event study results (RQ1)

To answer research question 1, an event study was conducted. The SENS announcement was regarded as the event because that is when the information of the directors' dealings is made public, and the market may react resulting in possible abnormal returns. To improve the robustness of the research design, the initial sample of 182, 185 and 277 SENS announcements for 30 small, 30 medium and 30 large companies respectively was checked to see if the sample contained confounding events as recommended by McWilliams and Siegel (1997). Confounding events were identified and removed for each company in the sample using the method discussed in section 3.5.1.

Refer to Table 1 below for a final sample of SENS announcements and the number of dealings after adjusting for confounding events.

Table 1: Final sample of SENS announcements and director's dealings

	Small	Medium	Large	Total
Number of companies	30	30	30	90
Number of SENS announcements	162	173	247	582

Number of dealings	331	368	504	1202
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A single SENS announcement can announce more than one director's dealing which explains why the number of dealings exceeds the number of SENS announcements.

The sample of SENS announcements listed in Table 1 above was determined after the elimination of confounding events from the initial population. This is the sample for which the CAARs and CAAVs were calculated and tested to identify if there are statistically significant abnormal returns and volumes. The development of the CAARs and CAAVs from the estimation window to the post-event window is depicted in figures 1-6 in Appendix A.

4.1.1 Descriptive statistics

Tables 2, 3 and 4 highlight a breakdown of all the directors' trades recorded in the SENS announcements that were collected. There were 582 SENS announcements in the sample for this study which recorded 1202 directors' dealings.

The director's dealings were classified based on the respective positions of the directors participating in the transactions resulting in 7 distinct classification groups. The CEO group encompassed dealings of any director who held the title of Chief Executive Officer (CEO) and included the CEOs of subsidiary companies and any smaller business units within the group. The same procedure was applied to the Chief Financial Officer (CFO) group which includes any dealings in which the director held the title of Chief Financial Officer in the group, any subsidiary company or any smaller business units within the group. The executive director (ED) group consists of the dealings of any other director who is involved in the operations of the company, whose trades would be reported in the SENS announcements, and is not listed as the CEO, CFO or non-executive. These directors include any other Chief Officers such as Chief Operating Officers, any Managing Directors, and/or any other executives who hold a directorship position either at a group level or divisional/subsidiary level. The trades of the company secretary (CS) have been shown separately because the SENS announcements distinctly list their trades separately from other trades within the SENS announcements suggesting that the company secretary transactions have a different level of prominence to other directors' transactions hence their transactions are captured separately in the CS group. The non-executive directors (NED) and independent non-executive directors (INED) groups consist of dealings by any directors who have been listed as non-executive directors or independent non-executive directors respectively in the integrated report and/or company website of the respective companies. The Chairman group (CHAIRMAN) consists of any

individuals who were listed as the board chairman or deputy chairman. Although these directors are required to be independent non-executive directors and could be classified as such, they are separately classified given the prominence and status of their position (Lipton and Lorsch, 1992).

Table 2: Analysis of directors' dealings of small companies

	Small							
	CEO	CFO	ED	CS	NED	INED	CHAIRMAN	Overall average
Total number of transactions	101	41	63	35	53	26	12	48
Average value of transaction (R'million)	R3.85	R1.37	R0.86	R0.69	R2.01	R2.77	R7.70	R2.76
Average number of shares per transaction	240 083	46 993	30 588	20 497	282 075	69 576	199 707	127 075
Number of purchases	43	14	16	11	32	15	11	21
Total value of purchases (R'million)	R106.43	R11.05	R9.53	R2.44	R45.22	R9.64	R81.36	R37.95

Average value of purchases (R'million)	R2.48	R0.79	R0.60	R0.22	R2.38	R0.64	R7.40	R2.07
Average number of shares purchased	276 014	18 957	11 783	15 885	541 087	32 531	189 310	155 081
Number of sales	58	27	47	24	21	11	1	27
Total value of sales (R'million)	R282.6	R45.28	R44.52	R21.66	R35.35	R62.31	R11.09	R71.83
Average value of sales (R'million)	R4.87	R1.68	R0.95	R0.91	R1.68	R5.66	R11.09	R3.98
Average number of shares sold	213 443	61 530	36 989	22 611	47 731	120 091	199 707	100 301

Table 3: Analysis of directors' dealings of medium companies

	Medium							
	CEO	CFO	ED	CS	NED	INED	CHAIRMAN	Overall average
Total number of transactions	97	68	100	37	32	28	6	53
Average value of transaction (R'million)	R3.52	R1.79	R2.02	R0.90	R4.04	R2.22	R5.16	R2.81
Average number of shares per transaction	59 505	44 221	53 988	14 121	46 380	68 732	134 350	60 186
Number of purchases	25	19	5	0	20	20	2	13
Total value of purchases (R'million)	R24.46	R8.98	R4.77	0	R96.16	R27.08	R0.54	R23.14

Average value of purchases (R'million)	R0.98	R0.47	R0.95	0	R4.81	R1.35	R0.27	R1.25
Average number of shares purchased	27 973	38 044	19 278	0	33 933	84 191	4 925	29 764
Number of sales	72	49	95	37	12	8	4	40
Total value of sales (R'million)	R317.20	R112.71	R197.74	R32.20	R33.11	R35.05	R30.43	R108.35
Average value of sales (R'million)	R4.41	R2.30	R2.08	R0.90	R2.76	R4.38	R7.61	R3.35
Average number of shares sold	70 453	46 616	55 815	14 121	67 126	30 084	199 062	69 040

Table 4: Analysis of directors' dealings in large companies

	Large							
	CEO	CFO	ED	CS	NED	INED	CHAIRMAN	Overall average
Total number of transactions	109	87	201	37	26	27	17	72
Average value of transaction (R'million)	R22.38	R7.1	R4.55	R0.55	R49.76	R1.24	R6.01	R13.08
Average number of shares per transaction	69 517	48 717	34 372	4 393	205 016	12 727	69 994	63 534
Number of purchases	17	19	22	2	10	21	13	15
Total value of purchases (R'million)	R168.84	R72.21	R105.92	R1.37	R14.54	R19.55	R14.73	R56.74
Average value of purchases (R'million)	R0.135	R3.80	R4.81	R0.68	R1.45	R0.93	R1.13	R1.85

Average number of shares purchased	135 175	55 896	44 161	10 853	22 906	11 570	10 376	41 563
Number of sales	92	68	179	35	16	6	4	58
Total value of sales (R'million)	R2 270.38	R545.71	R809.26	R18.77	R1 279.16	R13.99	R87.35	R717.80
Average value of sales (R'million)	R24.68	R8.03	R4.52	R0.54	R79.95	R2.32	R21.84	R20.27
Average number of shares sold	57 385	46 711	33 169	4 022	318 834	16 775	263 750	105 807

In general, the data indicates that the value and size of transactions are positively related to company size meaning that large companies have higher-value trades with greater number of shares than small and medium companies. This is shown in the overall average value of transactions in large companies, of R13.08 million being significantly higher than the average value in small and medium companies of R2.76 and R2.81 million respectively. This can be attributed to larger companies having a higher share price and greater liquidity of stocks in large companies compared to small and medium companies, meaning that each transaction in a large company would have a higher total value, contributing to the higher average. Conversely, there is a minor difference in the overall average value of transactions of small (R2.76 million) and medium (R2.81 million) companies.

The remuneration policies of companies which provide share-based incentives to directors further encourage more frequent transactions by directors. As executive directors, including the CEO and CFO, are involved in the daily operations their remuneration packages often include share-based incentives to encourage better performance by directors which benefits the stock price as well as their remuneration packages (Baker, Jensen and Murphy, 1988). These incentives are common in JSE-listed companies and motivate directors to engage in transactions to maximise personal gains, adjust risk exposure or convert them to cash for liquidity purposes such as to settle taxes related to the receipt of these stock awards. The increased participation in share-based remuneration schemes and the related transactions explains why executive directors including the CEO and CFO have more frequent transactions than non-executive directors (NED, INED and Chairman).

More specifically, the chairman of small and medium companies has the least number of transactions, with 12 and 6 transactions respectively, yet they show the highest average transaction value. A similar result is present in large companies where the chairman has the fourth-highest average transaction value despite having the least number of transactions (17). This behaviour is possibly explained by the role and influence of the chairman's position. As a high-ranking director, the chairman typically prioritises longer-term strategic gains over more frequent market activity resulting in less frequent and higher-value trades (del Brio, Perote, de Miguel and Gómez, 2018). Additionally, the reason for trades by the chairman is often the rebalancing of their investment portfolio which generally occurs annually. The rebalancing of an investment portfolio typically requires less frequent but larger trades to maintain an intended asset allocation, reduce transaction costs and enhance long-term returns which explains the less

frequent but higher-value transactions by the chairman (Brennan, Schwartz and Lagnado, 1997).

An analysis of the purchases and sales by directors produces several interesting insights relating to the trends of directors' dealings. It is apparent that the number of sales greatly outweighs the number of purchases evidenced by the consistently higher average number of sales in small, medium and large companies respectively. The reason for this is that sale transactions are often driven by the liquidity needs of directors (Wang et al., 2012). Given the increasing amount of equity-based remuneration received by directors, it is expected that some or all the stock received will be converted into cash depending on the director's liquidity needs resulting in a greater number of sale transactions. Further evidence supporting that liquidity needs drive sales is given by the significant difference between the purchase and sales average value and average number of shares traded. The average value and average number of shares traded are significantly larger for sale transactions than for purchase transactions which supports the notion that sales are driven by liquidity needs given the increased frequency and value compared to purchases.

The purchase transactions are dominated by CEOs in small companies (101) and medium companies (97) which is consistent with Wang et al. (2012) and S. Knewtson and R. Nofsinger (2014). Following the CEO, NEDs and INEDs also record significant trading activity ranking second and third in frequency. In contrast, large companies exhibit a different dynamic with INEDs trading more frequently than CEOs who are only ranked fourth in terms of frequency of purchases. This shift is attributed to the more complex governance structures and diversified management teams in large companies. The sale transactions in small companies are dominated by the CEO (58) however the ED group has a greater number of sales in medium (95) and large (201) companies. The greater number of ED sale transactions is explained size and management structure of medium and large companies. As these companies are larger, they have more individuals in directorship positions and subsequently more individuals with equity-based compensation. Consequently, the higher number of sale transactions reflects the greater number of directors present in medium and large companies. The dominance of CEOs is not surprising given that CEOs are usually better compensated and more wealthy than other directors allowing them to engage in both purchase and sale transactions of greater value and size (Wang et al., 2012).

These findings underscore the behaviour of directors based on company size and structure highlighting how the different positions of directors impact their trading behaviour. As companies grow the stock price and liquidity of the company increase along with the number of directors resulting in greater frequency, value and size of transactions.

4.1.2 Empirical results

To ensure the data collected is suitable for the research tests and methods that have been used to answer the research question, an analysis of the distribution of the data was performed.

