An Empirical Analysis of Patterns in, and the Informativeness of, Director Trading in the UK

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ABSTRACT

The key objective of this research is to examine various issues relating to trades of UK directors (insiders') in their company shares. Specifically, we examine the general patterns and characteristics of directors' trades, the seasonality patterns of aggregate directors' trades (measured by insider aggregate number and value of insider trading activities), the impact that director's age has on trade informativeness, and the effect of industry classification on the information content of directors' trades. To the best of our knowledge, no empirical examination of these issues has yet to be examined. When examining the general patterns and characteristics of directors' trades, we find that directors buy more frequently than they sell but the average value of sell trades are approximately seven times larger, which suggests that directors sell less frequently but in larger monetary amounts. Furthermore, the majority of trades occur for directors aged between 45 and 65. Small transactions tend to be purchases while large transactions tend to be sells. The majority of the trades were by former directors (for both transaction types) followed by executive and non- executive directors. The majority of trades occurred in the financial industry. When examining the seasonal patterns of aggregate directors' trades (as measured by the number and the value of insider transactions), the results show that there is a day of the week anomaly in aggregate insider activities. Insiders tend to trade more on Fridays and less on Tuesdays. Also, there is a month of the year anomaly in aggregate insider activities (as measured by the number of insider transactions). Specifically, insiders tend to trade more in March and trade less in August. The impact of director's age is also examined, and the results suggest that younger directors' buy transactions produce significantly higher abnormal returns than older directors. There is some evidence of statistically significantly negative CAARs for younger directors' sell trades. When controlling for director type, we find that younger executives (formers) are more informed about their buy trades than executives (formers) of other age groups. Unlike the previous pattern, older non-executives (over 70) seem to be more informed about their buy trades than younger non-executives. Finally, the results of whether industry classifications have an impact on the informativeness of directors' trades indicate that abnormal returns are highest for directors of technology industries. The level of information asymmetry has an impact on the informativeness of directors' trades. Specifically, insider gains are highest, for directors, in high R&D, high volatility, low regulated, highly concentrated, and low CEO compensation industries/sectors.

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Chapter 1: General Introduction

1.1 Introduction

This thesis is organised in seven chapters. The first chapter introduces the thesis while the second chapter reviews previous studies relating to the informativeness of insider transactions as well the theoretical arguments, for and against, insider trading activities. Chapter three describes the characteristics and patterns of insider trading activities pertaining specifically to UK directors over the period 1991-2010. In the following chapter, we test for seasonal patterns in aggregate insider trading activities, as measured by the aggregate number and value of insider transactions. The impact of directors' age and industry classifications on the informativeness of directors' trades are investigated in chapters five and six respectively. Finally, chapter seven concludes the thesis by summarising the findings.

This chapter lays the foundation for this thesis. Firstly, it justifies the research in section (1.2), and then it defines the term of insider trading in section (1.3). Section (1.4) explains the importance of this research, whereas the research objectives are presented in section (1.5), section (1.6) addresses the data and the methodology used to test the research hypotheses. The research limitations are outlined in section (1.7) and finally the thesis structure is presented in section (1.8).

1.2 Insider Trading and Financial Analysis

Financial analysis is defined as the process of identifying financial strengths and weaknesses of the firm by examining historical financial data to gain information about the current and future financial health of a company. Financial analysis gives managers (and investors) the information they need to make management (and investment) decisions.

Financial analysis serves the following purposes: measuring the profitability, indicating the trend of achievements, assessing the growth potential of the business, comparative position in relation to other firms, assessing overall financial strength, and assessing solvency of the firm.

Different parties benefit from the analysis of financial statements for different reasons. For example, investors who are interested in the earning capacity of the business and its prospects of future growth; managers who are interested in the financial position and performance of the enterprise. Other parties who may use financial analysis are lenders interested to know the solvency position of the entity and regulators interested to know if a company's statements are consistent with accounting standards and the rules of the SEC; and employee who are interested to know the growth of profit[1].

One piece of information can be used by these parties is other trades by company directors in their own company shares, because these directors often have access to private information not in public domain, we refer to them as insider trades. Outside investors have attempted to extract the information contained in their trades in attempt to make more informative investment choices. Furthermore, any systematic patterns in their trades can be exploited for the same reasons.

The aim of this thesis is to examine the general patterns and characteristics of director trading as well as to contribute to the previous literature on the informativeness of directors' trades by examining the impact of age and industry classifications on the informativeness of directors' trades.

1.3 Insider Trading by Definition

Insiders can include directors, managers or employees of a company, or they can refer to persons who can access private information indirectly from such managers or directors. In the context of insider trading, this information can be called inside information. This inside information can be accessed by many users and, therefore, can be used to gain abnormal returns. For the purpose of this thesis, insider trading refers to buying, or selling, shares by corporate

[1] The increase in profits may enable employee to ask for an increase in their salaries.

insiders of their own firms for which they have superior information not publicly available (not disclosed yet). Seyhun (1992) and Lakonishok and Lee (2001) defined insider trading as stock transactions by officers, directors, key employees, and shareholders holding more than 10% of any equity class[2]. Ajlouni and Toms (2008) defined insiders as those persons who have access to the firm's inside information. Hence, they include not only firm's directors, officers, and staff, but also the firm's external advisers, such as bankers, auditors, lawyers, and financial advisers. Insiders, according to Fidrmuc (2006), are "managers and members of the board of directors of publicly traded corporations, usually possess more information about their company than do (small) outside shareholders".

A distinguishing needs to be made between legal and illegal insider trading. Illegal insider trading is defined as trading activities by officers, directors, or employees possessing private information (price sensitive information or material information) not in public domain yet (Meulbroek, 1992). Moreover, Illegal insider transaction is one by which directors have their trades on information that the public have not or cannot access. An example of legitimist insider trading is when a director buys his or her company stocks because he or she is confident in his or her own ability to improve his or her company's performance.

An example of illegal insider trading is a director of a mobile company having private information about a new product release and buying more shares in the firm, from which he or she may benefit after the disclosure of this information. Another instance, a director of a company has lunch with her financial advisor and shares private information that the said company's annual reports have been consistently overstating profitability in recent years. The financial advisor then recommends to clients that they sell shares in the said company, and when the information becomes public those who sold such shares benefit.

In practice, it is difficult to distinguish between the two. However, ex post, academics have attempted to distinguish between those trades that outside investors view as being informative and those that are simply noise.

[2] The term officers covers the company president, principal of financial officer, principal of accounting officer, president in charge of any principal business unit, division, or function (sales, administration, or finance), and any other person who performs a policy-making function within the firm (Bettis et al 2000).

The literature which pertains to the informativeness of insider trades has attempted to apply various filters in order to distinguish between the two. For example, transaction, director and firm characteristics are often used in order to identify the information contained in specific trades. For example, Lorie and Niederhoffer (1968), Barclay and Warner (1992), Chakravarty (2001), and Friederich, et al. (2002) examined how the informativeness of directors' trades varies with trade size. King and Roll (1988), Pope et al. (1990), Hillier and Marshall (2002), and Gregory et al. (2009) studied how the informativeness varies with transaction type. Seyhun (1986), Gregory et al. (1994), Fidrmuc et al. (2006), Aussenegg and Ranzi (2008), and Gregory et al (2011) reported that directors' trades in small firms are more informative than directors' trades in large firms.

One aim of this thesis is to contribute to this debate. In chapter five, we inquire as to whether the age of a director at the time he or she transacts is viewed by outsiders as being relevant in determining whether the trades were informed or not. In chapter six, we examine whether the information contained in directors' trades varies with the industry in which the firm belongs.

To the best of our knowledge, both of these empirical questions have yet to be addressed. Furthermore, in chapters three and four, we examine the general patterns and characteristics of aggregate directors' trades and test for the existence of seasonal patterns that can potentially be exploited by outside investors. Thus, many issues that are relevant to regulators, who monitor insider trades, and outside investors who can use their information as a basis or their investment decisions.

1.4 The Significance of the Research

This thesis examines four topics in the general area of insider trading. Chapter three investigates the general patterns and characteristics of directors' trades. Chapter four examines the seasonality patterns of aggregate directors' trades (measured by insider aggregate number and value of insider trading activities). The impact that director's age has on trade informativeness and the effect of industry classification on the informativeness of directors' trades will be

examined in chapter five and six respectively. To the best of our knowledge, no examination of these issues has yet to be examined.

Chapter three will describe the dataset used in this thesis to analyze the information content of insider trading. The objective is to familiarize the reader with some important characteristics of insider trading activities. By identifying these characteristics and patterns, investors might be more able to make better decisions (Seyhun, 2000). For example, suppose an investor would like to use insider trading to help guide a portfolio decision. The first question the investor would ask is how often insider trades occur for a typical stock? If an insider trade is expected to occur once in every other month, then the investor would have a sufficient buy and sell signals to monitor his/her portfolio decision.

One aim of chapter four is to test for seasonal patterns in aggregate insider trading transactions (as measured by the aggregate insider number and value of insider transactions). Specifically, do insiders prefer to trade on any particular day of the week or month of the year? A second aim of chapter four, given that such seasonal patterns exist, will be to attempt to relate these patterns to explanations drawn from the literature on calendar anomalies (in returns and volumes). The previous literature on calendar anomalies has been on returns .i.e. do returns vary by month of the year or day of the week? This literature has attempted to simply identify whether these anomalies exists and/or to try to explain their existence. For example, Cross (1973) and French (1980) reported negative returns on Monday. This is maybe due to the methodology employed or the way of calculating returns (Connoly, 1989), investor psychology (Rystrom and Benson, 1989), the difference in trading patterns of individual and institutional investors (Lakonishok and Maberly, 1990), or settlement procedures (Keef and McGuiness, 2001). Similarly, studies by Rozeff and Kinney (1976), Keim (1983) and Gu (2006) documented positive returns on January. . Also, the literature on trading volume suggests that Monday's trading volume is higher compared to other days of the week. More specifically, investors sell more on Monday if they are individual investors and sell less if they are institutional investors. This is maybe due to the private information hypothesis (Sias and Starks, 1995), and the behavior of individual and institutional investors (Lakonishok and Maberly, 1990) The existence of monthly anomalies can be explained by a tax loss selling hypothesis (Fountas

and Segredakis, 2002), capital gains taxation (Constantinides, 1984), window dressing hypothesis (Haugen and Lakonishok, 1987), new information provided by the firms at the end of the financial year (Barry and Brown, 1984), or insider trading activities (Seyhun, 1988b, and Hillier and Marshall, 2002a). Also, the turn of the year effect might be due to director trading activities as measured by the aggregate number of directors' trades (Seyhun, 1988b, and Hillier and Marshall, 2002a).

Previous empirical literature in the general area of insider trading has found that the informativeness of directors' trades differs with trade, firm, and director characteristics. For example, Lorie and Niederhoffer (1968), Barclay and Warner (1993), Chakravarty (2001), and Friederich, et al. (2002) examined how the informativeness of directors' trades varies with trade size. Medium-sized trades (where the information exists) were found to be more informative than other sized trades. King and Roll (1988), Pope et al. (1990), Hillier and Marshall (2002b), and Gregory et al. (2009) studied how the informativeness varies with transaction type. Directors' buys are, generally, more informative than sales. Specifically, positive (and significant) abnormal returns are associated with buy trades, and negative (and insignificant) abnormal returns are associated with sale trades. Seyhun (1988a), Gregory et al. (1994), Fidrmuc et al. (2006), Aussenegg and Ranzi (2008), and Gregory et al (2012) reported that directors' trades in small firms are more informative than directors' trades in large firms. Degryse et al. (2009), Gregory et al. (2009), and Knewtson (2011) documented higher abnormal returns associated with executives' trades, whereas Fidrmuc et al. (2006) and Jeng et al (2003) found that there is no impact of directors' type on the informativeness of directors' trades (for example, there is no difference in the informativeness between Executive and Non-Executive directors).

By using a certain type of individuals which are directors, the purpose of chapter five is to examine whether the informativeness of UK directors' trades varies with age. There are many reasons why financial decisions may vary with life cycle. Psychological and physical studies concerning age suggested that memory and cognitive abilities decline with age (Gunesh and Merli, 2011; Fair 2007; and Grady and Craik, 2000). Intelligence level also declines with age (Baltes and Lindenberger, 1997). Introducing socioeconomic and demographic

factors such as education, income, wealth, race, ethnicity, and gender can lower the adverse effects of cognitive aging (Korniotis and Kumar, 2011). Financial literature also suggests there are opposing effects of age. On one hand, older investors who have more experience and greater investment knowledge are more likely to make effective financial decisions (Goetzmann and Kumar, 2008; Korniotis and Kumar, 2011). On the other hand, the possibility to make unsuitable decisions increases as the director get older due to memory decline (Lusardi and Mitchell, 2007; Van Rooij, et al. 2007).

Finally, there are also many reasons why the informativeness of directors' trades may vary across industries. These are related to information asymmetry differences across industries. Many measures of information asymmetry such as Research and Development expenditure (Aboody and Lev, 2000), industry regulation (Knewtson, 2011), industry concentration (Gugler, 2001; Blair, 1995; Chu and Song, 2011), and directors pay (Jung and Subramanian, 2013) have been shown to vary across industries. This variation may enable directors in certain industries to exploit information, trade on the basis of this information and this should manifest itself in higher abnormal returns (Aboody and Lev, 2000). Thus, the aim of chapter six is twofold; Firstly, to examine whether the informativeness of UK directors' trades varies among different industries, and secondly, to investigate whether the level of information asymmetry in an industry influences the informativeness of directors' trades.

1.5 Research Objectives

The main purpose of this thesis is to comprehensively examine the following principles:

Objective 1: to analyse the increasing body of literature considering the information content of insider trading, the timing behaviour of insiders' activities, and other issues. This could provide readers, researchers, and newcomers with an insight into how these concepts have been researched, been developed, and been linked over time.

Objective 2: to describe insider trading behaviour by describing the general characteristics, patterns, and activities of UK directors (Chapter 3).

Objective 3: to search for seasonal patterns in aggregate insider trading transactions (as measured by the aggregate insider number and value of insider transactions). Given that such seasonal patterns exist, there is an attempt to relate these patterns to explanations drawn from the literature on calendar anomalies in returns (Chapter 4).

Objective 4: to examine whether the informativeness of UK directors' trades varies with age or whether the age has an impact upon the informativeness of directors' trades (Chapter 5).

Objective 5: to examine whether the informativeness of UK directors' trades varies among different industries, and whether the level of information asymmetry in an industry influences the informativeness of directors' trades (Chapter 6).

1.6 Data and Methodology

This study is based on data supplied by two different data sources for the period January 1991 to December 2010.

1) Directus Ltd compiled a complete record of director's trades in the United Kingdom.

2) Directors Deals, which monitors and analyses share transactions made by directors in their own companies (sometimes known as Insider Deals).

This period yields a sample of 181,275 trades for every publicly disclosed transaction by UK directors in their own firms. The data covers trades by UK directors in both UK and Alternative Investment Markets over the period under examination.

The focus of this thesis will be only on ordinary shares purchases and sales by UK directors over the period 1991-2010. We removed trades[3] other than open market purchases and sales of ordinary shares by directors. Open market sales and purchases are more likely to represent actions taken because of special insider information (Seyhun, 1988; Gregory et al., 1994; and Friederich et al.,

[3] We removed trades such as option exercise, derivative, script dividends or bonus shares, rights issue, awards made to directors under Incentive plans or reinvestment plans, gifts, transfers and purchase, and sales of shares under personal equity plans, operations derived from tax or "bed & breakfast"

2002). Therefore, the sample includes 92,093 trades divided into 70,067 buy trades and 22,026 sale ones over the period 1991 to 2010, with a total monetary value of £29 billion.

To the best of our knowledge, this is a much larger dataset that has ever been used in similar UK studies. For example, Fidrmuc, et al. (2006) used the FTSE all small firms (the study covers the years 1991-1998), whilst Ajlouni and Toms (2008) have used the FTSE 100 firms (this study covers the years 1999-2000).