To test the normality of the data, a Kolmogorov-Smirnov test was performed over the CAARs and the CAAVs were calculated. The Kolmogorov-Smirnov test is generally performed when the sample size is greater than fifty, as is the case in the study for small, medium and large companies as displayed in Table 1 above (Mishra et al., 2019). The null hypothesis of this test is that the data is normally distributed (Mishra et al., 2019). The results of the Kolmogorov-Smirnov test indicate that the data is not normally distributed. At a 5% significance level, the p-value from the CAARs and CAAVs is less than 0.05 which means that the null hypothesis can be rejected for small and large companies. Similarly, the p-value from the CAAVs of medium companies is less than 0.05, meaning that the null hypothesis can be rejected for CAAVs. However, the p-value from the CAARs is greater than 0.05 indicating that the null hypothesis cannot be rejected for the CAARs of medium companies. The results of the Kolmogorov-Smirnov test have been reported in Table 5 below.

Table 5: Tests of Normality for the CAARs and CAAVs calculated for small, medium and large companies

	Kolmogorov-Smirnov ^a		
Small	Statistic	df	p-value
CAAR	0.074	162	0.030
CAAV	0.245	162	< 0.001
Medium	Statistic	df	p-value
CAAR	0.054	173	0.2
CAAV	0.334	173	< 0.001
Large	Statistic	df	p-value
CAAR	0.089	247	< 0.001
CAAV	0.237	247	< 0.001

a. Lilliefors Significance Correction

Given that there is more evidence that the CAARs and CAAVs not normally distributed which indicates that the mean value is not a representative value of the sample, it is more appropriate

that non-parametric tests were used to test the CAARs and CAAVs for statistical significance (Mishra et al., 2019).

Table 6: Wilcoxon Signed-Rank Test results for CAARs of purchase and sale transactions

	Purchase Transactions			Sale Transactions		
	Mean	Std. dev.	p-value	Mean	Std. dev.	p-value
Anticipation Window	-0.0087	0.067	0.029*	0.0023	0.061	0.616
Event day	-0.010	0.074	0.015*	0.0029	0.068	0.626
Post-event window	-0.0015	0.033	0.190	0.0011	0.037	0.656

*Denotes significance at the 5% level

Table 7: Wilcoxon Signed-Rank Test results for CAAVs of purchase and sale transactions

	Purchase Transactions			Sale Transactions		
	Mean	Std. dev.	p-value	Mean	Std. dev.	p-value
Anticipation Window	3 020 336	25 603 193	0.622	2 676 010	13 976 412	0.016*
Event day	3 588 541	28 051 602	0.963	3 150 619	15 781 390	0.008*
Post-event window	2 056 686	10 390 384	0.034*	2 231 104	9 118 840	0.001*

*Denotes significance at the 5% level

Table 8: Wilcoxon Signed-Rank test results for CAARs of small medium and large companies.

	Small			Medium			Large		
	Mean	Std. dev.	p-value	Mean	Std. dev.	p-value	Mean	Std. dev.	p-value
Anticipation window	-0.09	0.066	0.043*	-0.0008	0.067	0.808	0.0038	0.059	0.647
Event day	-0.010	0.713	0.037*	-0.001	0.074	0.760	0.0045	0.067	0.733
Post-event window	-0.002	0.0320	0.162	-0.002	0.033	0.382	0.004	0.0394	0.869

Table 9: Wilcoxon Signed-Rank test results for CAAVs of small medium and large companies.

	Small			Medium			Large		
	Mean	Std. dev.	p-value	Mean	Std. dev.	p-value	Mean	Std. dev.	p-value
Anticipation window	823 826	6 380 023	0.872	5 638 541	30 099 956	0.101	2 076 513	11 819 083	0.284
Event day	1 026 782	7 322 137	0.609	6 403 502	32 747 678	0.051	2 596 788	14 012 794	0.189
Post-event window	1 029 909	4 680 871	0.093	3 155 043	12 312 574	0.002*	2 239 749	9 640 800	0.045*

*Denotes significance at the 5% level

Tables 6 and 7 report the results of the Wilcoxon Signed-Ranked test conducted on the CAARs and CAAVs for purchase and sale transactions. The CAARs and CAAVs tested in Tables 6 and 7 were calculated considering all the purchase and sale transactions within the sample. Doing so provided an overall view of the market reaction to a purchase and/or sale transaction.

The results show that sale transactions generate higher abnormal returns than purchase transactions. The sale transactions showed positive abnormal returns across the anticipation window, event day and post-event window however none were statistically significant. Conversely, the purchase transactions showed statistically significant negative returns for the anticipation window and the event day as shown in Table 6. This suggests that the market has a significant negative reaction before and on the day of a purchase transaction. These results are partially consistent with Boubacar and Morris (2011), who present results finding significant negative CAARs following purchase transactions. However, the results of this study show that significant negative returns are present before and on the day of the announcement of the purchase reaction. This is possibly due to incentive plans which result in directors acquiring shares (which is seen as a purchase by the market). Given that these stocks are awarded to directors as part of their compensation, this 'purchase' does not provide as strong of a signal compared to when a director conducts a purchase on the open market. An open market purchase is typically associated with a positive signal as the director is risking their own money in this stock which attracts market attention. Therefore, the negative results presented in this study may also be due to negative information leakage or market speculation which resulted in a negative market reaction before the event.

The results of Table 7 indicate that purchase transactions generate higher abnormal volumes than sale transactions during the anticipation window and event day, however, these are not statistically significant. The sale transactions present statistically significant abnormal volumes during the anticipation window and event day. The significant abnormal volumes present during the anticipation window and event day of sale transactions suggest that the market anticipated the sale transactions before their announcement. This is possibly due to the market anticipating certain sale transactions following certain events such as the sale of shares following the vesting of shares in share incentive schemes.

Additionally, the purchase and sale transactions showed statistically significant abnormal volumes during the post-event window, with the sale transactions showing higher abnormal volumes than the purchase transactions. This suggests that sale transactions elicit a stronger

reaction from the market compared to purchases possibly due to sale transactions generally being larger than purchase transactions which may attract greater market attention (Karpoff, 1986).

Table 8 reports the results of the Wilcoxon Signed-Rank test conducted on the CAARs calculated during the anticipation window, event day, and post-event window for small, medium and large companies respectively (see Section 3.4.1). For the anticipation window, the average abnormal returns were negative for small and medium companies and marginally positive for large companies. The returns were not statistically significant for medium and large companies suggesting that no anticipatory trading took place prior to the announcement of the directors dealing.

The statistically significant (at a 5% significance level) negative return for small companies during the anticipation window suggests that there may have been some market speculation or related news prior to the event which caused the market to react negatively prior to the announcement of the directors dealing. Findings by Keown and Pinkerton (1981) and Jarrell and Poulsen (1989) confirm that statistically significant abnormal returns are possible in the anticipation window due to market speculation.

Similarly, the event day shows negative average abnormal returns for small and medium companies and a positive average abnormal return for large companies. The negative average return for small companies was found to be significant. The presence of this significant return suggests that the announcement of the directors' dealings provided new information to the market, which elicited a negative reaction.

The presence of these significant returns during the estimation and event window, respectively, suggests that the market views the announcement of directors' dealings as new, relevant information and that this information was possibly anticipated prior to the event taking place. This further highlights that there are possibly higher levels of information leakage in smaller companies, which allows for the market to anticipate the event in small companies.

The absence of statistically significant returns in medium and large companies is possibly due to the medium and large companies having lower levels of information asymmetry and greater liquidity. As medium and large companies typically have greater disclosure and more information publicly available, the likelihood of a significant reaction to new information is reduced while greater liquidity allows for new information to be absorbed more smoothly without causing significant reactions (Van Buskirk, 2012).

The post-event window showed negative average abnormal returns for small and medium companies and positive average abnormal returns for large companies. The large p-values indicate a lack of significance which suggests that there is no continued reaction to the director dealing after the event date.

Table 9 reports the results of the Wilcoxon Signed-Rank test conducted on the CAAVs that were calculated for the anticipation window, event day and post-event window. The estimation window shows that the average abnormal volumes were positive across small, medium and large companies but none of these abnormal volumes were statistically significant. This indicates that there was no market anticipation or anticipatory trading prior to the event. Similarly, the abnormal volumes of small, medium and large companies were positive for the event day, but none were statistically significant.

Small and medium companies may experience significant abnormal returns and insignificant abnormal volumes during the anticipation and event window due to price sensitivity. Small and medium firms are not as liquid as large companies therefore only a minimal number of trades need to be executed to impact prices without triggering abnormal volumes.

The post-event window shows statistically significant positive abnormal volumes for medium and large companies while small companies exhibit positive abnormal volumes that are not statistically significant. This may be a consequence of institutional investors who often dominate trading in medium and large companies and tend to react quickly to new information which creates spikes in trading volumes that are significant (Edelen, Ince and Kadlec, 2016).

The null hypothesis of RQ 1.1 states that directors' dealings will not trigger abnormal returns of the company's stock in a sample of companies on the JSE. The analysis of the CAARs indicates insufficient evidence to reject the null hypothesis for the anticipation window, event day and post-event window for both medium and large companies and for the post-event window of small companies. However, there is sufficient evidence to reject the null hypothesis for the anticipation window and event day of small companies.

The null hypothesis of RQ 1.2 states that directors' dealings will not trigger abnormal volumes of the company's stock in a sample of companies on the JSE. The analysis of the CAAV indicates insufficient evidence to reject the null hypothesis for the anticipation window and event day of small, medium and large companies as well as for the post-event window of small companies. Conversely, sufficient evidence is shown to reject the null hypothesis for the post-event window of medium and large companies.

Table 10 below reports a summary of the results of the analysis in terms of rejecting or failing to reject the null hypothesis.

Table 10: Summary of results

	RQ 1.1		
	Small	Medium	Large
Anticipation window	Reject	Fail to reject	Fail to reject
Event day	Reject	Fail to reject	Fail to reject
Post-event window	Fail to reject	Fail to reject	Fail to reject
	RQ 1.2		
	Small	Medium	Large
Anticipation window	Fail to reject	Fail to reject	Fail to reject
Event day	Fail to reject	Fail to reject	Fail to reject
Post-event window	Fail to reject	Reject	Reject

4.2 Regression results (RQ2)

4.2.1 Descriptive statistics

The descriptive statistics for models 1-6 are presented in Tables 11-16 below.

The correlation statistics and related statistical significance for models 1-6 are presented in the tables below and subsequently analysed and discussed.

Table 11: Correlations for Model 1

Correlations					
		ln(CAAR)	BID-ASK	ANA	SIZE
Pearson Correlation	ln(CAAR)	1,000	,181	-,052	-,061
	BID-ASK	,181	1,000	,151	-,307
	ANA	-,052	,151	1,000	-,005
	SIZE	-,061	-,307	-,005	1,000
Sig. (1-tailed)	ln(CAAR)	.	,013	,260	,225
	BID-ASK	,013	.	,031	,000
	ANA	,260	,031	.	,476
	SIZE	,225	,000	,476	.