The methodologies employed in this thesis vary according to the objectives of each chapter. More specifically, descriptive statistics to highlight insider trading patterns are employed in chapter three, whereas the linear regression model and the ordinary least squares-method (OLS), TOBIT regression model (which is a concord form of OLS model), and K-W statistic test are used in chapter four to investigate the seasonal pattern of director trading activities (measured by the aggregate number and value of director transactions). In chapters five and six, standard event study methodology based on the market model and market adjusted model is employed using announcement dates as the event dates to construct the abnormal returns. To examine whether the informativeness of directors' trades varies with the director's age (and industry classifications), a Univariate and multivariate regressions are used.

1.7 Research Limitations

The first limitation is that the period 2002-2010 contained more detailed information about directors' activities. Moreover, before 2002, the data covers only specific information about directors' trades such as company name, transaction and announcement date, transaction price, transaction amount, transaction value, transaction type and transaction class. After 2002, the data set contained more detailed information such as holding, holding changes, holding percentages, and company International Securities Identification Numbers[4].

Due to the lack of available data on director age, we are only able to cover the periods 1991-1997 and 2002-2010.

[4] This piece of information is discussed in more details in the first empirical chapter.

Because of data availability on directors' types, the sample analysed covers only 37% of total available trades during the sample period. More specifically, the period under examination starts at January 2002 and ends at December 2010.

Again, due to the lack of available data on director Industry/sector, we are only able to cover the period 2000-2010. This covers approximately 64% of total available trades.

Finally, the data on company International Securities Identification Numbers, which will be used to collect daily returns and market values and other variables needed to examine the hypotheses, covered only the period 2002-2010.

1.8 Structure of the Thesis

Chapter One: General Introduction

This is an introductory chapter to the thesis.

Chapter Two: Literature Review

This chapter reviews the literature relating to insider trading activities and the debate, for and against, their activities.

Chapter Three: Patterns and Characteristics of Aggregate Insider Transactions in the UK 1990-2010

This chapter describes the general patterns and characteristics of insider trading activities in the UK over the period 1990-2010.

Chapter Four: Seasonal Patterns of Aggregate Directors' Trades

This chapter tests for seasonal patterns of aggregate directors' trades, as measured by the number and value of insider transactions.

Chapter Five: The Informativeness of Directors' Age

This chapter explores whether the informativeness of directors' trades varies with age.

Chapter Six: The Informativeness of Directors Trades: The Impact of Industry Classifications

This chapter examines whether the informativeness of UK directors' trades varies among different industries and whether the level of information asymmetry in an industry influences the informativeness of directors' trades

Chapter Seven: Conclusions

This chapter concludes and summarises the results of the thesis.

Chapter 2: Literature Review

2.1 Introduction

As the key objective of this research is to examine various issues related to insiders' trades, particularly, the general patterns and characteristics of directors' trades, the seasonality patterns of aggregate directors' trades (measured by insider aggregate number, volume, and value of insider trading activities), the impact that director's age has on trade informativeness, and the effect of industry classification on the informativeness of directors' trades, this chapter critically reviews the relevant literature of insider trading activities. It analyses the increasing body of the literature, considering the information content of insider trading, the timing behaviour of insiders' activities, and other issues. This could provide readers, researchers, and newcomers with an insight into how these concepts have been researched, been developed, and been linked over time.

The remainder of the chapter is to review insider trading literature regarding the informativeness of directors' trades, the timing behaviour of directors' trades, the methodological employed in examining various insider trading hypotheses, and other studies relating to insider trading activities. The chapter concludes with a summary given in the last section.

2.2 Literature Review

This section reviews the literature on insider trading drawing on research in the UK and other countries. Following that, the literature on insider trading for each sub-section is divided according to smaller categories in similar fashion to Clacher, Hillier and Lhaopadchan, (2009). These categories are;

1. The information content of corporate insider trading activities; and
2. The timing behaviour of corporate insider trades.

In addition to the previous channels, we also review the methodological approaches and other evidences in separate sections.

2.2.1 International Evidence

This section reviews the literature on insider trading based on research held in different countries except UK.

2.2.1.1 The information Content of Insider Trading

In this section, insider trading studies that examined the existence of abnormal trading performance and the informativeness of directors' trades are presented. Early insider trading studies focused on the relationship between insider trading activities and stock market movements (changes). For example, Rogoff (1964) examined this relation using a sample of 45 companies in which, within a single month, three or more insiders bought their company's stocks and no insiders sold the stocks. The results showed that the returns to the insiders of these companies in the following six months were approximately 10% higher than the return to the stock market as a whole. Similarly, but using a sample of companies' directors where at least two more buyers than sellers or at least two more sellers than buyers, Lorie and Neiderhoffer (1968), Pratt and DeVere (1970), and Jaffe (1974) found that insiders are able to earn higher abnormal returns. Additionally the following pattern emerges: directors' purchases tend to be followed by purchases and directors' sales by sales, and they are also net purchases of their firm shares. This pattern emerged again in a study by Chowdhury et al. (1993). Furthermore, studies by Seyhun (1986, 1992) and Lin and Howe (1990) examined the relationship between insider trading activities and returns. These studies indicated that insiders are able not only to earn abnormal returns, but also to predict abnormal future stock price changes i.e. insiders purchase stocks before an abnormal rise in stock prices and sell stocks before an abnormal decline in stock prices. Unlike the previous findings, Wu (1963) found no relationship between insider trading activities and stock market movements, using a sample of fifty firms over the period 1957-1961. Therefore, insider's knowledge is not valuable for both the managerial authorities and the investors. Rozeff and Zaman (1988) and Lin and Howe

(1990) showed that once transaction costs were controlled, the abnormal returns to insiders' trades disappeared.

Moreover, previous insider trading studies examined whether the informativeness of directors' trades varies with trade, firm, and director characteristics.

Using US data, Barclay and Warner (1993), Chakravarty (2001), Lebedeva, Maug and Schneider, (2009), and Abad and Pascual (2011) examined whether the informativeness of directors' trades vary with trade size across insider groups, and found that medium-size trades are more informative than other-size trades (small or large trades). One explanation given is that privately informed traders would concentrate their trades in medium-size trades because small trades are expensive in term of trading cost and large trades might give them away. In the same vein, Seyhun (2000) argued that insiders broke up their large trades into smaller medium-size trades to avoid being caught by regulation authorities. Another explanation arises; directors act as liquidity traders who have no superior information and try to reduce price impact from trading large shares (Abad and Pascual, 2011). In Germany, Aussenegg and Ranzi (2008) showed that large volume sell trades reveal less information about the firm value than small volume sell trades do. These studies have used the number of shares as a measure of trade size.

Also, transaction type has been shown to have an impact upon the informativeness of directors' trades. Finnerty (1976), Seyhun (1988a), Lakonishok and Lee (2001), Aktas, De Boot and Oppens, (2008), and Aussenegg and Ranzi (2008) showed that buy transactions are more informative than sell transactions. This is because market participants view the insignificance of sell trades to be motivated by liquidity/diversification needs. On the other side, market participants view the significance of buy trades to be motivated by information advantages. Scott and Xu (2004) examined the informativeness of directors' sells. More specifically, this study tried to separate sales driven by liquidity or diversification needs from those driven by insiders' superior information. For that reason, they used the number of shares traded as a percentage of insiders' holdings. The results indicated that when insiders have negative information about their firms' future prospects, their sells are likely to be large in volume and to stand for a large portion of their holdings. Furthermore, small sells that accounted for small percentages of

insiders' holdings may show owners' need to raise income and reflect their attitudes towards their company which, in turn, lower their sells transactions as a percentage of their holdings. Using a sample of US companies, Aussenegg and Ranzi (2010) reported significantly positive abnormal returns associated with buy trades, but sell trades, unlike the previous studies, did not reveal negative private information.

Unlike the previous studies, Aktas et al. (2008) found positive abnormal returns associated with sell transactions and insignificant abnormal returns associated with buy transactions. Also, Degryse et al. (2009) examined the information content of corporate insiders' trades in Dutch listed firms. The results implied significantly large abnormal returns associated with insiders' buys and significantly low abnormal returns associated with insiders' sells.

When examining the impact of some trade characteristics such as size, number, and direction of the trade, Meulbroek (1992) found that these characteristics lead inside information to be incorporate into price.

Tavakoli, McMillan and McKnight, (2012) examined the informativeness of directors' trades by using three measures of insiders' activities (number of trades, volume of trades, and the value of trades). Their results revealed the following: when net buys are positive (negative), future returns are positive (negative) because of the belief that future firm value would increase.

The impact of firm size on the informativeness of directors' trades is also analysed by a number of studies. For example, studies by William (1986), Seyhun (1988a), Aussenegg and Ranzi (2008), Hotsen et al. (2008) and Tavakoli, McMillan and McKnight, (2012) found that directors' trades in small firms are more informative than directors' trades in large firms. There are many reasons why insiders in small firms are more informative than insiders in large firms. These reasons are; large firms tend to have more non-executive directors than small firms, or that directors' trades in large firms are more public which makes stock market react faster. Additionally, directors' trades in small firms are more informative because directors in small firms might have more relevant information, or because financial analyst have less attention to directors' trades in small firms (Ataullah et al., 2012). These studies, however, used market value (capitalization) as a measure of firm size. Other studies such as Rozeff and Zaman (1988) and Bonaimé and Ryngaert (2013) used another measure of firm size which is the book to market value. Madura and Wiant

(1995) examined whether bank size has an impact on the informativeness of directors' trades. The results showed that insiders in small banks are more informative than insiders of large banks.

Rozeff and Zaman (1988) further explored the impact of earning to price ratio, as a measure of the performance of insider trading, on the informativeness of directors' trades. They found that insiders in small firms with high earning to price ratio tend to buy, whereas insiders in large firms tend to sell.

Zhang, Cahan and Allen, (2005) examined whether there is a relationship between insiders' activities and pay to performance and reported low (high) insiders' activities are associated with high (low) pay to performance. .

Piotroski and Roulstone (2003) examined whether directors base their trades on superior information about firm's future returns and earning performance. The results showed that trades by insiders are positively associated with the firm's future earnings performance. Also, the behaviour of insider trading varies with the horizon of earning news within each book to market group. Moreover, directors' buys are significantly positive and related to next year's earning news. Also, for glamour (value) firms, the relation between directors' buys and earnings are negative (positive).

Other studies, such as Aboody and Lev (2000), Barth et al. (2001) and Joseph and Wintoki (2013), investigated the relation between insider trading profits and the superiority of insider information or whether investment in advertising has an impact on the informativeness of directors' trades. More specifically, Aboody and Lev (2000) showed that insider trading gains are lower for firms with low or no R&D expenditures, Barth et al. (2001) found that firms with more investment of intangible assets are associated with higher analyst following, and Joseph and Wintoki (2013) showed that directors' trades at firms characterised by high advertising investment are more informative than directors' trades at firms characterised by low or no advertising investments.

Frankel and Li (2002) examined the impact of firm's financial characteristics (financial statements, analyst following, and firm information provided by voluntary disclosures) on determining their effects on information asymmetry between managers and outsiders. The results suggested that increasing the informativeness of financial statements has an impact on managers' ability to predict future returns. Insiders buy less frequently when financial statements are more informative and when more analysts follow the firm.

Studies by Seyhun (1988a) and Jenter (2005), assumed that directors who involve more in firm's daily operations, such as the chairman of the board of directors or officer-directors, are more able to predict any changes in future stock price than officers or shareholders alone. The results showed that top managers tend to have contrarian views regarding their own firm shares. Therefore, high valuation firms' managers view their shares as overpriced, and low valuation firms managers view their shares as underpriced. Furthermore, undervalued firms experience net insider buying and have capital structures that reflect such undervaluation. Degryse et al. (2009) implied that top executive purchases in small and value[5] firms are more informative than top executive purchases in large firms. Besides, high abnormal returns are associated with large holdings prior to top executive purchases, and low abnormal returns are associated with large purchases. This is because executive directors are more involved in the firm's daily operations than other directors. Knewtson (2011) and Wang, Shin and Francis, (2012) examined the impact of CEOs and CFOs on the informativeness of directors' trades. The results showed that buy trades by CFOs are more informative than those by CEOs .i.e. Abnormal returns associated with CFOs buy trades are higher than abnormal returns associated with CEOs buy trades. This is because CFOs are responsible for the firm's financial strategies and financial reporting which allow them to have more detailed and unique information than CEOs. . On the other hand, Jeng et al. (2003) found no impact of director's type upon the informativeness of directors' trades. Also, Ravina and Sapienza (2010) showed that abnormal returns associated with independent (non-executive) directors' buy transactions are positive.

Hillier, Korczak and Korczak, (2013) examined whether individual characteristics (such as skills, expertise, or personality) have an impact on the informativeness of directors' trades. They found that firm or observable characteristics have less influence on insider trading performance than individual characteristics do. Also, superior return performance of top executives (CEOs and CFOs) can be due to their better expertise and skills and not preferential access to firm information.

[5] Value firms are firms that have low stock price compared to their accounting value.

Finally, Degryse et al. (2009) and Lebedeva (2012) reported that in less liquid market, insiders trade more slowly if they compete with other insiders, and trade faster under private information assumption.

2.2.1.2 Timing Behaviour of Corporate Insider Trades

The second major theme in insider trading research is concerned with an analysis of insider trading behaviour around firm specific information events (such as dividend announcements, merger announcements, and earning announcements).

The second major theme in insider trading research is concerned with an analysis of insider trading behaviour around firm specific information events (such as dividend announcements, merger announcements, and earning announcements).

Elliot Morse, and Richardson (1984), Givoly and Palmon (1985), and Oppenheimer and Dielman (1988) investigated insider trading relative to specific corporate announcements. Different from Penman's findings, these studies concluded that only a small proportion of insider trades may be related to firm-specific announcements. Elliot, Morse, and Richardson tried to test whether insiders can earn abnormal profits from advance knowledge of new announcements prior to their release to the public. Specifically, the authors studied abnormal returns generated before and after the public disclosure of information concerning dividends, earnings, bond ratings, mergers, and bankruptcies. Specifically, they examined the distribution and the general patters of insider trading activities surrounding public announcements. This will help indicating unusual insider trading patterns as well as providing insight why insiders trade. They used two measures of insider trading activities; the net number of buyers/sellers and percentage of shares purchased or sold[6]. Insider trading behavior was examined surrounding four good-news events[7] and four bad-news events[8].The results indicated that insiders with private

[6] This variable is defined as the market value of shares bought minus the market value of shares sold divided by the market value of shares of the firm's common stock.

[7] They are large earnings increases, large dividend increases, bond rating increases, and merger announcements.

[8] They are large earnings decreases, large dividend decreases, bond rating decreases, and bankruptcy announcements.

information should purchase shares before the public release of good news that increase prices and should sell shares before the public release of bad news that decrease prices. If a speculative portfolio position is taken before the public announcement, then increased selling should follow the public announcement of good news and increased buying should follow the public announcement of bad news. More specifically, Reduced selling (and/or greater buying) was observed before merger announcements and before large earnings and dividends increases. This pattern was also observed before large earnings decreases and bankruptcy announcements. Also, extreme insider trading for the net buyer/seller measure was defined as the number of sellers exceeding the number of buyers by three or more for a given month or vice versa. Extreme insider trading for the percentage of shares measure was defined as sales in excess of .202% of the outstanding shares and purchases in excess of .226% of the outstanding shares. Accordingly, periods of intensive insider buying are expected to occur more frequently preceding good-news events and periods of intensive insider selling are expected to occur more frequently preceding bad-news events. Therefore, trading strategy based on intensive trading by insiders yields greater abnormal returns.