Table 12: Correlations for Model 2

Correlations					
		ln(CAAV)	BID-ASK	ANA	SIZE
Pearson Correlation	ln(CAAV)	1.000	-.040	-.056	-.103
	BID-ASK	-0.040	1.000	0.119	-0.310
	ANA	-0.056	0.119	1.000	0.036
	SIZE	-0.103	-0.310	0.036	1.000
Sig. (1-tailed)	ln(CAAV)	0.0	0.311	0.242	0.099
	BID_ ASK	0.311	0.0	0.069	0.0
	ANA	0.242	0.069	0.0	0.325
	SIZE	0.099	0.0	0.325	0.0

Table 13: Correlations for Model 3

Correlations					
		ln(CAAR)	BID_ ASK	ANA	SIZE
Pearson Correlation	ln(CAAR)	1.000	0.020	0.209	0.093
	BID_ ASK	0.020	1.000	-0.144	-0.142
	ANA	0.209	-0.144	1.000	0.237
	SIZE	0.093	-0.142	0.237	1.000
Sig. (1-tailed)	ln(CAAR)	0.0	0.402	0.005	0.126
	BID-ASK	0.402	0.0	0.037	0.039
	ANA	0.005	0.037	0.0	0.002
	SIZE	0.126	0.039	0.002	0.0

Table 14: Correlations for Model 4

Correlations					
		ln(CAAV)	BID-ASK	ANA	SIZE
Pearson Correlation	ln(CAAV)	1.000	-0.027	-0.022	0.364
	BID-ASK	-0.027	1.000	-0.167	-0.132
	ANA	-0.022	-0.167	1.000	0.218
	SIZE	0.364	-0.132	0.218	1.000
Sig. (1-tailed)	ln(CAAV)	0.0	0.362	0.386	<0.001

	BID-ASK	0.362	0.0	0.014	0.042
	ANA	0.386	0.014	0.0	0.002
	SIZE	0.0	0.042	0.002	0.0

Table 15: Correlations for Model 5

Correlations					
		ln(CAAR)	ANA	BID-ASK	SIZE
Pearson Correlation	ln(CAAR)	1.000	0.122	-0.042	0.024
	ANA	0.122	1.000	-0.270	0.496
	BID-ASK	-0.042	-0.270	1.000	-0.270
	SIZE	0.024	0.496	-0.270	1.000
Sig. (1-tailed)	ln(CAAR)	0.0	0.029	0.257	0.354
	ANA	0.029	0.0	0.0	0.0
	BID-ASK	0.257	0.0	0.0	0.0
	SIZE	0.354	0.0	0.0	0.0

Table 16: Correlations for Model 6

Correlations					
		ln(CAAV)	ANA	BID-ASK	SIZE
Pearson Correlation	ln(CAAV)	1.000	0.268	0.026	0.098
	ANA	0.268	1.000	-0.271	0.490
	BID-ASK	0.026	-0.271	1.000	-0.268
	SIZE	0.098	0.490	-0.268	1.000
Sig. (1-tailed)	ln(CAAV)	0.0	<0.001	0.344	0.062
	ANA	0.0	0.0	0.0	0.0
	BID-ASK	0.344	0.0	0.0	0.0
	SIZE	0.062	0.0	0.0	0.0

The most significant observation from the correlations in relation to the BID-ASK variable. The BID-ASK variable presents statistically significant correlations with one or more other variables in all the models. The BID-ASK variable displays a statistically significant negative correlation with the SIZE variable in all the models which is consistent with Huang and Stoll (1997); Leuz and Verrecchia (2000); and Brent and Addo (2012), given the findings that larger firms have lower levels of information asymmetry and thus lower bid-ask spreads. The BID-ASK variable is also shown to have statistically significant correlations with the ANA variables in all the models apart from model 2, however, the direction of the correlations varies across

the models. Model 1 shows a relatively weak positive correlation while models 3, 4, 5 and 6 show a relatively weak negative correlation. The positive correlation may be due to the low liquidity of small companies to which model 1 relates. Small firms have naturally low liquidity; therefore, the increased analyst coverage may attract attention without substantially increasing trading volumes. The bid-ask spread may remain high to cover the liquidity risks associated with small firms despite the increased analyst following resulting in a positive correlation (Chung et al., 1995). The negative correlations could be explained by the reduced levels of information asymmetry associated with increased analyst coverage resulting in lower bid-ask spreads (Brennan and Subrahmanyam, 1995).

Models 3, 4, 5 and 6 showed that variables ANA and SIZE have a statistically significant positive correlation. The medium and large companies to which these models relate have greater visibility and attract more attention from retail and institutional investors given their size, therefore the increased demand for information from investors results in a higher analyst following (Bhushan, 1989). Additionally, the increased institutional investment in medium and large companies further explains this correlation. Institutional investors utilise analyst reports significantly in their investment decisions which encourages increased analyst following given the increased trading activity of institutional investors in medium and large firms.

Other notable correlations include the correlations between the following variables

Model 1- $\ln(\text{CAAR})$ and BID-ASK

Model 4- $\ln(\text{CAAV})$ and SIZE

Model 5- $\ln(\text{CAAR})$ and ANA

Model 6- $\ln(\text{CAAV})$ and ANA

These correlations show a statistically significant positive correlation with each other and support the results of the regression analysis (see Section 4.2.2) which finds these variables to have a statistically significant relationship with each other.

4.2.2 Empirical results

Analysis of models and normality of data

The feasibility of the regression models discussed in section 3.4.2 was evaluated using statistical analysis. Firstly, the VIFs were calculated to ensure that the degree of multicollinearity between the independent variables was sufficiently low to provide valid and accurate findings (Shrestha, 2020). As per Table B1 (see Appendix B), the VIFs for small, medium and large companies are below 5 and fall within the generally accepted range

indicating that there is sufficiently low multicollinearity between the independent variables for the models to provide valid and accurate results (Shrestha, 2020).

To ensure the data was suitable for the regression analysis, a Kolmogorov-Smirnov test for normality was conducted to verify that the data was normally distributed (Osborne and Waters, 2002). To enhance the normality of the data, the relevant variables were transformed using the natural logarithm and outliers were removed. The removal of outliers further enhances the normality of the data and enhances the reliability and validity of the model output (Stevens, 1984).

The dependent variables, CAAR and CAAV, were transformed using the natural logarithm. The independent variable, SIZE, was also transformed using the natural logarithm. The independent variable, BID-ASK, was initially calculated using the natural logarithm therefore no additional transformation was necessary. The natural logarithm transformation was not applied to the number of analysts following the company (ANA) because the result would not accurately reflect the analyst following. For example, in instances where the analyst following is 1, the natural logarithm would reflect a result of 0 which is not representative of the data and thus would provide inaccurate results. The variables transformed using the natural logarithm are presented by using the function “ln” before the relevant variables.

The removal of outliers was approached with caution to avoid eliminating more data points than necessary and the loss of valuable information. The Cooks distance was used to identify outliers, extreme values that deviate from expectations, which were consequently removed to enhance the normality of the data for statistical testing (Stevens, 1984). Cook's distance reveals the most influential data points being an outlier on the variables making it an appropriate measure for the identification of outliers (Stevens, 1984). In cases, where the data followed a normal distribution, no outliers were removed to maintain the integrity of the data and minimise the loss of information. Table 17 below details the number of outliers identified and removed from the sample of observations for small, medium and large companies.

Table 17: Number of outliers identified and removed from initial sample

Small	Initial sample	Outliers removed	Final sample
Model 1^a	162	9	153
Model 2^b	162	5	157

Medium	Initial sample	Outliers removed	Final Sample
Model 3 ^a	173	10	163
Model 4 ^b	173	0	173
Large	Initial sample	Outliers removed	Final sample
Model 5 ^a	247	5	242
Model 6 ^b	247	0	247

a. Dependent variable: $\ln(\text{CAAR})$

b. Dependent variable: $\ln(\text{CAAV})$

After transforming the relevant variables using the natural logarithm and removing the outliers, the Kolmogorov-Smirnov test was conducted to determine whether the assumption of a normal distribution has been met (Osborne and Waters, 2002; Mishra et al., 2019). Additionally, a normal Q-Q plot was used to visually inspect the distribution of the residuals and determine whether the distribution was normal (Osborne and Waters, 2002; Mishra et al., 2019). The results of the Kolmogorov-Smirnov test are presented in Table C1 and the related Q-Q plots are presented in Figures 8-13 in Appendix C.

The null hypothesis of the Kolmogorov-Smirnov test states that the data is normally distributed (Mishra et al., 2019). The results of Table C1 (see Appendix C) show that the test was non-significant, with the p-values all greater than 0.05. The p-values greater than 0.05 mean that the null hypothesis fails to be rejected indicating that the residuals are normally distributed. Additionally, the normal Q-Q plots presented in figures 8-13 respectively show that the data sufficiently approximates a normal distribution (Osborne and Waters, 2002). Both the normality tests employed provided evidence that the residuals were normally distributed indicating that the regression analysis was appropriate.

4.2.3 Regression statistics for models 1-6

The model summary and coefficients for models 1-6 is presented in Tables 18-23, respectively.

Table 18: Model summary for models 1 and 2 (small companies)

Small	Model Summary		
	R ^a	R-Squared	Adjusted R-Squared
Model 1 ^b	0.198	0.039	0.02

Model 2^c	0.135	0.018	-0.001
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- a. Predictors: (Constant), ANA, SIZE, BID-ASK
- b. Dependent variable: ln(CAAR)
- c. Dependent variable: ln(CAAV)

Table 19 Model summary for models 3 and 4 (medium companies)

Medium	R^a	R-Squared	Adjusted R-Squared
Model 3^b	0.221	0.049	0.03
Model 4^c	0.378	0.143	0.128

- a. Predictors: (Constant), ANA, SIZE, BID-ASK
- b. Dependent variable: ln(CAAR)
- c. Dependent variable: ln(CAAV)

Table 20: Model summary for models 5 and 6 (large companies)

Large	R^a	R-Squared	Adjusted R-Squared
Model 5^b	0.130	0.017	0.005
Model 6^c	0.288	0.083	0.072

- a. Predictors: (Constant), ANA, SIZE, BID-ASK
- b. Dependent variable: ln(CAAR)
- c. Dependent variable: ln(CAAV)

Table 21: Coefficients for models 1 and 2 (small companies)

	Small					
	Model 1^a			Model 2^b		
	Standardised Coefficients Beta	t-statistic	Sig.	Standardised Coefficients Beta	t-statistic	Sig.
(Constant)		-1.239	0.217		7.7748	< 0.001
ANA	-0.081	-1.002	0.318	-0.043	-0.532	0.596
BID-ASK	0.192	2.253	0.026*	-0.073	-0.859	0.392
SIZE	-0.003	-0.033	0.974	-0.124	-1.471	0.143

*Denotes significance at the 5% level

a. Dependent variable: $\ln(\text{CAAR})$

b. Dependent variable: $\ln(\text{CAAV})$

Table 22: Coefficients for models 3 and 4 (medium companies)

	Medium					
	Model 3^a			Model 4^b		
	Standardised Coefficients Beta	t-statistic	Sig.	Standardised Coefficients Beta	t-statistic	Sig.
(Constant)		-2.375	0.019*		0.218	0.828
ANA	0.205	2.482	0.014*	-0.106	-1.433	0.154
BID-ASK	0.057	0.705	0.482	0.006	0.087	0.931
SIZE	0.052	0.634	0.527	0.388	5.285	< 0.001*