Givoly and Palmon (1985) were unable to document a link between returns earned by insiders and specific disclosure announcements such as earnings and dividend announcements, whereas John and Lang (1991) and Del Brio and Miguel (2008) noted the relationship between insider trading and dividend changes, rather than earning announcements. Dividend increases accompanied by unusual insider buying signal good news, resulting in positive abnormal returns. The opposite is also true. LaPorta et al. (1997) found that, on average, value (growth) firms tend to have positive (negative) future earnings announcement period returns. Betzer and Theissen (2007) analysed both the profitability of insider trading and trading patterns around German earnings announcements. They reported that trading prior to earning announcements has a larger impact on prices. Another study in Hong Kong, Jaggi and Tsui (2007) examined the association between earning managements and insider selling after the end of the financial year, and found that executive directors reported earnings to maximise their private benefits from insider selling. Thus, the

relationship between insider selling and earnings can be moderated by the proportion of independent directors.

Chiang and Chang (2012) studied the relation between insider trading and option returns around earnings announcements. The results indicated that investors who take advantage of insider trading information can earn a return premium by holding option contracts even after controlling for systematic risk, volatility risk, and transaction cost.

Jeng et al. (1999) analysed all insider trades that took place in the US between 1975 and 1996. The results suggested that the purchase portfolio does better than the market by about 7.4 per cent per year. About one-sixth of the abnormal returns arise within the first five days of a trade, one-third within the first month, and three-quarters within the first six months. Nevertheless, insider sales do not provide evidence to be economically or statistically significant.

In Indiain capital markets, Agarwal and Singh (2006) examined trading activities by of insiders prior to merger announcement. The results showed that trading activities by insiders are higher (buying or selling shares) before merger announcement. Also in Germany, Li and Zhang (2006) looked at insider trading activities around financial restatement announcements, and found strong evidence of informed trading by insiders. Focusing on the association between net insider selling and restatement announcement abnormal returns, they provided evidence of net insider selling before the restatement announcements, little net insider selling immediately around the announcements, and net insider buying after the announcements. Ching et al. (2006) examined insider trading around seasoned equity offering announcements in Hong Kong. The results indicated positive (negative) abnormal returns associated with the announcement of placing (rights offerings).

Noe (1999) examined insider trading around management forecasts of earnings and found the trading patterns to be unrelated to the forecasted earnings news, whereas Seyhun (1990) also confirmed that insiders in bidder firms traded more prior to the announcement of a takeover bid.

Finally, evidence related to insider trading and bankruptcy is mixed. Gosnell et al. (1992) found that insiders sell prior to bankruptcy while Loderer and Sheehan (1989) did not find any evidence of selling.

2.2.2 UK Evidence

This section reviews the literature on insider trading based on research held in the UK.

2.2.2.1 The Information Content of Insider Trading

King and Roll (1988) examined the profitability of insider trading in the UK over the period from January 1986 to August 1987. The sample excluded option exercises, rights issues, and new share issues. They found that abnormal returns persevere for up to one year after the publication. Ignoring transaction costs, investors using this published information were able to gain abnormal profits. Another finding was that the abnormal returns for buy trades were greater than the abnormal returns for sell trades. This is because insider sell decisions are more likely to happen for non-information based reasons than purchase decisions. Therefore, insider purchases, as a whole, may be a stronger signal than collective sales.

Pope, Morris and Peel, (1990) tested whether directors in the UK, over the period 1977-1984, earned abnormal returns on their trades and whether the markets responded to their dealings. The main results implied positive average returns associated with insider purchases and negative average returns tend to follow insider sales. Nonetheless, only the insider sales tend to be significantly different from zero.

Gregory et al. (1994) re-examined the UK results of significant abnormal returns from directors' trading, and found that abnormal returns tend to be associated with small firms. Later, Gregory et al. (1997) tested whether the number and the size of insider trades are related to the magnitude of subsequent abnormal returns. They used a dataset of non-option related trades over the period 1986-1990. They found that there is a size effect over the period under examination, and this effect was indeed variable (positive during 1986-1988 and negative during 1989-1990). Thus, they concluded that it is necessary to choose correct the benchmark return model that controls for the size effect in this type of studies which examine abnormal returns over long-post event windows and includes many small firms in the sample under

examination. Furthermore, it was found that signal definition is also important when obtaining results and drawing conclusions.

Friederich and Tonks (2004) examined abnormal returns patterns in the days around directors' trades which are consistent with director's ability to predict short-term abnormal returns. Similar to earlier work, buy trades appear more informative than sells. Also, large abnormal returns are associated with buy trades that occur close to earning announcements.

Calvo and Lasfer (2002) analysed trades conducted by insiders prior to transaction date, and whether insiders time their trades and whether market reaction varies with insiders' superior knowledge. The following results emerged: insiders buy shares before price decreases and sell before the price increases, and abnormal returns associated with buy transactions are positive on the event date (and up to ten days event window) while abnormal returns associated with sell trades are negative for the same event windows. Therefore, insiders may convey information and outside investors may follow their trades.

Hamill et al., (2002) examined the informativeness of UK small firms' directors, and the relationship between excess returns and future financial performance of the firm. The results showed that buy trades produce significantly positive signals, whereas sell trades produce insignificantly negative signals. Therefore, outside investors may response positively to directors' buys. Furthermore, and similar to Gregory et al.(1994), there is a positive association between excess returns and future performance.

Fidrmuc, Georgen and Renneboog, (2004) explored the impact of the firms' ownership and control structure on the informativeness of directors' trades for all UK listed companies. The results showed that buy trades in firms with large directors' holdings is less positive than that for buy trades in firms with low directors' holdings, whereas sell trades in firms with large directors' holdings is less negative. Also, market reaction to former directors' buys (and poor performance firms' buys) is the strongest. Besides, the informativeness of chairman executive officers' trades is lower than that of other directors. Abnormal returns associated with buy trades are positive, whereas abnormal returns associated with sell trades are negative. Finally, the presence of block-holders (corporations, or individuals or families) reduces the information asymmetry. Later, Fidrmuc et al. (2006) tested the informativeness of the trades of five types of directors in the UK (CEOs, other executive directors,

chairman, other incumbent directors, and former directors). The results implied that the CAARs for the various categories are not significantly different from each other. Fidrmuc et al. (2006) went step further by comparing abnormal returns associated with insiders' trades between UK and US and found that abnormal returns in UK is higher than those in US. This difference is due to the difference in insider trading regulations between the two countries.

Similarly, Gregory et al. (2009) examined whether the informativeness of directors' trades varies with the director's type (executive or non-executive director) and the director's gender (male or female). The results were as follow: directors buy after a decrease in prices and sell after an increase in prices; this is consistent with the view that directors possess superior information about firm future prospects, buy trades produce positive signals; director's gender has no impact upon the informativeness of directors' trades, whereas director's type has an impact upon the informativeness of directors' trades; similar to Gregory, Matatko and Tonks, (1997), directors of small companies are more informative than their counterparts in large companies; finally, the results confirmed the previous findings of Scott and Xu (2004). Extending the analysis, Gregory et al. (2012) suggested that although market react less to female trades, but abnormal returns associated with female executive trades are significantly higher than abnormal returns associated with male executive trades up to twenty days after the announcement dates (when controlling for the firm and trade characteristics). For longer event windows (three months to one year), market reaction to male and female trades is not significantly different, but female trades (concentrated in executive groups) are more informative than male trades.

Gregory, Tharyan and Tonks, (2011) examined directors' trades patterns and the long run returns to their activities in value (glamour) firms listed in London Stock Exchange between 1997 and 2003 and found the following results; with buys (sells) following price falls (rises), directors buy (sell) more value (glamour) shares; buy (sell) signals in value (glamour) shares produce significantly positive (insignificantly negative) abnormal returns. Larger abnormal returns are concentrated in smaller value stocks in particular.

Ajlouni and Toms (2008) examined market reaction to FTSE100 directors'' trading on their own firm's ordinary buys and sells between 1999 and 2000. The results were in the same line with UK studies by King and Roll (1988),

Pope et al. (1990), and Friederich et al. (2002) which found positive abnormal returns associated with buy trades, and negative abnormal returns associated with sell trades. In long run (short run) event windows, directors of small firms earn significantly more returns than their counterparts in large firms. Moreover, outside investors can earn abnormal returns by observing insiders' transactions.

Giamouridis et al., (2008) examined the informativeness of directors' trades in the UK during the period 1994-2006 and found positive abnormal returns are correlated with trade size as a percentage of outstanding shares, director's type, and price momentum, whereas abnormal returns are negatively correlated with transaction value. Specifically, large trades by executive directors are more informative than small trades by other directors.

Andriosopoulos and Hoque (2011) examined the impact of aggregate insider trading on market returns in the UK. They found that, in the period surrounding the announcement dates, insiders are able to predict future returns; based on market to book ratio, insiders tend to buy shares with poor past performance. Market reaction to insiders' trades in small firms is stronger than that in large firms, and insiders' buy transactions convey information, whereas insiders' sell transactions are not.

Depending on a recent dataset on UK company director's trades in the banking sector; Lambe (2010) attempted to disentangle the relationship between bank returns, the activities of bank insiders and a variable taken to represent the extent of media coverage of the financial crisis. They found that the relationship is slight, and, at a shorter horizon, the actions of insiders, when looked on aggregate, bear a relationship to that overall sector's return. By using two samples of UK listed firms over the period 2001-2010 for announcements and rumours dates, Lambe (2011) reported significant abnormal returns prior to the public release of information. These abnormal returns are not due to reported informed trades, they are perhaps due to material information which is undisclosed and/or non-public.

Fidrmuc et al. (2012) tested whether country-level shareholder protection has an impact on abnormal returns after insider trades. The results showed that shareholder protection has a positive impact on cumulative abnormal returns for both insiders' buy and sell transactions.Besides, directors' buy trades are more informative than directors' sell trades because sell trades are likely to be driven by diversification and liquidity needs.

Ozkan and Trzeciakiewicz (2012) examined the impact of Chief Executive Officers' trades and Chief Financial Officers' trades upon the informativeness of directors' trades. The results showed that trades conducted by CEOs are more informative than trades conducted by CFOs.

2.2.2.2 The Timing Behaviour of Corporate Insider Trades

On the other hand, the effect of the London Stock Exchange Model Code, which bans directors from trading two months prior to their firm's earning announcement, was examined by Hillier and Marshall (2002c). They found that insiders buy after abnormally bad earnings news and sell after good news. On the other hand, Kavussanos and Tsounia (2007) suggested that, on basis of advanced knowledge, insiders tend to trade regarding proceeding mergers.

Tables (2.1) and (2.2) summarise the literature on the informativeness and the timing behaviour of directors' trades for UK and other countries.

Table 2.1: Summary of the Literature Relating to the Informativeness of Directors' Trades

The Informativeness of Directors' Trades		
Author (s)	Sample Period	Main Results
Rogoff (1964)		The returns to insiders' trades in the following six months were approximately 10% higher than the return to the stock market as a whole.
Lorie and Niederhoffer (1968)	1/ 50 to 12/60	Insiders are able to earn higher abnormal returns. Directors' purchases tend to be followed by purchases and directors' sales by sales, and insiders are also net purchases of their firm shares.
Pratt and DeVere (1970)	1960-1966	
Jaffe (1974)	1962-1968	
Chowdhury et al. (1993)	1975-1986,	Directors' purchases tend to be followed by purchases and directors' sales by sales, and insiders are also net purchases of their firm shares.
Seyhun (1986)	1975-1981	Insiders purchase stocks before an abnormal rise in stock prices and sell stocks before an abnormal decline in stock prices.
Lin and Howe (1990)	1/75-4/83	Insiders purchase stocks before an abnormal rise in stock prices and sell stocks before an abnormal decline in stock prices. Once transaction costs were controlled, the abnormal returns to insiders' trades disappeared
Seyhun (1992)		Insiders purchase stocks before an abnormal rise in stock prices and sell stocks before an abnormal decline in stock prices.
Wu (1963)		No relationship between insider trading activities and stock market movements.
Rozeff and Zaman (1988)	1957-1961	No abnormal returns to insiders' trades once transaction costs are controlled. Directors' trades in small firms are more informative than directors' trades in large firms. insiders in small firms with high earning to price ratio tend to buy, whereas insiders in large firms tend to sell. Directors' buy transactions are positively related to both future earnings performance and book to market ratio, but negatively related to past returns.
Barclay and Warner (1993)	1981- 1984	Medium-size trades are more informative than other-size trades (small or large trades).
Seyhun (2000)		Insiders broke up their large trades into smaller medium-size trades to avoid being caught by regulation authorities.
Chakravarty (2001)	6/84 to 8/84	Medium-size trades are more informative than other-size trades (small or large trades).
Lebedeva et al., (2009)		
Abad and Pascual (2011)	7/00-12/06	
Aussenegg and Ranzi (2008)	2002-2007	Small volume trades reveal more information about the firm value than large volume trades do. Buy transactions are more informative than sell transactions. Directors' trades in small firms are more informative than directors' trades in large firms.
Lakonishok and Lee (2001)	1975-1995	Buy transactions are more informative than sell transactions.
Aktas, De Boot and Oppens, (2008)	1/99-11/05	Financial markets' response does not significant for purchases and that the abnormal returns associated with the sales does not have the expected sign.
Scott and Xu (2004)	1987-2002	When insiders have negative information about their firms' future prospects, their sells are likely to be large in volume and to stand for a large portion of their holdings.
Aussenegg and Ranzi (2010)	2002-2007	Positive abnormal returns associated with buy trades.
Degryse et al., (2009)	9/02-12/07	Large abnormal returns associated with insiders' buys and significantly low abnormal returns associated with insiders' sells. Top executive purchases in small and value firms are more informative than top executive purchases in large firms. less liquid market, insiders trade more slowly if they compete with other insiders, and trade faster under private information assumption.
Meulbroek (1992)	1980-1989	Trade-specific characteristics such as trade size, number of trades, or trade direction, as well as the total volume traded by the insider, lead to the incorporation of inside information into price.
Tavakoli et al.,, (2012)	1/00-3/07	When net buys are positive (negative), future returns are positive (negative) because of the belief that future firm value would increase. Directors' trades in small firms are more informative than directors' trades in large firms.
William (1986)		Directors' trades in small firms are more informative than directors' trades in large firms.
Seyhun (1988a)	1/75 to 10/81	Directors' trades in small firms are more informative than directors' trades in large firms. Undervalued firms experience net insider buying and have capital structures that reflect such undervaluation.
Hotsen et al. (2008)	7-12/ 2005	Directors' trades in small firms are more informative than directors' trades in large firms.
Ataullah et al., (2012)	7/96-6/06	
Bonaimé and Ryngaert (2013)		
Madura and Wiant (1995)		Insiders in small banks are more informative than insiders of large banks.
Zhang, Cahan and Allen, (2005)	1978-1999	Low (high) insiders' activities are associated with high (low) pay to performance.
Piotroski and Roulstone (2003)		trades by insiders are positively associated with the firm's future earnings performance. Directors' buys are significantly positive and related to next year's earning news. Also, for glamour (value) firms, the relation between directors' buys and earnings are negative (positive). Directors' buy transactions are positively related to both future earnings performance and book to market ratio, but negatively related to past returns.
Aboody and Lev (2000)	1985-1997	Insider trading profits are higher for firms with R&D expenditures.
Barth et al. (2001)	1993-1995	Increased analyst following for firms with more intangible assets.
Joseph and Wintoki (2013)	1/86-12/11	Directors' trades at firms characterised by high advertising investment are more informative than directors' trades at firms characterised by low or no advertising investments.

Frankel and Li (2002)		Increasing the informativeness of financial statements has an impact on managers' ability to predict future returns. Insiders buy less frequently when financial statements are more informative and when more analysts follow the firm.
Wu and Zhu (2011)	1986-2005	Insiders trade, at least in part, on superior knowledge, and that the returns from insider trading are highly related to measures of firm level information asymmetry.
Jenter (2005)	1992 - 2000	Undervalued firms experience net insider buying and have capital structures that reflect such undervaluation.
Knewtson (2011)	1992-2009	Buy trades by CFOs are more informative than those by CEOs .i.e. Abnormal returns associated with CFOs buy trades are higher than abnormal returns associated with CEOs buy trades.
Wang, Shin and Francis, (2012)	1/92-7/02	
Jeng et al., (2003)	1969-1972	No impact of director's type upon the informativeness of directors' trades.
Ravina and Sapienza (2010)	1986- 2003	Abnormal returns associated with independent (non-executive) directors' buy transactions are positive.
Hillier, Korczak and Korczak, (2013)		Individual characteristics have a much greater influence on insider trading performance than the firm or observable characteristics. Also, superior return performance of top executives (CEOs and CFOs) can be due to their better expertise and skills and not preferential access to firm information.
Lebedeva (2012)	1997-2008	Less liquid market, insiders trade more slowly if they compete with other insiders, and trade faster under private information assumption.
UK Evidence		
King and Roll (1988)	1986-1987	Ignoring transaction costs, investors using this published information were able to gain abnormal profits. abnormal returns for buy trades were greater than the abnormal returns for sell trades.
Pope, Morris and Peel, (1990)	1977-1984	Positive average returns associated with insider purchases and negative average returns tend to follow insider sales. Nonetheless, only the insider sales tend to be significantly different from zero.
Gregory et al. (1994)	1984-1986	Abnormal returns tend to be associated with small firms.
Gregory et al. (1997)	1986-1990	There is a size effect over the period under examination, and this effect was indeed variable (positive during 1986-1988 and negative during 1989-1990). Directors of small companies are more informative than their counterparts in large companies.
Friederich and Tonks (2004)	2/86-11/94	Buy trades appear more informative than sells. Also, large abnormal returns are associated with buy trades that occur close to earning announcements.
Hillier and Marshall (2002b)	I/l/92 - 12/96	Purchases by directors are more informative than sales.
Calvo and Lasfer (2002)	1997-2001	Insiders buy shares before price decreases and sell before the price increases, and abnormal returns associated with buy transactions are positive on the event date (and up to ten days event window) while abnormal returns associated with sell trades are negative for the same event windows.
Hamill et al., (2002)	1990-2000	Buy trades produce significantly positive signals, whereas sell trades produce insignificantly negative signals. Therefore, outside investors may response positively to directors' buys.
Fidrmuc et al., (2004)	1986-1990	buy trades in firms with large directors' holdings is less positive than that for buy trades in firms with low directors' holdings, whereas sell trades in firms with large directors' holdings is less negative. The informativeness of chairman executive officers' trades is lower than that of other directors. Abnormal returns associated with buy trades are positive, whereas abnormal returns associated with sell trades are negative.
Fidrmuc et al. (2006)	1991-1998	Abnormal returns in UK are higher than those in US.
Gregory et al. (2009)	1/94-9/06	Directors buy after a decrease in prices and sell after an increase in prices. Director's gender has no impact upon the informativeness of directors' trades, whereas director's type has an impact upon the informativeness of directors' trades.
Gregory et al. (2012)	1/94-9/06	Abnormal returns associated with female executive trades are significantly higher than abnormal returns associated with male executive trades up to twenty days after the announcement dates (when controlling for the firm and trade characteristics).
Gregory, Tharyan and Tonks, (2011)	1997-2003	With buys (sells) following price falls (rises), directors buy (sell) more value (glamour) shares; buy (sell) signals in value (glamour) shares produce significantly positive (insignificantly negative) abnormal returns. Larger abnormal returns are concentrated in smaller value stocks in particular.
Ajlouni and Toms (2008)	1999 -2000	Positive abnormal returns associated with buy trades, and negative abnormal returns associated with sell trades. In long run (short run) event windows, directors of small firms earn significantly more returns than their counterparts in large firms.
Andriosopoulos and Hoque (2011)	1/99-12/03	Insiders are able to predict future returns; based on market to book ratio, insiders tend to buy shares with poor past performance. Market reaction to insiders' trades in small firms is stronger than that in large firms, and insiders' buy transactions convey information, whereas insiders' sell transactions are not.
Lambe (2011)	2001-2010	Significant abnormal returns prior to the public release of information.
Fidrmuc et al. (2012)		Positive impact of shareholder protection on cumulative abnormal returns for both purchases and sales. Besides, the information content of insider sales is less than for purchases
Ozkan and Trzeciakiewicz (2012)	2000-2010	Trades conducted by CEOs are more informative than trades conducted by CFOs.

Table 2.2: Summary of the Literature Relating to the timing behaviour of Directors' Trades

Author(s)	Sample Period	Main Results
Elliot et al., (1984)	1975-1979	Insiders with private information should purchase shares before the public release of good news that increase prices and should sell shares before the public release of bad news that decrease prices. If a speculative portfolio position is taken before the public announcement, then increased selling should follow the public announcement of good news and increased buying should follow the public announcement of bad news.
Givoly and Palmon (1985)	1973-1975	No link between insider trading profits and subsequent disclosure events (including earnings and dividend announcements)
Oppenheimer and Dielman (1988)		
John and Lang (1991)	1/75-10/85	Dividend increases accompanied by unusual insider buying signal good news, resulting in positive abnormal returns. The opposite is also true.
Del Brio and Miguel (2008)	1992-1996	
LaPorta et al. (1997)	2/79-1/93	Value (growth) firms tend to have positive (negative) future earnings announcement period returns.
Betzer and Theissen (2007)	1992–2001	Trading prior to earning announcements has a large impact on prices.
Jaggi and Tsui (2007)		Executive directors reported earnings to maximise their private benefits from insider selling. Thus, the relationship between insider selling and earnings can be moderated by the proportion of independent directors.
Chiang and Chang (2012)	1/96-10/10	Investors who take advantage of insider trading information can earn a return premium by holding option contracts even after controlling for systematic risk, volatility risk, and transaction cost.
Jeng et al. (1999)	**5/75 -12/96**	The purchase portfolio does better than the market by about 7.4% per year. About one-sixth of the abnormal returns arise within the first five days of a trade, one-third within the first month, and three-quarters within the first six months.
Lakonishok and Lee (2001)	1975-1995	There is no relationship between pre-issue insider trading and the post-issue long-run performance of primary seasoned equity issuing firms after controlling for exogenous consumption shocks.
Ke et al., , (2003)	1989 to 1993	Stock sales by insiders increase three to nine quarters prior to a break in a string of consecutive increases in quarterly earnings. Besides, there is little abnormal selling in the two quarters immediately prior to the break.
Agarwal and Singh (2006)	1996-1999	High levels of share trading volume before the public announcement of merger.
Li and Zhang (2006)	1/97-6/02	net insider selling before the restatement announcements, little net insider selling immediately around the announcements, and net insider buying after the announcements
Ching et al. (2006)	1993 - 1998	Positive (negative) abnormal returns associated with the announcement of placing (rights offerings).
Noe (1999)	7/79-12/87	Trading patterns are unrelated to the forecasted earnings news.
Seyhun (1990)		Insiders in bidder firms traded more prior to the announcement of a takeover bid.
Muller et al. (2009)	2002–2007	Insiders of goodwill impairment firms engage in abnormal selling of their shares quarters prior to the announcement of such losses.
Gosnell et al. (1992)	1985-1987	insiders sell prior to bankruptcy.
Loderer and Sheehan (1989)	1971-1985	No evidence of selling prior to bankruptcy.
Hillier and Marshall (2002c)		Insiders buy after abnormally bad earnings news and sell after good news.
Kavussanos and Tsounia (2007)	6/00 to 6/05	insiders tend to trade regarding proceeding mergers.

2.2.3 Methodological Issues

Some researchers have considered the role of empirical methodology in detecting insider trading performance. For example, the choice of insider trading event window differs across most empirical studies. A long event window of several months is likely to reflect information from subsequent events, and so a shorter event window is preferable (Lakonishok and Lee, 2001; Seyhun, 1986; Clacher et al., 2009).

Seyhun (1986) and Rozeff and Zaman (1988) used the market-model in measuring the abnormal returns of individual stocks, whereas Chowdhury,

Howe and Lin, (1993) used vector autoregressive (VAR) model to examine the relation between collective insider transactions and stock market returns.

Using three different measures of abnormal performance, Lin and Howe (1990) reported conflicting evidence on abnormal returns accruing to insiders after they trade.

Eckbo and Smith (1998) estimated the performance of insider trades on the closely held Oslo Stock Exchange (OSE). They formed portfolios of monthly aggregate insider holdings, which reflected the insiders' actual holding periods in their respective stocks, and then subjected these portfolios to modern techniques of performance measurement. Moreover, they compared the performance estimates for the aggregate insider portfolios to the performance of managed mutual fund portfolios on the OSE over the same time period. The performance analysis rejected the hypothesis of positive abnormal performance by insiders.

Bhattacharya and Nicodano (2001) showed, with an inter-temporal model of individual as well as aggregate liquidity shocks to uninformed agents, that insider trading can improve outsiders' welfare.

Using a conditional event study framework, Li and McNally (1999) examined the determinants of firms' repurchase decision and the market reaction to the decision. Jeng, Metrick and Zeckhauser, (2003) resolved the problems included in event studies by using a value-weighted portfolio approach to analyse all insider trades that took place in the US between 1975 and 1996. For each day, a value-weighted portfolio of insider purchases (sales) was created and one-year holding period returns were computed for each portfolio, and then compared to a target portfolio in order to examine the profitability of insider trades.

Iqbal and Shetty (2002) used Granger-causal tests to examine the relationship between aggregate insider trading and stock market returns. Beny (2006) described the relationship between corporate valuation and insider trading laws using a simple agency model, and then examined the model's three testable hypotheses using firm-level data from a cross-section of developed countries.

Agarwal and Singh (2006) investigated insider trading activity prior to merger announcement in Indian capital market. To examine the behaviour of stock prices a modified market model was used to estimate the parameters for the estimation window. These estimates were used to compute average return and

cumulative average returns for the event window, which are measures of abnormal returns. Caldentey and Stacchetti (2007) used a model of strategic trading with asymmetric information of an asset whose value follows a Brownian motion; Del Brio et al. (2008) used panel data estimation. Fidrmuc et al. (2006), Ajlouni and Toms (2008), and Gregory et al. (2009) explored the informativeness of directors' trades using event study methodology based on Market Model, Capital Asset Pricing Model, Market Adjust Return Model respectively. In addition to using event study methodology, Fidrmuc et al. (2006) and Gregory et al. (2009) employed a Multivariate Regression Model to capture all the possible factors that might have an impact on the informativeness of directors' trades. However, in this section, we only reviewed the methodologies that were used to test various hypotheses regarding insider trading activities.

Tables (2.3) summarises the methodologies used to examine various hypotheses relating to insider trading activities.

Table 2.3: Summary of the Literature According to Methodology Used

Author(s)	Methodology
Seyhun (1986)	Market-model in measuring the abnormal returns of individual stocks
Rozeff and Zaman (1988)	
Chowdhury, Howe and Lin, (1993)	Vector Auto Regressive (VAR) model to examine the relation between collective insider transactions and stock market returns
Lin and Howe (1990)	Three different measures of abnormal performance
Eckbo and Smith (1998)	They compared the performance estimates for the aggregate insider portfolios to the performance of managed mutual fund portfolios on the OSE over the same time period
Bhattacharya and Nicodano (2001)	Inter-temporal model of individual as well as aggregate liquidity shocks to uninformed agents
Li and McNally (1999)	Conditional event study
Jeng et al., (2003)	Value-weighted portfolio approach
Iqbal and Shetty (2002)	Granger-causal tests
Beny (2006)	Agency model
Agarwal and Singh (2006)	Modified market model was used to estimate the parameters for the estimation window
Fidrmuc et al. (2006)	Event study methodology based on Market Model and Multivariate Regression Model
Ajlouni and Toms (2008)	Event study methodology based on Capital Asset Pricing Model
Gregory et al. (2009)	Event study methodology based on Market Adjust Return Model and Multivariate Regression Model

2.2.4 Other Evidences

This section reviews the literature on insider trading based on research different from those discussed above.

Larcker, Reder and Simon, (1983) examined the impact of FASB statement No.19 on insiders' transactions. They found that insiders in those firms who

expected to be adversely affected by the accounting change were net sellers in the period preceding the pronouncement.

Seyhun (1992b) examined the seasonal patterns of US aggregate insider trading activities in order to highlight the nature of seasonal patterns in stock returns. The results indicated that some insiders in small firms tend to accelerate their planned stock purchases and postpone their stock sales in December in contrast with an opposite pattern of insider trading in larger firms. Therefore, this enables insiders in small firms to capture more of the positive return in January. Besides, insider trading activity in small firms does not significantly increase in January. Thus, an uninformed trader in small firms is not more likely to trade against an informed insider in January than in other months. In contrast to the US studies, but using UK data, Hillier and Marshall (2002a) examined the January effect in UK listed securities and found that it was significant but not persistent through the time. Also, the results showed that the seasonalities in insider trading were not the main determinant of the turn of the year effect.

Carpenter and Rimerez (2001) examined whether insiders use private information when they exercise options and reported two main findings; abnormal returns associated with insiders' exercises are positive (when insiders had to hold the stock acquired through option exercise for six months). Abnormal returns associated with top directors' exercises are negative in small companies (when insiders had to sell the stock acquired through option exercise immediately). Similarly, Kyriacou and Mase (2003) examined whether there is information content in executive directors when they exercise options and found that insiders use their private information when they decide to exercise stock option, and how much of the stock acquired through this exercise they should sell. Also, the sale of low proportion of share (categorised as a sale) is less informative than the sale of high proportion of share (categorised as a buy).

Yu and Bricker (2007) explored insider trading as a function of differences between managers' and the market's assessment of company earning components – specifically operating cash flows and accruals. This study also built a perspective of managers as sophisticated investors who, while engaging in earnings management, ultimately make insider trading decisions based on the divergence between their private valuation of earnings components and the

market's. Thus managers may, seemingly counter-intuitively, engage in income-increasing earnings management and insider buying in the same period. They found strong evidence that insider buying, but not selling, behaviour is consistent with managerial insider trading based on a market valuation divergence of both operating cash flows and accruals, rather than on either element individually, or on managers' use of accounting discretion.

Jiang and Zaman (2010) examined whether insiders trade on the basis of contrarian beliefs or superior information. Using vector autoregressive (VAR) model, they decomposed market returns into expected return, unexpected cash-flow news, and unexpected discount rate. If insiders trade on the basis of superior knowledge, the relationship between aggregate insider trading and unexpected cash-flow news will be positive. In contrast, if insiders trade on the basis of contrarian beliefs, the relationship between aggregate insider trading and past expected returns will be negative. The results showed that insiders trade on the basis of superior information and therefore predict market returns because of having superior knowledge about future cash-flow news. Further, they split the firms into high information uncertainty and low information uncertainty firms using firm size and analyst following as proxies for information uncertainty. They found that "the predictive ability of aggregate insider trading in high information uncertainty firms is due to superior knowledge".

Marin and Olivier (2008) explored the relationship between insider trading and stock price crashes and reported high insiders' sales many months prior to a large drop in stock prices, whereas high insiders' buys only one month before a large jump in stock prices. Also, uninformed investors may react more strongly to the absence of insider sales than to their presence. These patterns might be due to different reasons such as patterns of insider trading driven by earnings announcement dates, or insiders timing their trades to evade prosecution. Moreover, any insider who wishes to exploit private information related to poor company earnings has to trade significantly before the actual earnings announcement and hence significantly before the crash.

Gider and Westheide (2009) examined whether insider time their trades in a way that enable them to exploit high amount of information asymmetry, and indicated that insiders - based on short term information advantage - tend to trade more frequently during times expected to have private information being

impounded into stock prices (when idiosyncratic volatility is high). Moreover, in times of high information asymmetry, former directors are able to earn high abnormal returns.