*Denotes significance at the 5% level

a. Dependent variable: $\ln(\text{CAAR})$

b. Dependent variable: $\ln(\text{CAAV})$

Table 23: Coefficients for models 5 and 6 (large companies)

	Large					
	Model 5^a			Model 6^b		
	Standardised Coefficients Beta	t-statistic	Sig.	Standardised Coefficients Beta	t-statistic	Sig.
(Constant)		-2.227	0.027*		9.287	< 0.001*
ANA	0.143	1.908	0.058	0.309	4.321	< 0.001*
BID-ASK	-0.017	-0.255	0.799	0.103	1.585	0.114
SIZE	-0.051	-0.685	0.494	-0.026	-0.363	0.717

*Denotes significance at the 5% level

a. Dependent variable: $\ln(\text{CAAR})$

b. Dependent variable: $\ln(\text{CAAV})$

The results in Tables 18-20 indicate that the models have a generally weak predictive power, displayed by the low R-squared and adjusted R-squared values for both $\ln(\text{CAAR})$ and $\ln(\text{CAAV})$. The R-squared values for the $\ln(\text{CAAR})$ models range from 0.017 to 0.049 while

R-squared values for the $\ln(\text{CAAV})$ models range from 0.018 to 0.143. This suggests that the small, medium and large models predicted 3.9%, 4.9% and 1.7% of the variation in $\ln(\text{CAAR})$. The $\ln(\text{CAAV})$ models showed marginally better results with 1.8%, 14.3% and 8.3% of the variation in $\ln(\text{CAAV})$ being predicted by the small, medium and large models.

The adjusted R-squared values are even lower at 0.02, 0.03 and 0.005 for small, medium and large $\ln(\text{CAAR})$ models respectively. This indicates that only 2%, 3% and 0.5% of the variation in $\ln(\text{CAAR})$ would be accounted for if the model had been derived from the population from which the sample was selected. Similarly, the small, medium and large $\ln(\text{CAAV})$ models report lower adjusted R-squared values of -0.001, 0.128 and 0.072 respectively. The negative adjusted R-squared value of the small model suggests that the model would not explain the variation in $\ln(\text{CAAR})$ if the model had been derived from the population from which the sample was selected. The medium and large models offer better results with 12.8% and 7.2% of the variation being accounted for if the model was derived from the population from which the sample was taken.

Analyst following

$\ln(\text{CAAR})$ models

Analyst following is generally associated with information availability and information asymmetry in companies (Roulstone, 2003; Frankel and Li, 2004; Brent and Addo, 2012; Amiram, Owens and Rozenbaum, 2016) which can be used to explain the relationships depicted in the tables above, for the $\ln(\text{CAAR})$ models.

The number of analysts (ANA) displayed a varying but generally weak relationship with $\ln(\text{CAAR})$, showing a weak negative relationship for small companies but a weak to moderate positive relationship for medium and large companies.

The weak negative relationship for small companies is depicted by a coefficient of -0.081. This suggests that as the level of analyst following decreases, the CAAR for small companies increases or conversely as the analyst following increases, the CAAR for small companies decreases. This is possibly explained by the level of information availability associated with small companies. Roulstone (2003) finds that analysts increase the amount of publicly available information, therefore small companies with a larger analyst following may not experience a significant price reaction when new information such as directors' dealings is revealed to the market due to the increased amount of information available about the company,

reducing their abnormal returns. This relationship, although not statistically significant, is consistent with the findings of Branson, Guffey and Pagach (1998).

The medium $\ln(\text{CAAR})$ model showed the strongest relationship with ANA displaying a positive coefficient of 0.205 and a p-value of 0.014 indicating that the weak-to-moderate positive relationship was statistically significant. Medium companies tend to have more information available than smaller companies but less than larger companies. This improved information flow may attract more investor attention thus contributing to the statistically significant, modest abnormal returns earned by medium companies.

The large company $\ln(\text{CAAR})$ model showed a non-significant, weaker positive relationship evidenced by the coefficient of 0.143 and p-value above 0.05. The non-significant relationship is due to the p-value of 0.058 marginally above the 0.05 threshold, however, the relationship would be significant if considered at the 10% significance level. As large companies are subject to more information disclosure and are more efficient in reducing information asymmetry (Brent and Addo, 2012), the analyst following has a minor and less impactful effect on the abnormal returns than for small or medium companies.

These findings indicate that analyst following does not have a uniform relationship with abnormal returns across company sizes. Medium-sized companies occupy a unique position in the market, as they are not as widely scrutinised as large companies but more visible than small companies. This intermediate level of visibility suggests that analyst following is more likely to have a more pronounced relationship with how the market reacts to events such as directors' dealings.

Consequently, the null hypothesis that the stock price reaction to directors' dealings will not have a statistically significant relationship with the number of analysts is rejected for medium companies. The null hypothesis fails to be rejected for small and large companies.

$\ln(\text{CAAV})$ models

The $\ln(\text{CAAV})$ models displayed mostly negative relationships with analysts following (ANA) of varying strengths. Small companies show a weak negative relationship with a coefficient of -0.043. This relationship is not statistically significant given the p-value of 0.596 which is well above the threshold of 0.05. Similarly, in medium companies, ANA demonstrates a weak non-significant negative relationship with $\ln(\text{CAAV})$ depicted by a coefficient of -0.106 and a p-value of 0.154. While prior research by Roulstone (2003) suggests that analyst following

increases market liquidity, this result suggests that ANA does not meaningfully affect abnormal volumes traded.

In contrast, the large $\ln(\text{CAAV})$ model showed a moderately strong, statistically significant relationship with ANA. The coefficient of 0.309 shows a high statistical significance with a p-value < 0.001 . Bhushan (1989) and Marston (1997) find that analyst following is positively related to firm size suggesting that larger firms have a greater analyst following. The higher analyst following is typically associated with higher levels of institutional investors in larger firms (O'Brien and Bhushan, 1990). Institutional investors in large companies may adjust their portfolios due to directors' dealings, which may trigger large trades resulting in abnormal volumes.

The results of the small and medium models fail to reject the null hypothesis which states that the trading volume reaction (CAAV) to directors' dealings will not have a statistically significant relationship with the number of analysts while the results of the large model allow for the null hypothesis to be rejected.

Bid-ask spread

$\ln(\text{CAAR})$ models

Research by Venkatesh and Chiang (1986), Kim and Verrecchia (1994), Tung (2000), Leuz and Verrecchia (2000) and Gregoriou et al. (2005) show that the bid-ask spread increases with information asymmetry suggesting that the bid-ask spread is indicative of information asymmetry (see section 2).

The bid-ask spread shows a moderate to weak positive relationship with abnormal returns for small and medium $\ln(\text{CAAR})$ models respectively while the large $\ln(\text{CAAR})$ model shows a weak negative relationship.

The small companies $\ln(\text{CAAR})$ model displays a moderate, statistically significant positive relationship with BID-ASK as indicated by a coefficient of 0.192 and p-value of 0.026. As this study uses BID-ASK as a measure for information asymmetry, these results suggest that as information asymmetry increases abnormal returns increase and vice versa. The $\ln(\text{CAAR})$ model for medium companies presents a similar result however the coefficient of 0.057 and the p-value of 0.482 indicates that the relationship is weaker and not statistically significant for medium companies. Information asymmetry introduces uncertainty and risk which market participants compensate for by demanding higher returns which results in wider spreads (Gregoriou et al., 2005). As information asymmetry is at its highest in smaller companies

(Brent and Addo, 2012), it is sensible that the small company model demonstrates a stronger statistically significant relationship as market participants would demand the highest return from a small company which would result in the highest abnormal returns. Medium companies can allocate more resources towards information disclosure thereby reducing their levels of information asymmetry and risk, therefore market participants reduce their demand for higher returns explaining the weaker and non-significant relationship.

Conversely, the large company $\ln(\text{CAAR})$ model has a non-significant weak negative relationship with BID-ASK evidenced by the -0.017 coefficient and p-value of 0.799, which is significantly greater than the threshold of 0.05. Although not statistically significant the large company $\ln(\text{CAAR})$ model presents an interesting result which suggests that as information asymmetry (BID-ASK) decreases, the abnormal returns increase and vice versa. This result is possibly explained by larger firms being more efficient in reducing information asymmetry (Brent and Addo, 2012). The reduced information asymmetry allows large firms to be more transparent which improves investor confidence and subsequently leads to higher abnormal returns.

These results allow for the null hypothesis, which states that stock price reaction to directors' dealings (CAAR) does not have a statistically significant relationship with the bid-ask spread to be rejected for small companies, however, the null hypothesis fails to be rejected for medium and large companies.

$\ln(\text{CAAV})$ model

The $\ln(\text{CAAV})$ models presented a weak negative relationship for small companies with a coefficient of -0.073 and weak positive relationships for medium and large companies with coefficients of 0.087 and 0.103 respectively. None of the relationships were statistically significant with p-values of 0.392, 0.931 and 0.114 for small, medium and large companies respectively which is significantly higher than the 0.05 threshold. This means that the null hypothesis fails to be rejected for small, medium and large companies, stating that the trading volume reaction to directors' dealings does not have a statistically significant relationship with the bid-ask spread.

Firm Size

$\ln(\text{CAAR})$ models

The coefficients of SIZE present a mixture of results across the models, none of which are statistically significant. The coefficients of -0.03 and -0.051 for small and large companies

indicate a weak negative relationship with $\ln(\text{CAAR})$ whereas the coefficient of 0.052 for the medium company model indicates a weak positive relationship. Although not statistically significant, the results suggest that as firm size decreases the abnormal returns marginally increase and vice versa. The direction of the coefficients is consistent with the findings of Bachrach and Galai (1979), Banz (1981) and Neill et al. (2008) who both report a negative association between average return and the market value of stocks (size) after adjusting for CAPM-based risk (Levy, 1990). The lack of significance suggests that other variables such as the event type may diminish the significance of the abnormal returns. For instance, directors' dealings are a commonly reported corporate action for companies of all sizes. Although they cannot be anticipated, like an earnings announcement which generally occurs during a set period, the increased occurrence of the event may diminish the market reaction to the event resulting in the non-significance of the coefficient for companies of all sizes. The lack of significance results in the null hypothesis failing to be rejected for small, medium and large companies.

$\ln(\text{CAAV})$ models

The coefficients of SIZE for the $\ln(\text{CAAV})$ models present the same mixture of results as the $\ln(\text{CAAR})$ models with coefficients of the small and large companies indicating moderate to weak negative relationships with $\ln(\text{CAAV})$. The coefficients of -0.124 and -0.026 for small and large companies are not significant, evidenced by the p-values of 0.143 and 0.717 respectively, which are both significantly greater than the 0.05 threshold. Notably, the statistically significant (p-value < 0.001) and coefficient of 0.388 for medium companies indicates a moderately strong relationship between SIZE and $\ln(\text{CAAV})$. This result suggests that larger medium-sized companies will have greater abnormal volumes whereas the opposite is true for smaller medium-sized companies. Medium-sized companies are placed between the high-liquidity large firms and lower visibility small firms, therefore events such as directors' dealings may have a significant effect on the abnormal volumes as both institutional and retail investors adjust their holdings resulting in more pronounced trading volume movements. Additionally, medium-sized firms may be faced with growing institutional interest and market visibility resulting in greater volumes of stock traded which may contribute to the statistically significant result. Based on these results, the null hypothesis would fail to be rejected for small and large companies. However, the statistically significant result for medium companies allows for the null hypothesis to be rejected.