Cziraki (2012) investigated whether bank executives took excessive risks in the run-up to the recent financial crisis by analysing their trading in their own bank's stock. Cziraki examined whether insiders of banks with the highest exposure to subprime risk changed their insider trading before the onset of the crisis. Two main findings emerged. First, there were large differences in insider trading patterns between high- and low-exposure banks starting in mid-2006, when US housing prices first declined. The economic effect is sizeable: insiders of high-exposure banks sold 30% more equity than insiders of low-exposure banks. This increase in insider sales proceeded the fall of bank stock prices. Second, there was no difference in insider trading patterns between banks with high and low exposure in 2004-2005. Thus, Cziraki concluded that insiders of high-exposure banks revised their views on the profitability of their banks' investments following the reversal in the housing market.

Chiang and Chang (2012) studied the relation between insider trading and option returns around earnings announcements. The results indicated that investors who take advantage of insider trading information can earn a return premium by holding option contracts even after controlling for systematic risk, volatility risk, and transaction cost.

Similar to Fidrmuc et al., (2012), Von Koch et al., (2013) showed more positive and stronger impact of firm-level shareholder protection (rather than country-level shareholder protection) on cumulative abnormal returns for directors' buy transactions.

Tang et al., (2012) suggested that informative financial reporting and stock price environment lead to less informative directors' trades.

Rong (2013) found that insider trading patterns within the firm explain the contemporary changes in its R&D productivity. Moreover, managers have more superior knowledge about R&D productivity than outside investors which might suggest that they are more able to benefit from this knowledge.

Tables (2.3) summarises the studies that used insider trading data to test other hypotheses different from those discussed earlier in sections (2.2.1), (2.2.2) and (2.2.3).

Table 2.4: Summary of Other Studies that Examined Different Hypotheses of Insider Trading Activities

Author(s)	Sample Period	Main Results
Larcker et al., (1983)	6-8/77	insiders in those firms who expected to be adversely affected by the accounting change are net sellers in the period preceding the pronouncement
Seyhun (1992b)		Some insiders in small firms tend to accelerate their planned stock purchases and postpone their stock sales in December in contrast with an opposite pattern of insider trading in larger firms. Therefore, this enables insiders in small firms to capture more of the positive return in January. Besides, insider trading activity in small firms does not significantly increase in January
Hillier and Marshall (2002a)		The seasonalities in insider trading were not the main determinant of the turn of the year effect.
Carpenter and Rimerez (2001)	1/84-11/95	Abnormal returns associated with insiders' exercises are positive (when insiders had to hold the stock acquired through option exercise for six months). Abnormal returns associated with top directors' exercises are negative in small companies (when insiders had to sell the stock acquired through option exercise immediately).
Kyriacou and Mase (2003)	7/95-7/98	Insiders use their private information when they decide to exercise stock option, and how much of the stock acquired through this exercise they should sell. Also, the sale of low proportion of share (categorised as a sale) is less informative than the sale of high proportion of share (categorised as a buy).
Yu and Bricker (2007)	1996-2005	Insider buying, but not selling, behaviour is consistent with managerial insider trading based on a market valuation divergence of both operating cash flows and accruals, rather than on either element individually, or on managers' use of accounting discretion
Marin and Olivier (2008)	1/85-12/02	High insiders' sales many months prior to a large drop in stock prices, whereas high insiders' buys only one month before a large jump in stock prices. Also, uninformed investors may react more strongly to the absence of insider sales than to their presence.
Jiang and Zaman (2010)	1975-2000	Insiders trade on the basis of superior information and therefore predict market returns because of having superior knowledge about future cash-flow news.
Gider and Westheide (2009)	Starts at 1992	Insiders - based on short term information advantage - tend to trade more frequently during times expected to have private information being impounded into stock prices (when idiosyncratic volatility is high).
Cziraki (2012)		There are large differences in insider trading patterns between high- and low-exposure banks starting in mid-2006, when US housing prices first declined. There was no difference in insider trading patterns between banks with high and low exposure in 2004-2005.
Chiang and Chang (2012)	1995-2009	Investors who take advantage of insider trading information can earn a return premium by holding option contracts even after controlling for systematic risk, volatility risk, and transaction cost.
Rong (2013)	1986-2002	Managers have more superior knowledge about R&D productivity than outside investors which might suggest that they are more able to benefit from this knowledge.

2.3 Conclusion

The aim of this chapter was to review the relevant literature of insider trading activities and to analyse the increasing body of the literature considering the information content of insider trading, the timing behaviour of insiders' activities, and other issues in order to provide readers, researchers, and newcomers with an insight into how these concepts have been researched, been developed, and been linked over time.

Results from previous empirical studies strongly suggested that insiders can detect and exploit mispricing in their own company's securities. Also, the previous empirical literature in the general area of information contents of directors' trades found that the informativeness of directors' trades depends on firm, trade, and director characteristics. More specifically, buy trades are more informative than sell trades (Seyhun, 1988b; King and Roll, 1988; Fidrmuc et al., 2006; Gregory et al., 2009), medium-size trades are more informative than other-size trades (Barclay and Warner, 1993; Chakravarty, 2001; Abad and Pascual, 2010), insiders in small firms (with high price to earnings ratio) are more informative than insiders in large firms (with low price to earnings ratio) [Williams, 1986; Rozeff and Zaman, 1988; Pope et al., 1990; Ajlouni and Toms, 2008]; trades by executive directors are more informative than trades by other types of directors (Seyhun, 1988b; Jenter, 2005; Knewtson, 2011), female executive directors are more informative than male executive directors (Gregory et al., 2012) and trades conducted by CEOs are more informative than trades conducted by CFOs (Ozkan and Trzeciakiewicz, 2012).

Besides, the previous empirical literature in the timing behaviour of insider trading found that directors who trade prior to the disclosure of price sensitive news inform the market of mispricing, and as such the market will react correspondingly. In examining different hypothesis regarding insider trading activities, previous studies employed different methodological approaches. For example, event study methodology based on Market Model or Capital Asset Pricing Model was used to calculate the cumulative average abnormal returns in order to examine the informativeness of directors' trades (Fidrmuc et al., 2006; Ajlouni and Toms, 2008).

Finally, other insider trading studies examined whether high returns in January and April can be explained by insider trading activities (Seyhun, 1992b; Hillier and Marshall, 2002a), whether insiders use private information when they exercise options (Carpenter and Rimerez, 2001; Kyriacou and Mase, 2003), whether insiders trade on the basis of contrarian beliefs or superior information (Jiang and Zaman, 2010), the relationship between insider trading and stock price crashes (Marin and Olivier, 2007), or whether the changes in R&D productivity can be explained by insider trading patterns within the firm (Rong, 2013).

Chapter 3: Patterns and Characteristics of Aggregate Insider Transactions in the UK 1991-2010

3.1 Introduction

This chapter describes the dataset used in this thesis to analyse the information content of insider trading. The objective is to familiarise the reader with some important characteristics of insider trading activities.

Previous studies used directors' trades to examine various hypotheses in the general area of insider trading. One aim of this literature has been to examine how the informativeness of directors' trades varies with trade, firm, and director characteristics. For example, Lorie and Niederhoffer (1968), Barclay and Warner (1993), Chakravarty (2001), and Friederich et al. (2002) examined how the informativeness of directors' trades varies with trade size. Medium-sized trades are more informative than other sized trades. King and Roll (1988), Pope et al. (1990), Hillier and Marshall (2002b), and Gregory et al. (2009) studied how the informativeness varies with transaction type. Directors' buys are positive and significant (informative) whilst sales are negative and insignificant (uninformative). Seyhun (1986), Gregory et al. (1994), Fidrmuc et al. (2006), Aussenegg and Ranzi (2008), and Gregory et al. (2012) reported that directors' trades in small firms are more informative than directors' trades in large firms. Degryse et al. (2009), Gregory et al. (2009), and Knewtson (2011) documented higher abnormal returns associated with executives' trades, whereas Fidrmuc et al. (2006) and Jeng et al. (2003) found that there is no impact of the directors' type on the informativeness of directors' trades (for example, there is no difference in the informativeness between executive and non-executive directors).

Depending on the findings of the literature that attempted to distinguish between the information driven from noisy insider trades, we present and examine insider trading characteristics and patterns based on the type and size of transaction, the type and age of directors (type and age), and the characteristics of the firm i.e. the industry which the firm belongs to).

Seyhun (2000) devoted a chapter of his book to examining the historical statistical characteristics and patterns of directors' trades in the US. By identifying these characteristics and patterns, he says that investors might be more able to make better decisions. For example, suppose an investor would like to use insider trading to help guide a portfolio decision. The first question the investor would ask is how often do insiders' trades occur for a typical stock? If an insider trade is expected to occur once in every other month, then the investor would have a sufficient buy and sell signals to monitor his/her portfolio decision. In other words, the examination of insider trading patterns can help us interpret such insider signals. Also, in order to identify a particularly unusual insider trading activity, Seyhun suggested knowing "usual" or "normal" insider trading patterns in different type of firms. For example, if insiders typically sell 10,000 shares per month in a given firm, a new purchase activity could signal a significant turning point. He concluded that in large firms, insiders tend to sell twice as frequent as they buy, whereas in small firms, they tend to execute four purchases for each three sale transactions.

This chapter comprehensively reviews insider trading behaviour, describing the general characteristics, patterns and activities of UK directors over the period 1991-2010. To the best of our knowledge, such an exercise has never been conducted before. Such an analysis may shed light on insider trading behaviour.

This study is based on data supplied by two different data sources for the period January 1991 to December 2010.

1) Directus Ltd compiled a complete record of director's trades in the United Kingdom (1991-2001).

2) Directors Deals, which monitors and analyses share transactions made by directors in their own companies (sometimes known as Insider Deals).

This period yields a sample of 181,275 trades for every publicly disclosed transaction by UK directors in their own firms.

The chapter is organised as follows. Section (3.2) explains the procedures applied in order to obtain the final sample, particularly the inclusion criteria, and how missing entries are dealt with. Section (3.3) defines some of the variables in our sample, such as executives' status. Section (3.4) presents and describes the general features and characteristics of UK directors' trades for the whole sample; while the conclusions are presented in Section (3.5).

3.2 Constructing the Final Sample

The purpose of this section is to explain the procedures applied to construct the final sample which we use in our analysis. For that reason, we identified the basic inclusion criteria that determine the minimum standards which each transaction should contain to be accepted as a suitable entry in our sample.

3.2.1 Inclusion Criteria

Inclusion criteria are minimum standards that must be adhered to by each transaction in order to be accepted as an entry in our final sample. One example of these criteria is that it is necessary to have, as a minimum, a company name, transaction price, amount (number of shares) and value (the price of the transaction is multiplied by its amount) of the transaction, transaction date, transaction class (A type or category of a security, such as ordinary share or executive share option), and type of the transaction (buy or sell of ordinary shares, exercise or sell post exercise of options).

Table (3.1) presents a deliberately selected sample of transactions that need either to be removed or to be modified based on above criteria. This table highlights the main information that each transaction should contain to be consistent with the inclusion criteria.

Table 3.1: A Sample of Selected Number of Transactions That Might or Might not Consistent with Inclusion Criteria

N	Sector	Company Name	Transaction Date	Announcement Date	Price (£)	Amount	Value'	Transaction Type	Class	Exec Status
1		Portals	10/06/94	13/06/94	6.63	5000		Take Up	Rights	
2		Pearson	23/08/96	23/08/96	6.64	24423		Take Up	Rights	
3	Engineering and Machinery	Whatman	14/04/98	14/04/98	-	7396	-	Sell	Ordinary	
4	Media and Photography	WPP Group	09/03/99	11/03/99	-	24719	-	Buy	Ord	
5	Distributors	WF Electrical	25/08/99	26/08/99	-	2000	-	Gift Given	Ord	
6	Personal Care and Household Prod	Reckitt Benckiser	19/11/00	19/11/00				Options Granted	OPT	
7	Banks	Royal Bank of Scotland	18/12/00	20/12/00	-	194,080		Sale post Ex	Ordinary	
8	Electronic and Electrical Equip	Xaar	06/03/01	07/03/01	NULL	500000		Exercise	OPT	
9	Media and Photography	Totally PLC	27/12/01	27/12/01	129769	0.01	1298	Buy	Ord	
10	Media and Photography	Totally PLC	27/12/01	27/12/01	129769	0.01	1298	Buy	Ordinary	
11	Telecomms	KT Corporation	23/05/02	31/05/02	46	310	9834	Subscribe	Ord	Former
12	Media and Photo	WILink	21/01/03	23/01/03	0	33816	263765	Given Away	Ord	Executive
13	Banks	Barclays	01/10/03	06/10/03	4.7519	3975	18889	Div Re	Ord	Former
14	Banks	Abbey National	24/03/04	29/03/04	4.405	3747	16506	Award	Ord	Former
15	Media and Photo	WILink	04/05/05	05/05/05	2.75	105100	289025	Transfer	Ord	Executive
16	Health	Smith and Nephew	31/03/06	19/04/06	7.584	675	2918	Contract Buy	Ord	PDMR
17	Mining	Rio Tinto	28/04/06	17/05/06	30.38	98	2977	Transfer In	Ord	PDMR
18	Life Assurance	Prudential	31/12/07	31/12/07	0	23495	166932	Award	Ord	PDMR
19			27/04/98	05/05/98	0.45	50000		Sale post Ex	ordimary	

N refers to transaction number for the purpose of the analysis.

Table (3.1) presents the main variables of the sample, which every entry should have. Those variables are the company name, transaction and announcement date, transaction price, transaction amount, transaction value, transaction type and transaction class. For transaction number (19), an unknown director exercised an option (sell) on the 27th of April 1998, but the name of the company was missing. Thus, this transaction was removed from the sample because the company name is one of the inclusion criteria. This was the case for a number of transactions during the sample period, for which the company name was unavailable; ultimately, 2060 trades with no company name were excluded from the sample. This left a sample of 186,683 trades over the period 1991-2010.

Since transaction value is equal to the number of shares multiplied by the transaction price, it is necessary to have (at least) both transaction price and number of shares, or both transaction price and transaction value. Some trades within the sample included no transaction price and no transaction value. For example, Royal Bank of Scotland exercised an option (sell) in December 2000, but the transaction price and transaction value were unknown (see transaction number 6). Such transactions are inconsistent with the inclusion criteria. Therefore, more than 5200 transactions with both no price and no value were removed from the sample.

After cleaning the dataset for duplicate and inaccurate or incomplete transactions, a total of 181,275 trades by directors over the sample period remain.

3.3 Variable Definition

As it is mentioned previously, the sample contains 181,275 observations. The variables considered in this chapter are the company's name, transaction and announcement date, transaction price, amount, transaction value, transaction type and transaction class. In addition to the company's name, the dataset includes for each transaction the director's name, company's name, executive's status (describing the orientation of a director to the board of a company), and the date of birth (to allow calculation of age at the day of the transaction). Table (3.2) shows the different types of directors with a definition for each type.

Table 3.2: A Brief Definition for Each Type of Directors

Executive status	Definition
Executive	The orientation of a director to the board of a company; usually a full-time employee
Former	No longer a board member
Non-Executive	A member of the full board who only dictates part of his available time to the company in an advisory capacity
PDMR (Person Dispensing Managerial Responsibility)	Not a member of the board but an employee considered being a party to price sensitive information and therefore subject to the same rules as Board members
Supervisory Member of the Supervisory board	Usually used for Continental companies; not a direct equivalent of Non-Executive, since it is a different board structure

The information about directors' types was only available for the period 2001-2010 and it includes 105,639 trades (this number constitutes 58% of the total sample number of trades).

Because of the variety of the variables, it is possible to categorise the data in different ways. One of these ways is by the type of transaction that directors engage in. Table (3.3) describes the different types of directors' trades related to our sample during the period 1991-2010. For each firm we have the sector, and for each transaction we also have transaction date (the day in which the transaction occurred), announcement date (the day on which the information about the transaction is released, the price, the amount (the number of shares bought or sold or exercised or traded), the value (the number of shares traded multiplied by the price), the type, and the class.

Table 3.3: Transaction's Types

Award	Usually acquired below the market price or for nil consideration as part of a director's remuneration package. Awards are reported when they are vested. That is when they are given to the director and form part of his beneficial holding. In rare cases, there may be conditions to this holding and will be reported in the note
Buy	Discretionary purchase of shares. In almost all cases, this would be at the prevailing market price, exceptions are explained in the notes.
Sell	Sale of part or all of the director beneficial holding at the prevailing market price unless otherwise stated in the notes
Contract Buy	Director buys shares on the market as part of a contractual agreement. This may be to qualify for a matching award or under a regular share purchase plan. Although these are 'on-market' they are not considered to be indicative trades
Transfer in Director acquires	Shares generally without direct monetary payment. This can be for a number of reasons
Transfer Out	Director holding is reduced after shares have been transferred to a third party. This may occur when a director's minor children come of age, for example.
Transfer All or part of a Directors holding	Transferred between two parties in which the director has an interest. The beneficial holding of the director remains unchanged. For example a director may sell shares from a company in which he is a beneficiary to a Pension Fund in which he is also a beneficiary. He may not be the exclusive beneficiary of either or both parties and his beneficial interest will be stated in the note where possible.
Dividend Reinvested	Purchase of further shares with the proceeds of dividends payable on directors existing holding. This may take the form of a [scrip] issue of new shares to all shareholders
Exercise	Vesting of options which form part of the directors beneficial holding after the event. Unless in exceptional circumstances the exercise price is below the market price and may even be nil
Sale Post-Exercise	Shares sold at prevailing market price after acquiring them through the exercise of an option. May be also used where shares have been sold after being acquired by award
Given Away	Usually a charitable donation. Shares are no longer part of the directors beneficial holding but are not sold at the prevailing market price.
Subscribe	Subscription to the new issue. As a director or as an existing shareholder directors may be allocated rights to subscribe to new shares which are generally just below the prevailing market price

In addition to the previous information which each trade should contain as a minimum, the period between 2002 and 2010 included more detailed information about each trade, such as holdings (owning a controlling quantity of shares in one or more other companies), holding change (the changes in holding percentage during the time), holding comment (refers to another transaction by the director made on the same day), holding percentage (percentage of total shares owned by the director), personal ID (proprietary reference which identifies the person trading; person A may have directorships at more than one company), diseases, and many other information.

3.4 Descriptive Statistics

This section reports the general features, characteristics and patterns of directors' trades. In section (3.4.1), summary statistics are presented to highlight the trends and patterns of UK directors' trades whilst considering all trades conducted by UK directors over the period of study. In section (3.4.2), we repeat the previous analysis by focusing only on ordinary buys and sales and by dividing the sample according to transaction's size, director's age, director's type, director's company, and director's sector (or industry). To examine this, a quantitative analysis is employed.

3.4.1 Summary Statistics Related to all Transaction Types

After applying the exclusion criteria and cleaning the dataset for duplicate and inaccurate or incomplete transactions, missing announcement dates and company names, there is a total of 181,275 trades by directors over the sample period.

Table (3.4) reports summary statistics related to our sample categorised by transaction type during the period 1991-2010. The table shows that the 181,275 transactions within our sample are related to 20 different transaction types. The total number of shares traded was 126 billion with a total value of £59.1 billion.

The most frequent transactions were on ordinary shares (buys and sales) and the exercise of options (exercises and sale post exercises): 98,087 trades (54% of all insider transactions) and 45,926 transactions (23%), respectively. Approximately, 41% of our sample is buys, 14% is exercises, 13% is sales and 11% is sale post exercises. Hence, directors' buys are more frequent than other directors' trades.

Additionally, in term of the total number of shares traded, the most frequent transactions were subscribes, buys, sales, exercises and sale post exercises. The total number of shares subscribed by insiders constitutes approximately 70% of total shares traded over the sample period. This is due to three transactions on November 2008 with a total number of shares of 61 billion. Excluding these trades would lead the total number of subscribed shares constitute only 14% of the total traded shares. On the other hand, the total number of shares for transactions such as buys, exercises, sale post exercises, and sells constitutes 7%, 4%, 9%, and 2% of the total shares trades respectively. These percentages would change after excluding large trades. For example, the total number of shares bought and sold would constitute roughly 50% of total shares traded over the sample period. The total number of shares for transactions such as buys, exercises, sale post exercises, and sells constitutes 25%, 14%, 8%, and 24% of total shares trades respectively.

The total monetary value of directors' trades is £59.1 billion. Of these, approximately, 16% is for buy transactions, 10% is for exercise transactions, 37% is for sale transactions, 15% is for sale post exercise transactions, and 21% is for other transactions.

There are approximately three times as many buy trades as sells. Although buy trades are more frequent than sell trades, the average value of sell trades is approximately eight times larger, which suggests that directors sell less frequently but more in value (a similar argument can be said to the number of shares).

There is one exercise transaction for each sale post exercise transaction. Although there is approximately slightly more frequent exercises than sale post exercise trades, the average value of sale post exercise trades are approximately two times larger, which suggests that directors sell the shares acquired from exercising options less frequently but more in value (similar argument can be said to the number of shares).

Table 3.4: Summary Statistics Categorised by Transaction Type

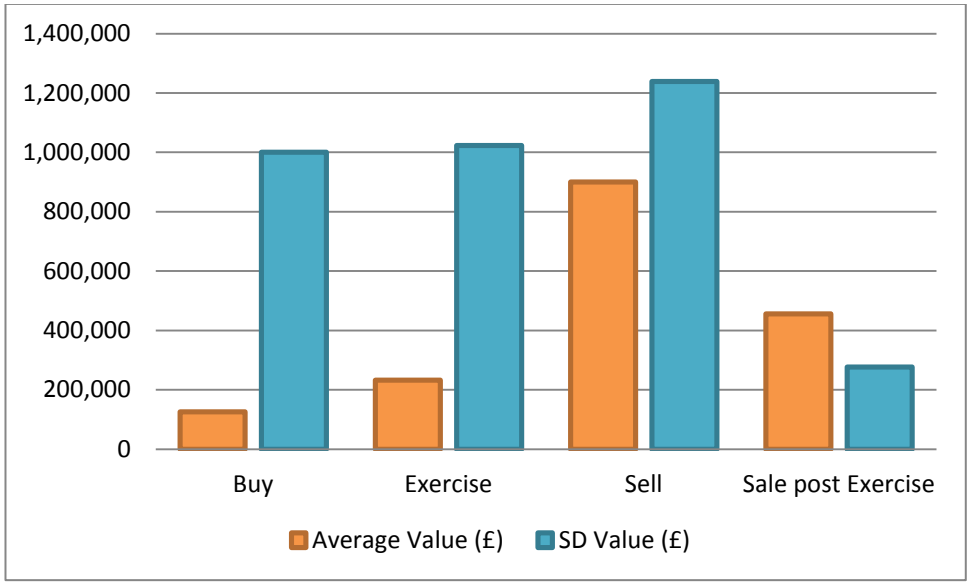
1991-2010

Transaction Type	No of Trades	Average Value (£)	Average No of Shares	Total Value (£)	Total No of Shares	Median Value (£)	Median No of Shares	SD Value (£)	SD No of Shares
Award	12,662	231,728	70,804	2,930,000,000	897,000,000	49,711	13,646	772,035	335,143
Buy	73,972	125,716	124,269	9,300,000,000	9,190,000,000	10,800	10,000	1,000,379	422,763
Bed and Breakfast	579	99,573	60,647	57,700,000	35,100,000	15,040	10,000	5,482,214	1,211,483
Contract Buy	7,046	39,873	72,513	281,000,000	511,000,000	5,459	2,029	480,933	856,258
Dividend Received	5,025	62,750	15,973	315,000,000	80,300,000	4,551	1,075	500,914	136,915
Exercise	25,798	232,520	187,069	6,000,000,000	4,830,000,000	59,843	35,000	1,022,741	1,205,459
Gift Given	19	128,526	119,580	2,441,996	2,272,018	64,980	30,000	223,240	271,334
Gift Received	104	120,554	48,480	12,500,000	5,041,962	19,969	9,676	259,864	133,266
Given Away	558	1,363,439	495,422	761,000,000	276,000,000	118,638	50,000	8,154,248	3,089,015
Inherited	3	16,098	71,833	48,295	215,500	5,700	2,000	21,182	122,256
Options Granted	103	113,539	68,913	11,700,000	7,098,074	74,998	38,778	122,477	84,674
Sell	24,115	899,811	480,888	21,700,000,000	11,600,000,000	61,235	28,000	1,238,505	517,074
Sale post Exercise	19,831	455,285	124,936	9,030,000,000	2,480,000,000	157,060	37,000	276,972	86,643
Scrip Dividend	1,825	16,887	6,479	30,800,000	11,800,000	250	90	9,337	3,906
Scrip Issue	6	5,763	2,411	34,575	14,468	1,065	446	9,955,669	4,295,015
Subscribe	5,642	278,965	15,800,000	1,570,000,000	89,300,000,000	25,000	90,352	2,771,441	491,833,002
Take Up	1,074	84,561	127,548	90,800,000	137,000,000	7,125	5,066	457,494	580,732
Transfer	248	2,036,925	4,311,376	505,000,000	1,070,000,000	82,130	60,308	8,804,919	22,136,201
Transfer In	1,558	1,442,100	2,583,042	2,250,000,000	4,020,000,000	41,183	82,754	8,327,558	9,828,810
Transfer Out	1,107	3,857,636	1,868,565	4,270,000,000	2,070,000,000	83,386	75,000	55,415,608	8,993,277
Total	181,275	326,130	697,783	59,100,000,000	126,000,000,000	22,143	15,667		

Average value for each type represents the total value for that type divided by the number of trades**.** Average number of shares for each type represents the total number of shares for that type divided by the number of trades.

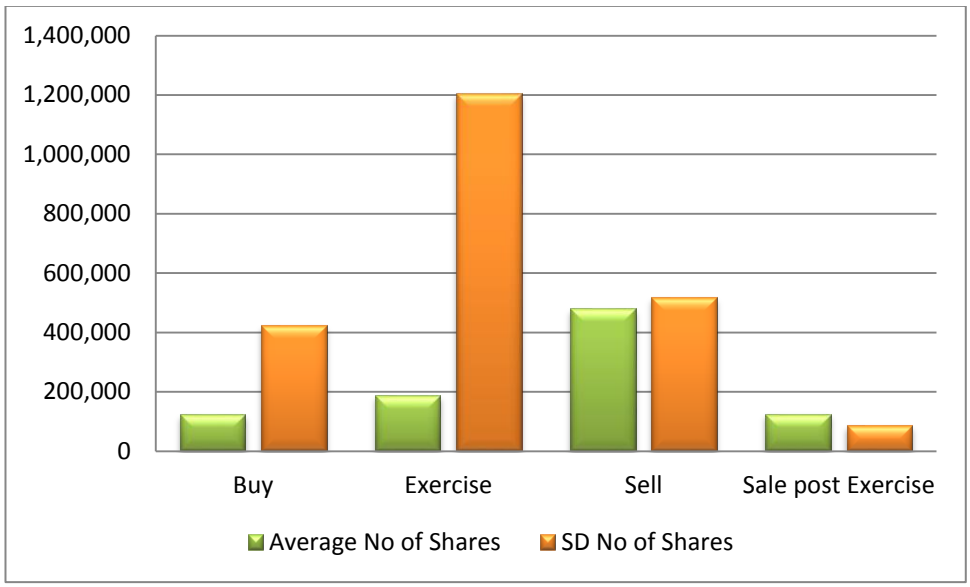
Figures (3.1) and (3.2) show the distribution of the average value (and number of shares) and the standard deviation of trades' value (and number of shares) across directors' buy, exercise, sell and sell-post exercise trades. Figure (3.1) shows that the standard deviation of trades' value of directors' buy and exercise transactions is, at least, four times higher than the average value of those transactions (buy and exercise). This indicates that some values are deviated highly from the mean. In other words, this might be explained by the presence of extremely high or extremely small values. Excluding these values might lower the deviation between the values and the mean, and therefore, the standard deviation, but it will not change the results. Unlike the previous pattern, the average value of sell post exercise transactions is higher than the standard deviation, which indicates that the deviation between values is small.

Figure 3.1: The Distribution of the Average Value and the Standard Deviation of Trades' value



For trades' number of shares, the same pattern can be seen .i.e. the standard deviation for buy and exercise transactions is higher than the average value by, at least, three times, whereas the opposite pattern can be seen for directors' sell post exercise trades. For sell trades, there is no big difference between the average and the standard deviation of number of shares.

Figure 3.2: The Distribution of the Average Number of Sharesand the Standard Deviation of Trades' Number of Shares



Since the data comes from two different data sources, we find that it is useful to split the sample into two sub-samples. The first sub-sample covers the period 1991 to 2001 while the other sub-sample covers the period 2002 to 2010. This division is important for two reasons: firstly, to capture any change in transaction's types, total number of trades, total value, and the total number of shares, and, secondly, to confirm the patterns found in table (3.4).

Table (3.5) reports summary statistics related to our sample categorised by transaction type during the period 1991-2001. The table shows that the 75,349 transactions within this period were related to 13 different types. The total number of shares traded was over 7 billion, with a total value of £12.4 billion. Approximately, 53% of our sample is buys, 14% is exercises, 19% is sales and 9% is sales post exercise. Hence, directors' buys are more frequent than other directors' trades.

The total number of the traded shares is over 7 billion. Approximately, 32% of these shares are for buy trades, 13% are for exercise trades, 44% are for sale trades, and 9% are for sales post exercise trades. The total monetary value of directors' trades is £12.4 billion. Of these, approximately, 12% is for buy transactions, 10% is for exercise transactions, 55% is for sale transactions, 21% is for sale post exercise transactions, and 12% is for other transactions.

There are approximately two times as many buy trades as sells. Again, although buy trades are more frequent than sell trades, the average value of sell trades are

approximately twelve times larger, which suggests that directors sell less frequently but more in value (similar argument can be said about the number of shares).

There is one exercise transaction for each sale post exercise transaction. Although there is approximately slightly more frequent exercises than sale post exercise trades, the average value of sale post exercise trades are approximately three times larger, which suggests that directors sell the shares acquired from exercising options less frequently but more in value (similar argument can be said to the number of shares).

These results confirm the pattern found in table (5.4). Directors' sells are two times less than directors' buys, but they are greater in value. In other words, UK directors are net seller of their firms' shares.

Table 3.5: Summary Statistics Related to our Sample Categorised by Transaction Type

1991-2001

Transaction Type	No of Trades	Average Value (£)	Average No of Shares	Total Value (£)	Total No of Shares	Median Value (£)	Median No of Shares	SD Value (£)	SD No of Shares
Buy	40,057	38,129	60,251	1,530,000,000	2,410,000,000	8,160	6,000	992,767	423,636
Bed and Breakfast	579	99,573	60,647	57,700,000	35,100,000	15,040	10,000	277,818	511,759
Dividend Received	20	944	810	18,886	16,203	671	568	1,082	949
Exercise	10,622	117,602	95,503	1,250,000,000	1,010,000,000	40,114	30,000	424,887	293,294
Gift Given	19	128,526	119,580	2,441,996	2,272,018	64,980	30,000	74,908	278,165
Gift Received	104	120,554	48,480	12,500,000	5,041,962	19,969	9,676	266,991	135,019
Inherited	3	16,098	71,833	48,295	215,500	5,700	2,000	21,182	122,256
Options Granted	103	113,539	68,913	11,700,000	7,098,074	74,998	38,778	123,822	85,786
Sell	14,337	479,391	233,339	6,870,000,000	3,350,000,000	36,270	20,000	1,063,356	206,791
Sale post Exercise	6,600	387,150	102,087	2,560,000,000	674,000,000	172,063	45,000	275,908	86,278
Scrip Dividend	1,825	16,887	6,479	30,800,000	11,800,000	250	90	9,337	3,906
Scrip Issue	6	5,763	2,411	34,575	14,468	1,065	446	3,470,035	1,656,887
Take Up	1,074	84,561	127,548	90,800,000	137,000,000	7,125	5,066	456,659	578,748
Total	75,349	164,711	101,470	12,400,000,000	7,650,000,000				

Average value for each type represents the total value for that type divided by the number of trades**.** Average number of share for each type represents the total number of shares for that type divided by the number of trades.