Sensitivity tests

The regression models 1-6 were subjected to sensitivity tests to determine whether the models were robust to changes in measurement approximations. The sensitivity analysis was conducted over the approximation measure for company size given the number of papers which use different measurement approximations for size. The regressions were reperformed using the natural logarithm of revenue as an indicator of company size. The VIFs of these regressions are well below 5 (see Appendix D) and indicate that the regressions have a sufficiently low level of multicollinearity to provide valid and accurate results.

The results indicate no significant differences between the R-squared and adjusted R-squared results reported for the regression models 1,3,5 and 6 above and the models used in the sensitivity tests. The results for models 2 and 4 indicate the predictive power of the $\ln(\text{CAAV})$ models decreases when using the natural logarithm of revenue as an approximation for size evidenced by the lower R values and R-squared values respectively. This is possibly a result of the different proxies capturing different aspects of firm characteristics in different contexts (Dang et al., 2018). Revenue is more related to the product market and does not capture investor sentiment and forward-looking market expectations which explains why the models, which use the stock market reactions to directors' dealings as dependent variables, have a lower predictive power when using the natural logarithm of revenue.

Furthermore, the results report no significant differences in the direction and magnitude of the coefficients or their statistical significance for models 2,3 and 5. This suggests that the reported results for models 2,3, and would not significantly change if a different measurement approximation for company size was used and illustrates that the models used in this study are robust to using different measurement approximations for size (Dang et al., 2018).

Differences in the signs, magnitude and statistical significance were only noted for the SIZE variable in models 1,4 and 6. These findings contradict those of Dang et al. (2018) who report that coefficients of regressors other than firm size often change sign and statistical significance when using different measurement approximations for firm size. A change in the signs of the SIZE coefficients was noted in models 1 and 6 with the coefficients of both models changing from a negative sign to a positive sign. The magnitude of the coefficients indicated that there were still weak relationships that existed, and their p-values indicate that the coefficients remain non-significant. A significant difference was noted in model 4 where SIZE changed from a statistically significant moderately positive relationship with a coefficient of 0.388 and p-value of < 0.001 to a non-significant weak negative relationship depicted by a coefficient of

-0.06 and p-value of 0.941. Once again, these differences may be caused by the fact that revenue controls for size in the product market and does not capture market sentiment and market-driven factors which is important given that the focus of these models is on the stock market reaction to directors' dealings and the information environment.

4.2.4 Summary of results

The results of this study in relation to the RQs and the corresponding hypothesis (introduced in Section 1.5) are summarised in Table 24 below.

Table 24: Summary of results

Research Question (RQ)	Hypothesis	Result
Do the stock price and trading volume reactions to directors' dealings (identified in RQ1) have a significant relationship with:	Null Hypothesis	Reject/ Fail to reject
2.1) the number of analysts following the company	2.1.1) The stock price reaction to directors' dealings will not have a significant relationship with the number of analysts following the company in a sample of companies on the JSE.	Small-Fail to reject Medium- Reject Large- Fail to reject
	2.1.2) The trading volume reaction to directors' dealings will not have a significant relationship with the number of analysts following the company in a sample of companies on the JSE.	Small- Fail to reject Medium- Fail to reject Large- Reject
2.2) the bid-ask spread of the company's stock	2.2.1) The stock price reaction to directors' dealings will have a significant relationship with the bid-ask spread in a sample of companies on the JSE.	Small- Reject Medium- Fail to reject Large- Fail to reject
	2.2.2) The trading volume reaction to directors' dealings will have a significant relationship with the bid-ask spread in a sample of companies on the JSE.	Small- Fail to reject Medium- Fail to reject Large- Fail to reject

2.3) the size of the company	2.3.1) The stock price reaction to directors' dealings will have a significant relationship with the company size in a sample of companies on the JSE.	Small- Fail to reject Medium- Fail to reject Large- Fail to reject
	2.3.2) The trading volume reaction to directors' dealings will have a significant relationship with the company size in a sample of companies on the JSE.	Small- Fail to reject Medium- Reject Large- Fail to reject

Overall, it is evident from these results that there is a diverse relationship between the market reaction to directors' dealings and each of the indicators of the information environment. This is evidenced by the combination of rejecting and failing to reject the null hypothesis across small, medium and large companies. Small companies reflecting a significant relationship with the bid-ask spread and stock price reaction reflect the higher levels of information asymmetry experienced by small companies. The observed significance between analyst following with stock price reaction and company size and trading volume reaction suggests that medium companies are in a transitional phase, and certain aspects of the information environment (analyst following and company size) begin to play a more influential role in mitigating information asymmetry. The significant result observed between analyst following and trading volume reaction within large companies suggests that greater visibility and coverage reduces information asymmetry.

Section 5: Conclusion

5.1 Review of study and concluding remarks

This study aims to evaluate the relationship between the market reaction to directors' dealings and the information environment. The study was conducted in two parts, the first part uses an event study to determine whether directors' dealings trigger abnormal returns and abnormal volumes of a company's stock. The cumulative average abnormal return (CAAR) and cumulative average abnormal volume (CAAV) were calculated to measure the stock price and trading volume reaction to directors' dealings. Thereafter, a regression analysis was performed using the CAAR and the CAAV as the dependent variables and indicators of the information environment as independent variables to determine if there is a relationship between the stock

price and trading volume reaction to directors' dealings and the company's information environment.

While there are numerous studies which examine whether directors themselves earn abnormal returns from their trades (Lakonishok and Lee, 2001; Mordant and Muller, 2003; Dardas and Güttler, 2011a; Moodley, Muller and Ward, 2020), this research conducted an event study to determine whether directors' dealings trigger abnormal returns and abnormal volumes of a company's stock. This study used a sample of companies of different sizes listed on the JSE to ensure that the population of the JSE is represented in the sample which resulted in the collection of 1202 directors' dealings for which the CAAR and CAAV were calculated. The CAAR and CAAV were calculated for the anticipation window (being five days prior up to one day before the SENS announcement of the director's dealing), the event date and five days post the event date.

The CAARs and CAAVs were tested for significance using non-parametric tests to identify if they were significantly different from 0. The results of the analysis of the CAARs, indicate that there is insufficient evidence to reject the null hypothesis of RQ 1.1, which states that directors' dealings will not trigger statistically significant abnormal returns of a company's stock, for the anticipation window, event day and post-event window for medium and large companies as well as for the post-event window of small companies. However, the results of small companies show that there is a statistically significant negative return present during the anticipation window and event day. This suggests that directors' trades may convey more significant information in small companies which have less information available about them due to limited resources and analyst following. Consequently, these trades can trigger a stronger market reaction leading to abnormal returns. These results are consistent with the findings of Keown and Pinkerton (1981) and Jarrell and Poulsen (1989) and present sufficient evidence to reject the null hypothesis for the anticipation window and event day of small companies.

The analysis of the CAAVs indicates that there is insufficient evidence to reject the null hypothesis of RQ 1.2, which states that directors' dealings will not trigger statistically significant abnormal volumes of a company's stock, for the anticipation window and event day of small medium and large companies as well as for the post-event window of small companies. The post-event window of medium and large companies shows statistically significant abnormal volumes which may be a consequence of institutional investors in medium and large

companies who are often quick to react to new information (Lipton and Lorsch, 1992). These results present sufficient evidence for the null hypothesis of RQ 1.2 to be rejected.

A regression analysis was employed to determine the relationship between the stock price and trading volume reaction to directors' dealing and the company's information environment, consistent with Thalassinou et al. (2012) and Nanda and Barai (2020). The dependent variables were firm size (SIZE), bid-ask spread (BID-ASK) and the number of analysts following the firm (ANA) and the independent variables were the CAAR and CAAV calculated from the event study. The results indicate that the models have a generally weak predictive power depicted by the low R-squared and adjusted R-squared values. The results further show that the number of analysts has a statistically significant moderately strong positive relationship with CAAR for medium companies and CAAV for large companies. The bid-ask spread is shown to have a statistically significant weak-to-moderately strong relationship with CAAR for small companies and firm size is shown to have a statistically significant moderately strong positive relationship with CAAV for medium companies. Additionally, the regression models were subject to sensitivity tests to determine whether the models were robust to changes in measurement approximations for firm size in line with (Dang et al., 2018). The results of the sensitivity analysis showed no significant changes in the direction and magnitude of the coefficients or their statistical significance confirming that the models are robust to using different measurement approximations for firm size.

Furthermore, an analysis of the director's transactions underscores the behaviour of directors based on company size and structure highlighting how the different positions of directors impact their trading behaviour. As companies grow the stock price and liquidity of the company increase along with the number of directors resulting in greater frequency, value and size of transactions.

5.2 Areas of future research

This study provides a comprehensive review of the stock market reaction to directors' dealings and their relationship with the information environment. The results of the event study have important implications for the efficiency of the JSE and shareholder wealth creation. The results indicate that abnormal returns and abnormal volumes of a company's stock can be triggered by directors' dealings which highlights the impact of the information environment on investor sentiment and the market reaction. This further suggests that shareholder wealth can be enhanced through the abnormal returns earned.

The finding of statistically significant negative abnormal returns following purchase transactions contrasts with the general notion that purchases are typically associated with positive abnormal returns (Lakonishok and Lee, 2001). Future research could investigate the reasons or possible causes of the negative abnormal returns following purchase transactions. The finding that there are statistically significant abnormal returns for small companies during the estimation window and event window suggests that there is possibly information leakage in small companies which allows the market to anticipate the event taking place. Future research could investigate the degree of information leakage across various companies to determine the extent of events being anticipated by the market.

The results of this study appear to confirm the informational value of directors' trades as discussed in Seyhun (1986) and Lakonishok and Lee (2001) for companies on the JSE. Future research could be extended to compare the reactions and relationships determined in markets with differing levels of disclosure and regulatory environments. Additionally, economic downturn and/or market volatility such as the global financial crisis of 2008 and more recently the Covid-19 pandemic can alter how investors perceive activities such as directors' trades (Hoffmann, Post and Pennings, 2013). Future research could examine how market reactions vary during these times of crisis or uncertainty which would provide insights into the robustness of directors' dealings as information signals under different market conditions.

The results of the regression analysis indicate the limitations of the study. Firstly, the R-squared and adjusted R-squared values indicate that the models have weak explanatory or predictive power. These results coupled with the limitation of only 3 indicators of the information environment being used in this study suggest that future studies could investigate additional variables which may add to the predictive power of the models. Secondly, the quantitative analysis used in this study showed that statistically significant relationships exist between specific variables in specific models. A qualitative analysis may be useful to reveal the reasons behind the magnitude and direction of these relationships as well as the other factors that influence them which could reinforce the findings of this study.