Turning to the second sub-sample, Table (3.6) reports summary statistics related to our sample categorised by transaction type during the period 2001-2010. The table shows that the 105,926 transactions within this period were related to 12 different types. Approximately, 32% of our sample is buys, 14% is exercises, 9% is sales and 12% is sales post exercise. Hence, directors' buys are more frequent than other directors' trades.

Additionally, the total number of shares subscribed by insiders constitutes approximately 70% of total shares traded over the sample period. On the other hand, the total number of shares for transactions such as buys, exercises, sale post exercises, and sells constitutes 6%, 3%, 7%, and 2% of total shares trades respectively. These percentages would change after excluding large trades. For example, the total number of shares bought and sold would constitute roughly 50% of total shares traded over the sample period.

The total monetary value of directors' trades is £47.4 billion. Of these, approximately, 17% is for buy transactions, 10% is for exercise transactions, 32% is for sale transactions, 14% is for sale post exercise transactions, and 27% is for other transactions.

There are approximately three times as many buy trades as sells. Again, although buy trades are more frequent than sell trades, the average value of sell trades are approximately four times larger, which suggests that directors sell less frequently but more in value (similar argument can be said to the number of shares). There is one exercise transaction for each sale post exercise transaction.

These results confirm the pattern found in table (3.4). Directors' sells are less than directors' buys, but they are greater in value. In other words, UK directors are net seller of their firms' shares. Also, directors' sale-post exercises are one time less than directors' exercises, but they are greater in value.

Table 3.6: Summary Statistics Related to our Sample Categorised by Transaction Type

2001-2010

Transaction Type	No of Trades	Average Value (£)	Average No of Shares	Total Value (£)	Total No of Shares	Median Value (£)	Median No of Shares	SD Value (£)	SD No of Shares
Award	12,662	231,728	70,804	2,930,000,000	897,000,000	49,711	13,646	768,251	334,305
Buy	33,915	217,805	192,480	7,920,000,000	7,000,000,000	16,200	18,895	122	5,613
Contract Buy	7,046	39,873	72,513	281,000,000	511,000,000	5,459	2,029	7,799,461	1,651,150
Dividend Received	5,005	62,972	16,028	315,000,000	80,200,000	4,582	1,077	478,827	860,244
Exercise	15,176	304,914	245,210	4,810,000,000	3,870,000,000	75,106	40,000	505,225	136,697
Given Away	558	1,363,439	495,422	761,000,000	276,000,000	118,638	50,000	#DIV/0!	#DIV/0!
SELL	9,978	1,469,815	811,111	15,200,000,000	8,380,000,000	126,000	50,000	1,257,789	1,516,602
Sale post Exercise	13,231	490,380	136,640	6,620,000,000	1,840,000,000	149,522	32,475	#DIV/0!	#DIV/0!
Subscribe	5,642	278,965	15,800,000	1,570,000,000	89,300,000,000	25,000	90,352	1,501	843
Transfer	248	2,036,925	4,311,376	505,000,000	1,070,000,000	82,130	60,308	8,115,223	3,095,012
Transfer In	1,558	1,442,100	2,583,042	2,250,000,000	4,020,000,000	41,183	82,754	28,233	15,207
Transfer Out	1,107	3,857,636	1,868,565	4,270,000,000	2,070,000,000	83,386	75,000	929,183	263,760
Total	105,926	431,879	1,086,467	47,400,000,000	119,000,000,000	30,009	20,000		

Average value for each type represents the total value for that type divided by the number of trades**.** Average number of share for each type represents the total number of shares for that type divided by the number of trades.

Comparing table (3.5) with table (3.6) reveals the following results; the total number of trades during the period 2002-2010 exceeded the total number of trades during the period 1991-2001 (only 31% of trades occurred between 1991 and 2001). The total value of directors' trades in 2002-2010 is approximately four times higher than the total value of directors' trades in 1991-2001.

The total number of buy trades over the period 1991-2001 exceeded the total number of buy trades over the period 2002-2010. Approximately 54% of buy trades occurred during the period 1991-2001 while 46% of those trades occurred during the period 2002-2010. The same can be said for directors' sells. For directors' exercises, roughly 58% of exercise trades happened between 2002-2010, compared to 42% of trades between 1991 and 2001. On the other hand, it appears that sale post-exercise trades are higher for the second sub-sample than for the first sub-sample. The total number of trades for that period constituted 66% of the total number of sale post-exercise trades during the whole period. For both sub-samples, directors were net sellers of their company shares; therefore, directors' sales were fewer in number but much larger in value.

In our sample, the main transaction types are buys, sells, exercises, sale-post exercises, and dividend received. Other transactions' type varies between the two periods. For example, transactions such as Awards, Transfer In, Transfer Out, and Subscribe were firstly introduced in 2002, whereas other transactions' types such as Bed and Breakfast, Gift Received, and Gift Given were lastly shown in 2001. This variation might be due to the difference in data sources or to changes in disclosure criteria for such types of transactions.

Given that there are more years in the first sample, we calculated the average value per year for the two samples. Moreover, Figure (3.3) shows the average value per year for buy, sell, exercise, and sale post exercise transactions before and after 2002. This figure indicates that the average value per year of buy trades before 2002 was less than the average value per year of buy trades after 2002. The same can be noticed for director's sells, sale post-exercise and exercise before and after 2002.

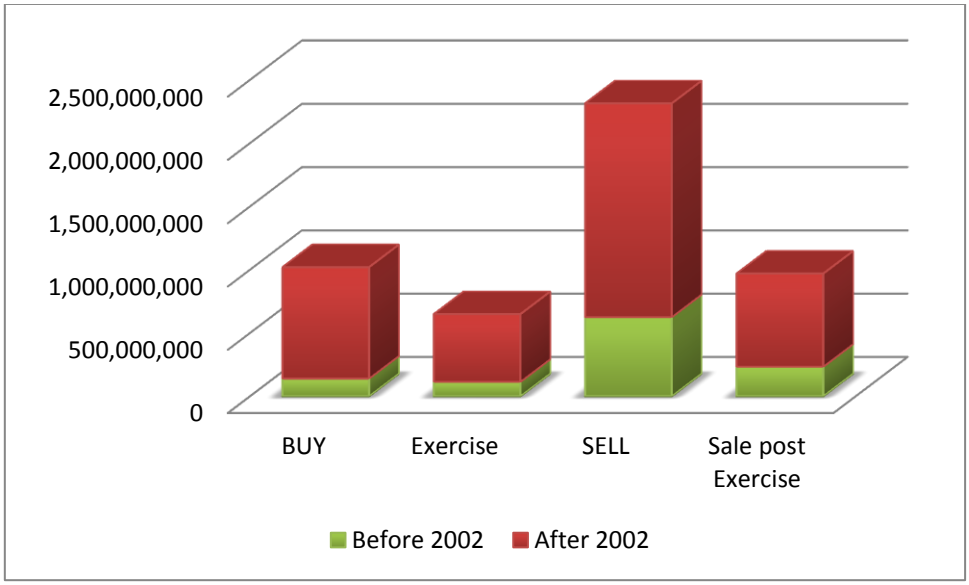


Figure 3.3: Director's total number of trades before and after 2002

3.4.1.1 Summary Statistics Categorised by Directors' Types

In this section, the general features and characteristics of directors' trades are categorised by directors' position in the firm (director type). The data on director type was only available for the period 2002 -- 2010. The total number of trades by different types of directors was 105,639 trades (this number presents 58% of the total sample number of trades).

Table (3.7) reports summary statistics related to our sample categorised by both transaction type and director type during the sample period. In our sample, the main directors' types are executive directors, non-executive directors, former directors and Person Dispensing Managerial Responsibility directors (PDMR). Also, there is a total of 105,639 transactions. The majority of these are by former directors followed by executive and PDMR directors.

Table (3.7) also shows that the total number of trades by formers is higher than the total number of trades by other types of directors. On the other hand, the total value of trades by executives is more than the total value of trades by formers. Therefore, trades by formers were larger in number but smaller in value. Formers' buys (exercises) are higher than other directors' buys

(exercises), but the total value of Executive sells (sale-post exercises) is the highest.

Table 3.7: Summary Statistics Categorised by Both Transaction and Director Types

Type	No of Trades				Total Value £m			
	Executive	Former	Non-Executive	PDMR	Executive	Former	Non-Executive	PDMR
Award	3,702	4,210	826	3,928	1,276	815	71	769
BUY	8,610	11,586	10,923	2,655	4,092	876	1,052	738
Contract Buy	1,352	1,778	2,440	1,475	140	49	31	61
Dividend Received	1,229	1,849	710	1,208	116	58	114	27
Exercise	4,678	4,835	880	4,765	1,529	1,638	384	1,197
Given Away	171	204	106	77	279	205	70	204
Sale post Exercise	3,932	3,563	461	5,262	2,131	2,231	345	1,763
SELL	2,391	3,528	1,429	2,323	3,999	7,391	1,577	1,572
Subscribe	1,476	1,655	1,928	586	572	476	432	93
Transfer	92	98	43	15	268	176	64	2
Transfer In	482	469	425	178	676	585	919	71
Transfer Out	363	352	257	134	2,950	489	717	110
Total	28,478	34,127	20,428	22,606	18,029	14,990	5,776	6,606

Executive directors typically perform operational and strategic functions and are full-time employees of the firm. Non-executives are not generally involved with the operations of the firm; they are mainly hired for their experience and expertise in specific areas to provide advice and objectivity. PDMR or Person Dispensing Managerial Responsibility is not a member of the board but an employee considered being a party to price sensitive information and therefore subject to the same rules as Board members. Former refers to directors who are no longer board members.

Table (3.8) constitutes an additional summary statistics related to sample of all transaction types categorised by the director type. In term of the number of trades, approximately, 32% of our sample is for Formers, 27% is for Executives, 19% is for Non-Executives, and 21% is for PDMRs.

For the total value of trades, approximately, 33% of our sample is for Formers, 40% is for Executives, 13% is for Non-Executives, and 15% is for PDMRs.

Also, Formers' total number of shares presents 64% of the total sample number of shares which is three times as large as non-executives' total number of shares and five times as large as executives' total number of shares.

Table 3.8: Summary Statistics Categorised by Director Types

Type	No of Trades	Total Value £m	No of Shares #m	Average No of Shares	Average Value £
Executive	28,478	18,029	13,776	483,731	633,086
Former	34,127	14,990	74,913	2,195,135	439,244
Non-Executive	20,428	5,776	25,759	1,260,942	282,741
PDMR	22,606	6,606	3,258	144,122	292,202
Total	105,639	45,400	117,706		

Average value for each type represents the total value for that type divided by the number of trades. Average number of share for each type represents the total number of shares for that type divided by the number of trades.

Diagrammatically, some of the results of table (3.8) can be seen below in Figure (3.4) which shows the distribution of the total number of trades over directors' types during the period of study. As can be noticed, the total number of trades by formers constitutes 32% of the total sample trades, whereas the total numbers of trades by non-executives and PDMRs are almost the same (19% and 21% respectively).

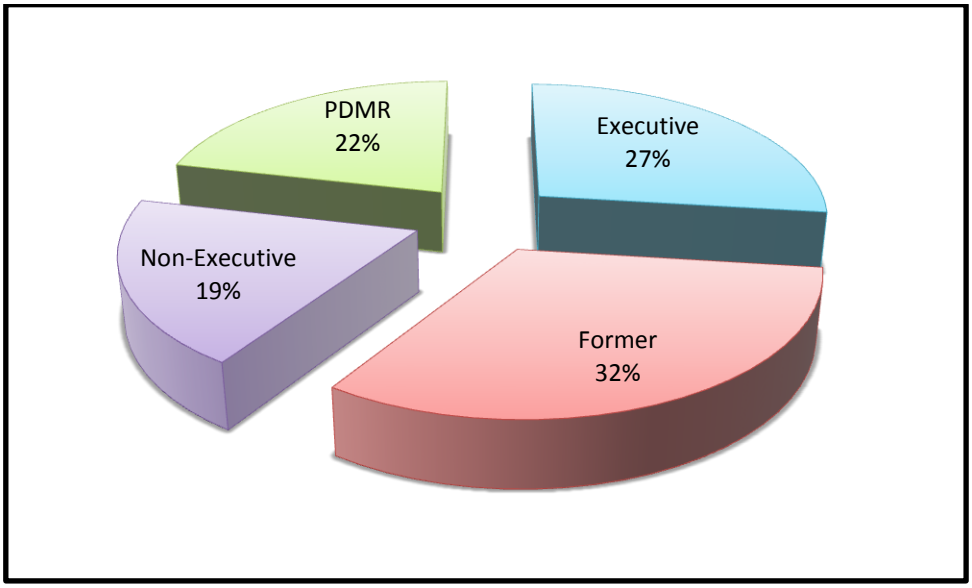


Figure 3.4: Total Number of Trades by Director Type

To summarise, after examining the general patterns of UK directors' trades, the results show that, compared to directors' buys, sells are fewer in number but much larger in value. Therefore, UK directors are net sellers of their firms' shares. This pattern is repeated for formers' trades, non-executives' trades, and PDMRs' trades. Formers' trades are larger in number, whilst executives' trades are larger in value.

3.4.2 Ordinary Buy and Sale

The original dataset provides information on various transaction types. The focus of this section is to highlight the main features of the data set related only to the ordinary shares purchases and sales by UK directors over the period 1991-2010. To do this, we removed trades[9] other than open market purchases and sales of ordinary shares by directors. Open market sales and purchases are more likely to represent actions taken because of special insider information (Seyhun, 1988a; Gregory et al., 1994; and Friederich et al., 2002).

Table (3.9) presents summary statistics categorised by transaction type (buys and sales only) during the sample period. The sample includes 92,093 trades divided into 70,067 buy trades and 22,026 sale ones over the period 1991 to 2010, with a total monetary value of £29 billion. There are approximately three times as many buy trades as sells. Although buy trades are more frequent than sell trades, the average value of sell trades is approximately seven times larger, which suggests that directors sell less frequently but in larger monetary amounts (a similar argument can be said to volume). The average value of directors' purchases was £122,047 (with the maximum buy of £575 million in 2007), but the average value of sales was £927,866 (with the maximum sell of £437 million in 2006), so directors' sales are fewer in number but much larger in value.

The last column of table (3.9) shows the number of days during the period in which at least one buy (sell) takes place. There are approximately 5,010 event dates (99% of sample days) for buy trades and 4,595 event dates (91% of sample days) for sell trades. During our sample period, there are trades of on average of thirteen buy trades (five sell trades) per event date. There is no day during the sample period that has neither buy nor sale.

Table (3.9) also shows that in our sample, the 92,093 trades (buys and sells) are related to more than 5000 separate firms. Specifically, the 70,067 buy transactions were conducted by directors in 5,427 separate firms. Thus, each firm had an average of just over twelve transactions. On the other hand, the

[9] We removed trades such as option exercise, derivative, script dividends or bonus shares, rights issue, awards made to directors under Incentive plans or reinvestment plans, gifts, transfers and purchase, and sales of shares under personal equity plans, operations derived from tax or "bed & breakfast"

22,026 sell transactions were conducted by directors in 3,263 separate firms. Thus, each firm had an average of seven transactions.