This study is limited to a sample of companies from the JSE across a variety of industries, future research could replicate the regression analysis on an industry-by-industry basis to assess the robustness and generalisability of the model and determine whether the magnitude and extent of the relationships determined in this study are maintained in specific industries. The research could be expanded further to include companies from markets in developed and

developing regions. This research would help in understanding the consistency of findings across various contexts.

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Appendices

Appendix A

Figure 2: Development of CAAR for small companies

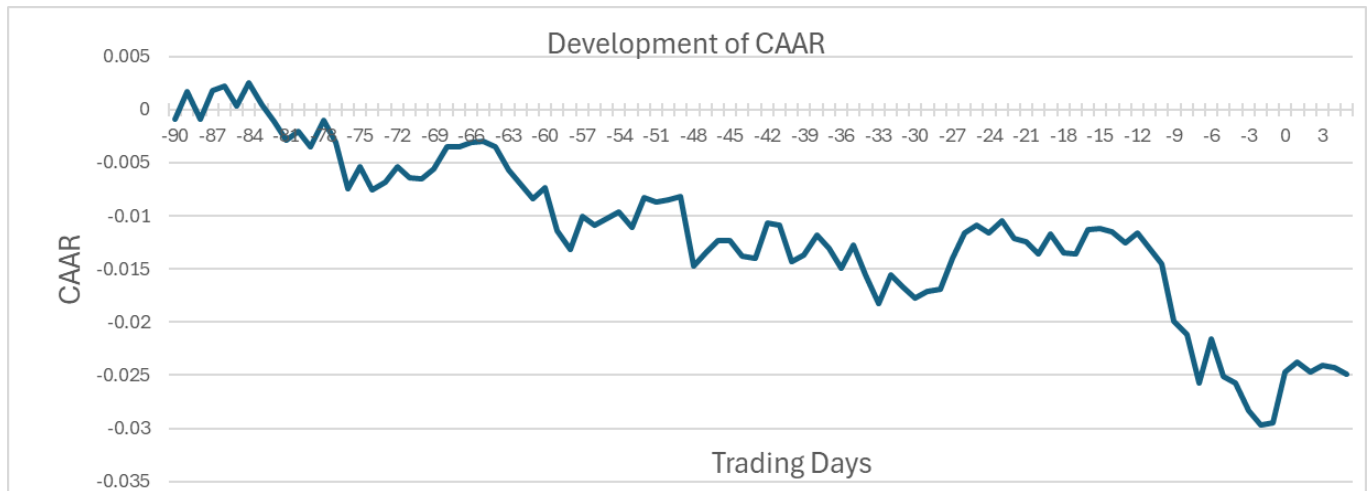


Figure 3: Development of CAAV for small companies

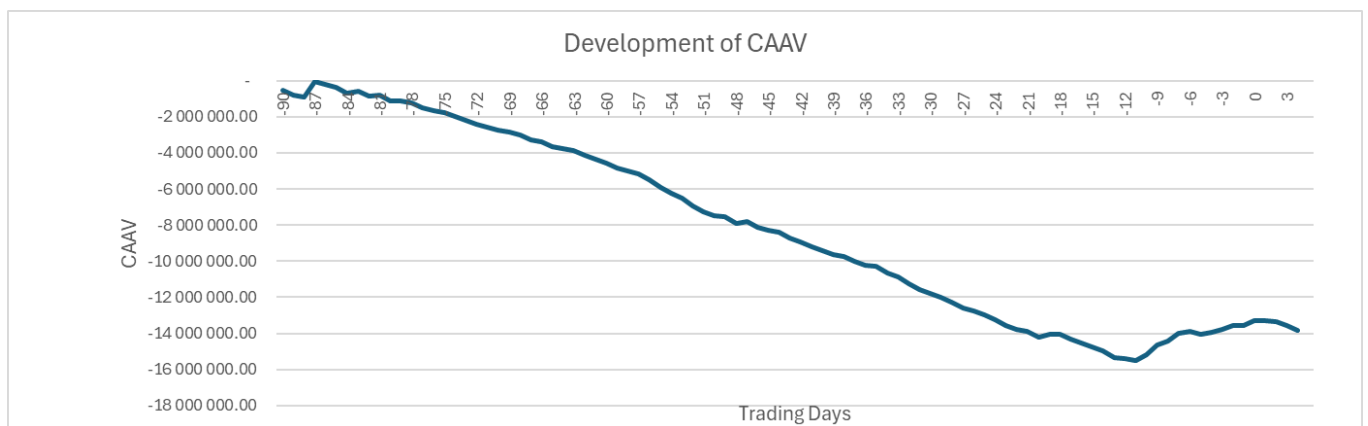


Figure 4: Development of CAAR for medium companies

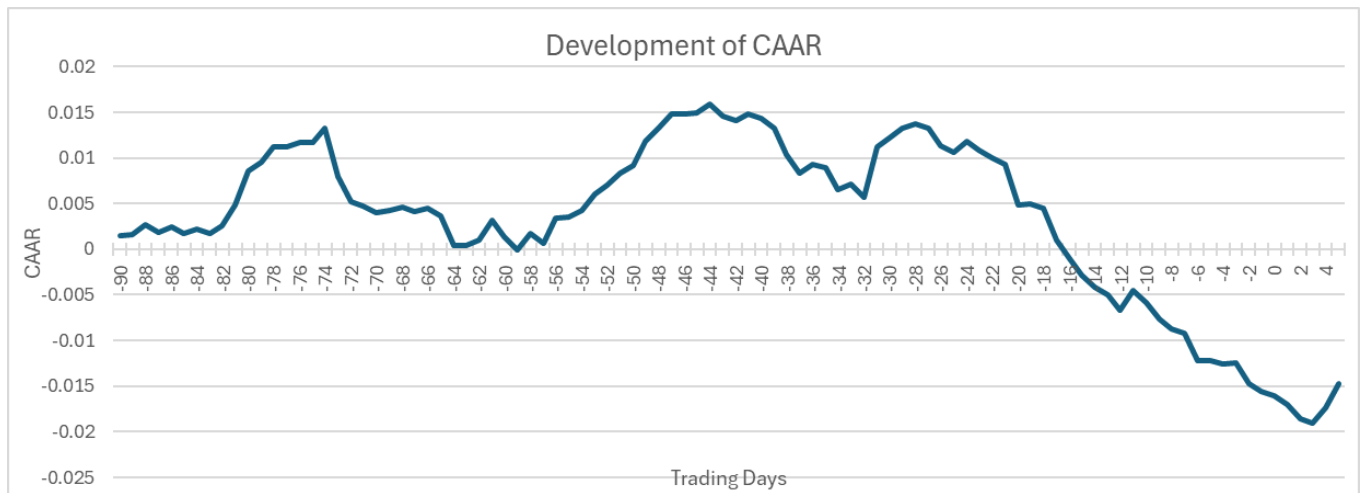


Figure 5: Development of CAAV for medium companies

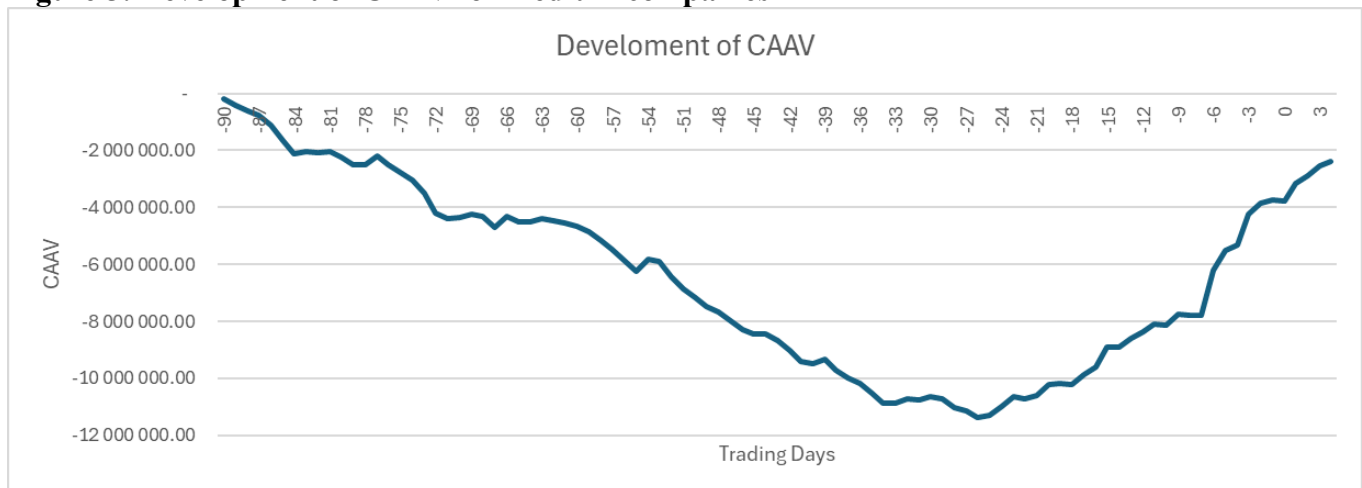


Figure 6: Development of CAAR for large companies

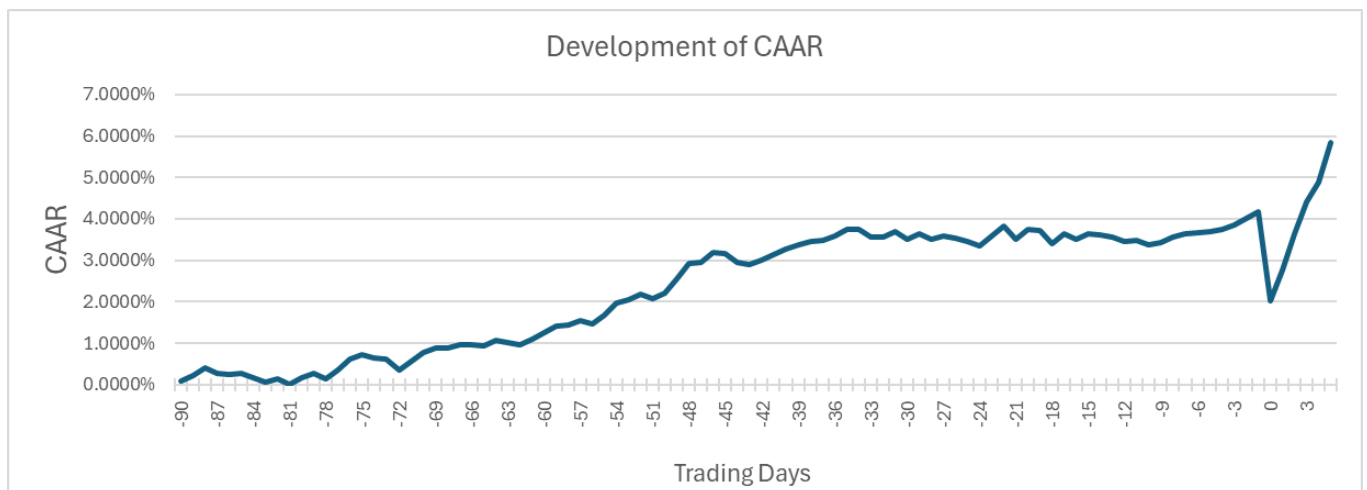
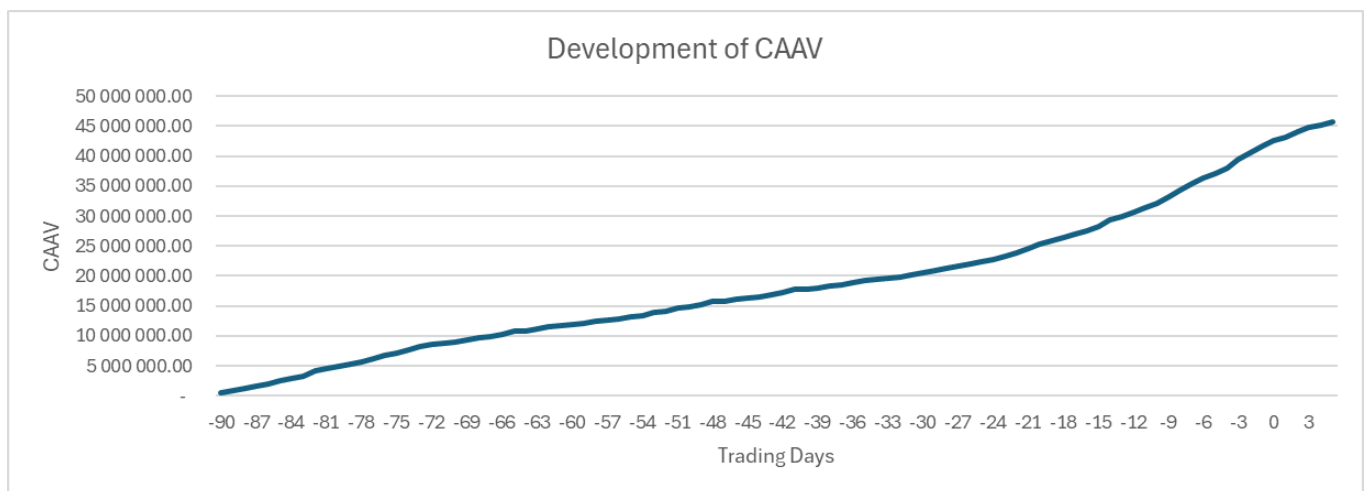


Figure 7: Development of CAAV for large companies



Appendix B

Table B 1: VIF statistics of regression models 1-6

	Small		Medium		Large	
	Ln(CAAR) (Model 1)	Ln(CAAV) (Model 2)	Ln(CAAR) (Model 3)	Ln(CAAV) (Model 4)	Ln(CAAR) (Model 5)	Ln(CAAV) (Model 6)
ANA	1.025	1.020	1.074	1.072	1.363	1.354
BID-ASK	1.132	1.127	1.034	1.039	1.108	1.108
SIZE	1.106	1.113	1.073	1.060	1.362	1.351

Appendix C

Table C 1: Tests of normality for regression models 1-6

	Kolmogorov-Smirnov^a		
Small	Statistic	df	p-value
Ln(CAAR) (Model 1)	0.087	153	0.06
Ln(CAAV) (Model 2)	0.068	157	0.075
Medium	Statistic	df	p-value
Ln(CAAR) (Model 3)	0.087	154	0.006
Ln(CAAV) (Model 4)	0.062	173	0.097
Large	Statistic	df	p-value
Ln(CAAR) (Model 5)	0.054	242	0.081
Ln(CAAV) (Model 6)	0.035	247	0.20

Figure 8: Normal Q-Q plot for model 1

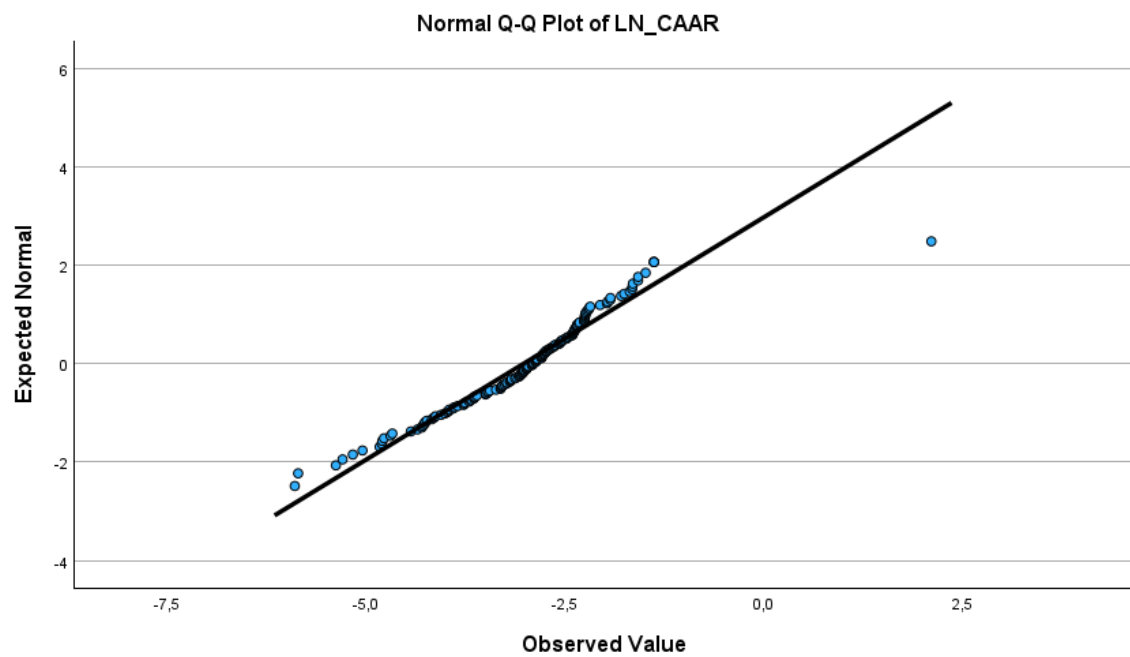


Figure 9: Normal Q-Q plot for model 2

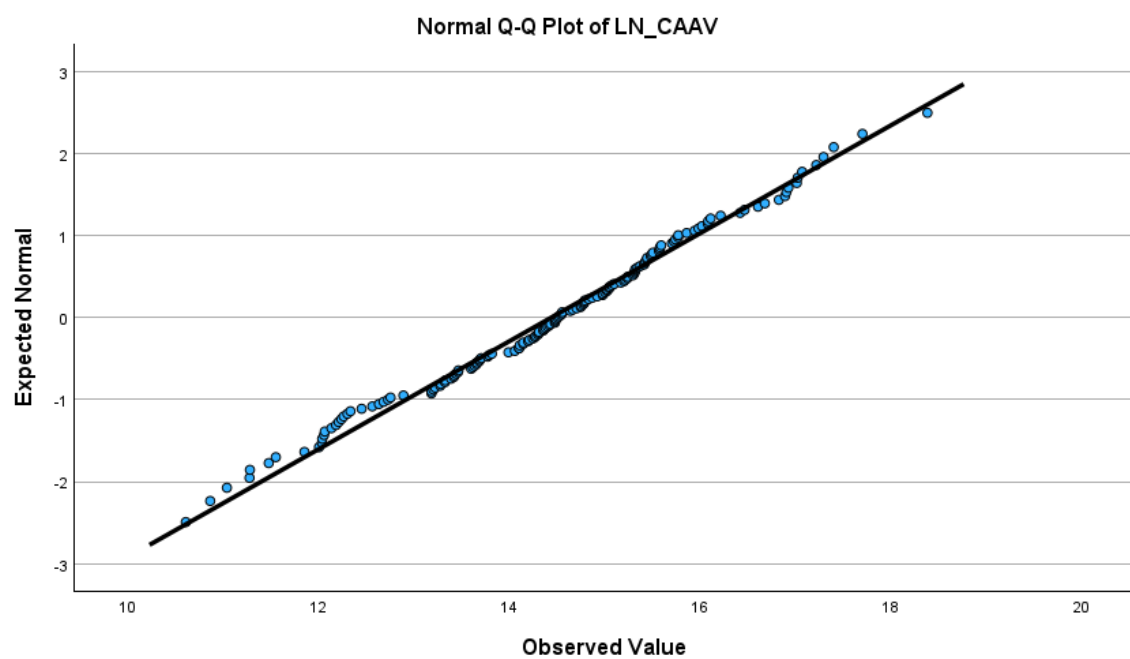


Figure 10: Normal Q-Q plot for model 3

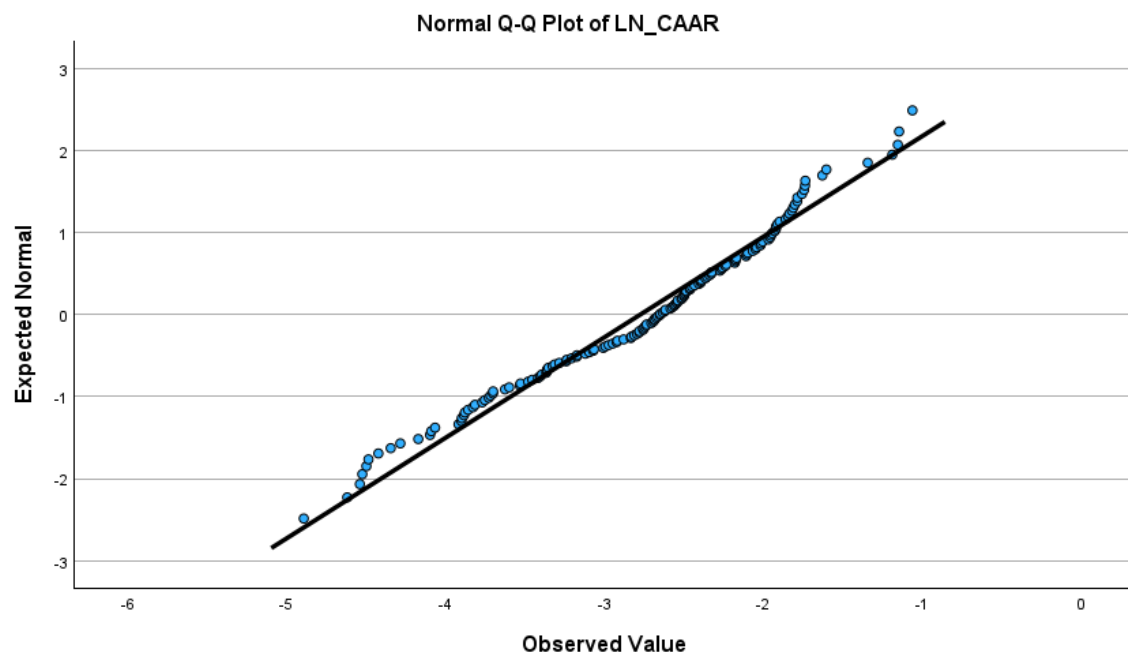


Figure 11: Normal Q-Q plot for model 4

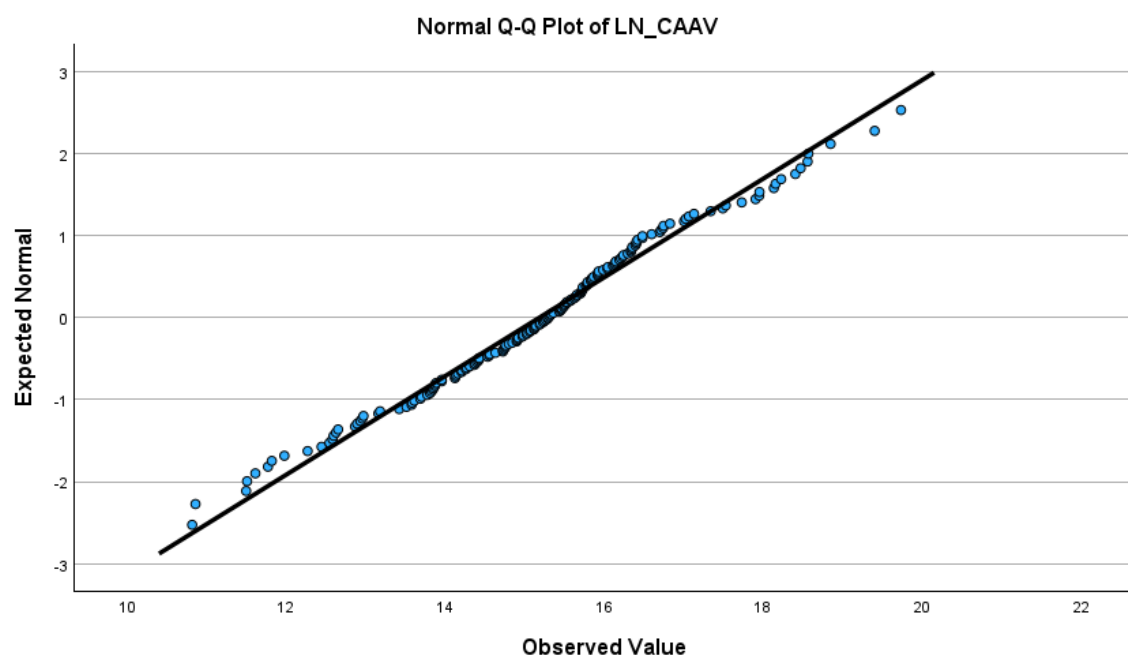


Figure 12: Normal Q-Q plot for model 5

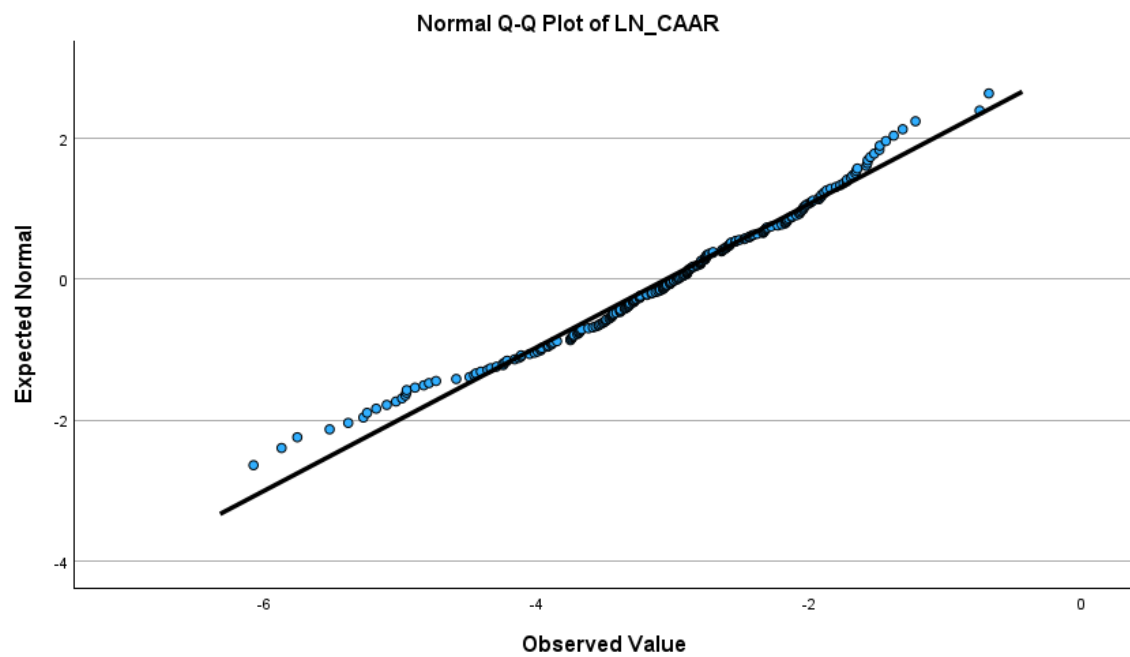
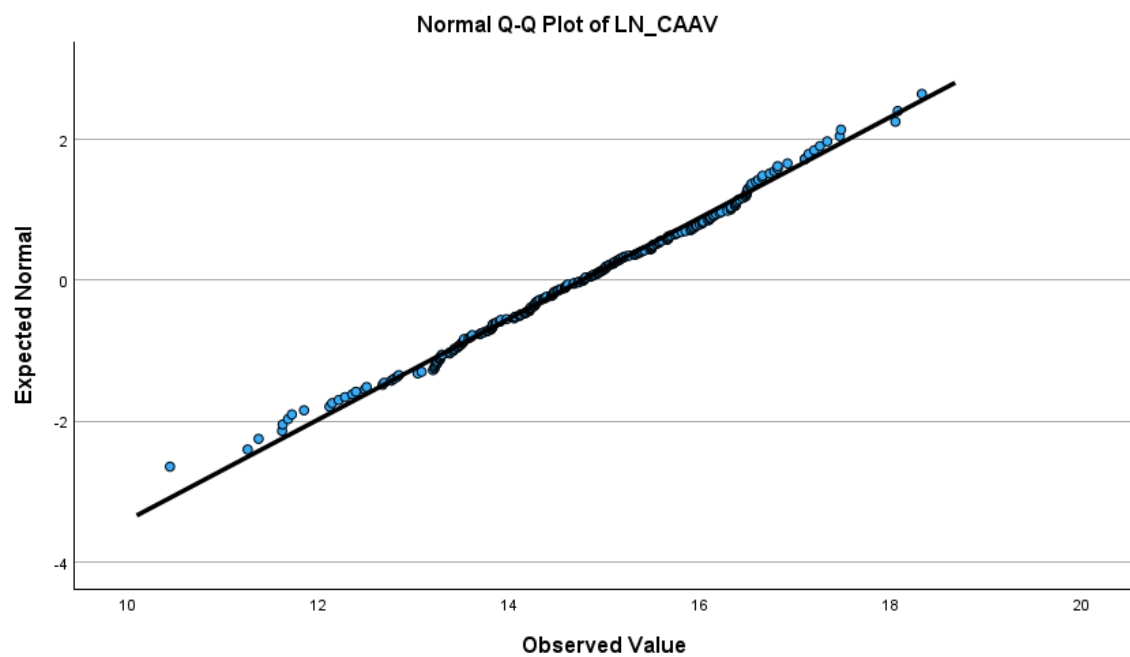


Figure 13: Normal Q-Q plot for model 6



Appendix D

Regression results for sensitivity analysis

Table D 1 : VIF statistics of regression models 1-6

	Small		Medium		Large	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ANA	1.056	1.036	1.207	1.240	1.363	1.542
BID-ASK	1.313	1.267	1.078	1.079	1.108	1.079
SIZE	1.293	1.256	1.279	1.296	1.362	1.468

Table D 2: Model summary for models 1 and 2 (small companies)

	Model Summary		
Small	R ^a	R-Squared	Adjusted R-Squared
Model 1^b	0.202	0.041	0.021
Model 2^c	0.075	0.06	-0.014

a. Predictors: (Constant), ANA, SIZE, BID-ASK

b. Dependent variable: ln(CAAR)

c. Dependent variable: ln(CAAV)

Table D 3: Model summary for models 3 and 4 (medium companies)

	Model Summary		
Medium	R ^a	R-Squared	Adjusted R-Squared
Model 3^b	0.225	0.051	0.032
Model 4^c	0.039	0.002	-0.016

a. Predictors: (Constant), ANA, SIZE, BID-ASK

b. Dependent variable: ln(CAAR)

c. Dependent variable: ln(CAAV)

Table D 4: Model summary for models 5 and 6 (large companies)

	Model Summary		
Large	R ^a	R-Squared	Adjusted R-Squared
Model 5^b	0.123	0.015	0.003

Model 6^c	0.287	0.083	0.071
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a. Predictors: (Constant), ANA, SIZE, BID-ASK

b. Dependent variable: ln(CAAR)

c. Dependent variable: ln(CAAV)

Table D 5: Coefficients for models 1 and 2 (small companies)

	Small					
	Model 1^a			Model 2^b		
	Standardised Coefficients Beta	t-statistic	Sig.	Standardised Coefficients Beta	t-statistic	Sig.
(Constant)		-3.481	<0.001		15.308	< 0.001
ANA	-0.089	-1.073	0.285	-0.047	-0.569	0.570
BID-ASK	0.214	2.328	0.021*	-0.052	-0.575	0.566
SIZE	0.044	0.480	0.632	-0.042	-4.464	0.643

*Denotes significance at the 5% level

a. Dependent variable: ln(CAAR)

b. Dependent variable: ln(CAAV)

Table D 6: Coefficients for models 3 and 4 (medium companies)

	Medium					
	Model 3^a			Model 4^b		
	Standardised Coefficients Beta	t-statistic	Sig.	Standardised Coefficients Beta	t-statistic	Sig.
(Constant)		-4.649	< 0.001*		11.057	< 0.001*
ANA	0.187	2.142	0.034*	-0.025	-0.291	0.772
BID-ASK	0.067	0.816	0.416	-0.033	-0.413	0.680
SIZE	0.076	0.847	0.398	-0.006	-0.074	0.941

*Denotes significance at the 5% level

a. Dependent variable: ln(CAAR)

b. Dependent variable: ln(CAAV)

Table D 7: Coefficients for models 5 and 6 (large companies)

	Large					
	Model 5^a			Model 6^b		
	Standardised Coefficients Beta	t-statistic	Sig.	Standardised Coefficients Beta	t-statistic	Sig.
(Constant)		-2.760	0.006		9.266	< 0.001*
ANA	0.124	1.554	0.122	0.288	3.770	< 0.001*
BID-ASK	-0.01	-0.147	0.884	0.106	1.668	0.097
SIZE	-0.008	-0.102	0.919	0.016	0.213	0.831

*Denotes significance at the 5% level

a. Dependent variable: $\ln(\text{CAAR})$

b. Dependent variable: $\ln(\text{CAAV})$