Although it is not reported in table (3.9), the 90% of the value of buy trades are under £85,100, whereas 25% of buy values are under £4,800. For trades' volume, the 90% of trades' volume are under 142,000 shares.

Turning to directors' sells, the 90% of the sells' values are under £1.3 million, whereas only 25% are under £16,491. For trades' volume, the 90% of trades' volume are under 600,000 shares.

Table 3.9: Summary Statistics Categorised by Transaction Type

1991-2010

Type	No of Trades	No of Shares	Total Value (£)	Average Value (£)	Average No of Shares	No of Firms	No of Days
BUY	70,067	8,620,000,000	8,550,000,000	122,047	123,064	5,427	5010
SELL	22,026	11,000,000,000	20,400,000,000	927,866	501,459	3,263	4595
Total	92,093	19,700,000,000	29,000,000,000				

Average value for each type represents the total value for that type divided by the number of trades.

Average number of share for each type represents the total number of shares for that type divided by the number of trades.

Diagrammatically, some of the results of table (3.9) can be seen below in Figure (3.5). Figure (3.5) shows the breakdown of trades and value by transaction type (buy and sale). Figure (3.3) indicates that directors' buys are three times larger than directors' sells in terms of the total number of trades, but the average value of directors' sells is greater than the average value of their buys.

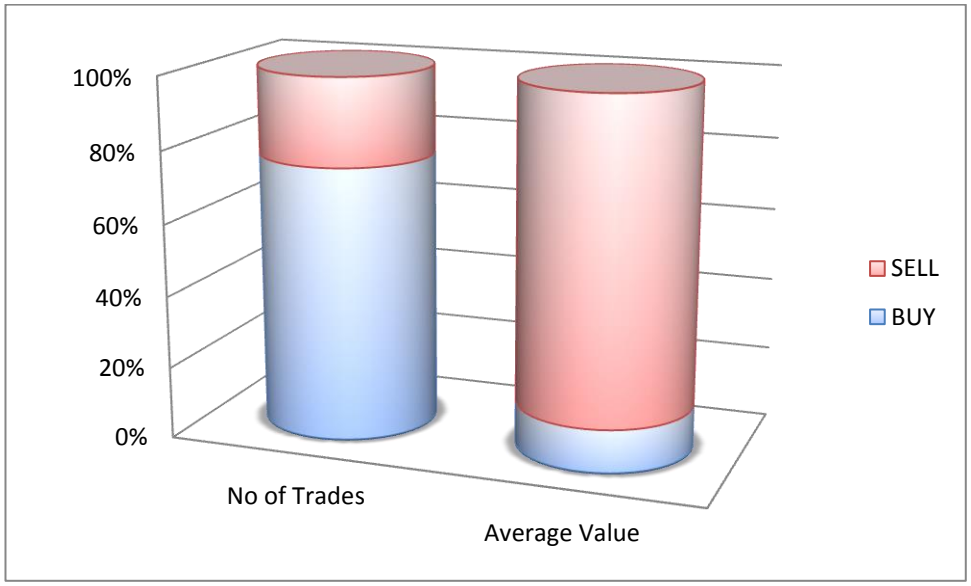


Figure 3.5: Directors' number of trades and average value for directors' buys and sells

It is also interesting to examine how these types of transactions have varied over time. To this purpose, table (3.10) presents yearly summary statistics for directors' trades (buys and sells) during the sample period.

To illustrate: in 1991 there were 1,708 buy transactions by UK directors. This is related to 95.6 million shares purchased at a total value of £64.3 million. Thus, the average number of shares traded per transaction was approximately 56,000 whereas the average transaction value was about £37,617. The rest of table shows this information by year and by transaction type (buy and sale), looking first, at the number of trades purchased every year. Initially, buy volume increases and becomes 250.5 million shares in 1996 which corresponds to £120.5 million pounds. In 1998, the total number of shares purchased became three times as large as the number of shares purchased in 1997. Three years later, in 2002, there was another jump in the number of shares. The total number of shares jumped over 801 million, with a total value of £304 million. For the years 2004 to 2008, directors' purchases increased from 278 million shares in 2004 to 1,073 billion shares in 2008. The value of the shares bought peaked in 2007 and gradually fell.

Diagrammatically, figure (3.6) highlights the key features of our time series. Figure (3.6) shows how the number of shares bought and the total value of shares bought vary over the sample period. Both of these variables moved in the same direction during the sample years. In 2007, the total value of shares purchased reached a peak, and it was four times as large as the previous year. In 2009, the total value of shares purchased was three times less than the total value of shares purchased in 2007.

For directors' sells, the total number of shares sold in 1991 was 299.3 million, which was approximately three times as large as the total number of shares sold in 1992. After a number of ups and downs in directors sell between 1993 and 1995, an increase in total shares number occurred in 1996, when the total number of shares sold became 448.3 million. During the period 2001-2003, the total number of shares sold increased significantly from 126.5 million to 1.279 billion, which was ten times higher. On the other hand, there was a decrease in number of shares sold between 2006 and 2008. The total value peaked in 2007. This is perhaps due to the financial crisis which occurred in that year.

Interestingly, the value of shares sold was similar to that in 2006, perhaps indicating that directors, collectively, were anticipating the crisis.

Cziraki (2013) examined insider trading behavior of high- and low-exposure banks starting in 2006, when US housing prices indices first declined. During 2006, insiders of high-exposure banks increased their selling by 20% compared to those of low-exposure banks. This increase in insider sales precedes the drop in banks' stock prices and the increase in banks' Credit Default Swap spreads by at least 12 months. This study linked trading by bank insiders (executives and independent directors) to the developments in the housing market, which played a crucial role in starting the crisis. The results showed that bank executives did sell large amounts of stock in 2006, when housing prices started to decline and that high-exposure bank managers exposed to the housing market sold more than low-exposure bank managers. Moreover, executives of high-exposure banks increased their selling as a anticipation, before housing prices started to fall.

Based on this study, the peak in insider trading sales during 2006-2007 might be explained by insiders anticipating the crisis before housing prices started to decline.

Another study by Fahlenbrach and Stulz (2011) indicated that CEOs did not reduce their ownership in 2007 or during the peak of the crisis in 2008 because they believed that the risks they took before the crisis would pay off. Hence, their trading behaviour might not change before the crisis hits.

Diagrammatically, figure (3.7) shows how the number of sold shares and the total value of sold shares vary over the sample period. Both of these variables moved in the same direction during the sample years. In 2006 and 2007, the total value of shares sold reached its maximum.

Comparing the total number of trades over the sample period, one can see that the number of buy trades is always greater than the number of sell trades. Although it is not shown in table (3.10) directly, the number of buy trades per year is approximately three times the total number of sell trades per year. The difference reached its peak in 2008 when there were approximately eight times as many buy trades as sell trades.

Table 3.10: The Distribution of Directors' Trades by Year

Year	Buy					Sell					% Volume
	No of Trades	No of Shares	Total Value (£)	Average No of Shares	Average Value (£)	No of Trades	No of Shares	Total Value (£)	Average No of Shares	Average Value (£)	
1991	1,708	95,614,544	64,341,927	37,671	55,980	1,269	299,318,039	317,737,382	250,384	235,869	0.09%
1992	2,109	100,493,466	51,637,563	24,484	47,650	932	92,186,673	190,805,229	204,727	98,913	0.05%
1993	1,686	108,172,945	69,494,648	41,219	64,160	1,236	205,937,472	293,652,786	237,583	166,616	0.07%
1994	2,848	146,551,712	76,021,211	26,693	51,458	1,074	177,115,135	301,980,796	281,174	164,912	0.07%
1995	3,793	206,199,818	74,255,353	19,577	54,363	1,311	254,918,966	376,609,974	287,269	194,446	0.08%
1996	2,890	250,592,303	120,583,946	41,725	86,710	1,287	448,315,575	806,407,306	626,579	348,342	0.13%
1997	3,531	183,865,328	138,782,400	39,304	52,072	1,075	288,719,996	515,576,102	479,606	268,577	0.07%
1998	7,559	572,626,393	313,766,666	41,509	75,754	2,061	455,929,284	1,112,061,558	539,574	221,218	0.14%
1999	4,968	211,181,732	185,235,048	37,286	42,508	1,337	401,250,521	932,458,312	697,426	300,113	0.07%
2000	4,590	207,755,503	206,328,854	44,952	45,263	977	336,981,560	1,458,003,663	1,492,327	344,915	0.06%
2001	2,417	216,692,983	143,530,703	59,384	89,654	546	126,555,677	356,275,463	652,519	231,787	0.03%
2002	3,669	801,453,229	304,067,833	82,875	218,439	607	493,703,558	609,991,793	1,004,929	813,350	0.12%
2003	2,967	477,454,635	224,323,761	75,606	160,922	881	1,279,062,261	573,687,333	651,177	1,451,830	0.19%
2004	2,899	278,141,782	165,897,839	57,226	95,944	869	1,062,830,881	804,914,938	926,254	1,223,050	0.19%
2005	2,990	397,137,203	225,348,411	75,367	132,822	1,042	1,143,302,783	1,481,037,778	1,421,341	1,097,220	0.19%
2006	3,446	560,064,252	712,519,215	206,767	162,526	1,475	1,153,601,537	3,018,040,073	2,046,129	782,103	0.19%
2007	4,344	953,644,124	3,333,334,666	767,342	219,531	1,378	971,584,250	3,146,448,157	2,283,344	705,068	0.19%
2008	5,737	1,073,337,765	1,596,899,252	278,351	187,090	717	439,250,467	762,555,397	1,063,536	612,623	0.13%
2009	3,110	958,349,221	262,280,702	84,335	308,151	856	611,106,793	962,882,481	1,124,863	713,910	0.13%
2010	2,805	823,361,555	282,821,289	100,828	293,534	1,096	803,462,222	2,416,058,327	2,204,433	733,086	0.13%
Total	70,067	8,622,693,193	8,551,474,796			22,026	11,045,133,650	20,437,184,847			

Average value for each type represents the total value for that type divided by the number of trades**.** Average number of share for each type represents the total number of shares for that type divided by the number of trades. % volume is the average number of shares (bought and sold) as a percentage of FTSE All Shares average volume.

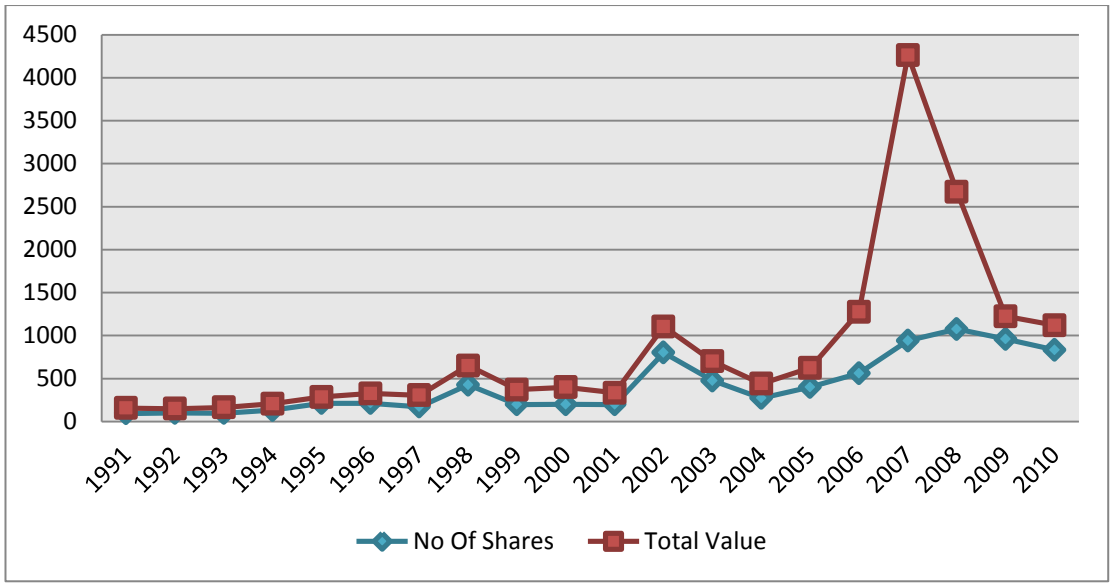


Figure 3.6: The Total Number of Shares Bought and the Total Value of Directors' Buy Trades over Time

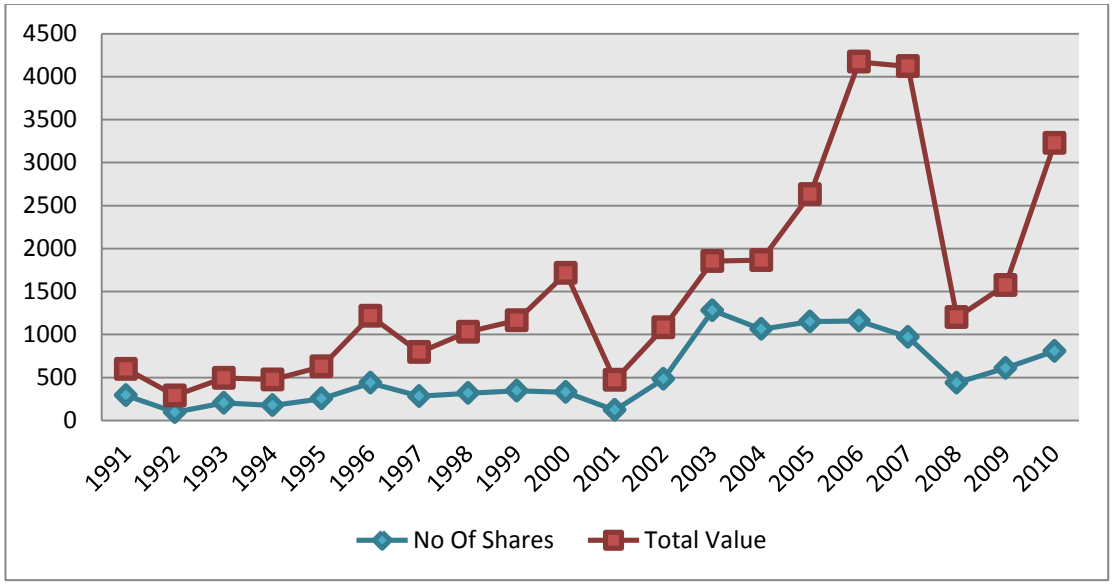


Figure 3.7: The Total Number of Shares Sold and the Total Value of Directors' Sell trades over Time

Table (3.11) provides additional yearly summary statistics for directors' trades (buys and sells). This table shows that the standard deviation is higher than the mean for both value and volume of trades. This means that some observations are far away from the mean. This results are not surprising since both insiders' value and volume include very small and very high observations starting from £1 (or 1 share) to more than ten million pounds (or shares). Generally, the

percentiles statistics provides information about the impact the subject under interest has had compared with other subjects in the same area and in the same year (Bornmann, 2012). Statistically, percentile finds the value under which X percent of the numbers lie and tells us how spread apart our numbers are. For example, table (3.11) shows that 75% of directors' buys as measured by value are under £12,330 for the year 1991 and only 25% of trades' value are under £2,452 for the same year (the same argument can be made for the volume of buy trades). Although it is not reported in table (3.11), the 90% of the value of buy trades are under £32,100. Hence, the upper 10% of directors' value of buys have large values. Interestingly, the 75% of the volume of buy trades for years 2008 and 2009 are under 100,000 shares which are, at least, twice as large as the 75% of the volume of buy trades of other years.

Similarly, table (3.11) shows that 75% of directors' sells as measured by value are under £117,000 for the year 1991 and only 25% of trades' value are under £10,433 for the same year.

However, table (3.11) shows that the upper 10% of directors' trades have large values which drive the standard deviation to be higher than the mean.

Table 3.11: Additional Yearly Summary Statistics for Directors' Trades (Buys and Sells)

Year	Buy								Sell							
	Value				Volume				Value				Volume			
	Percentile			Standard Deviation	Percentile			Standard Deviation	Percentile			Standard Deviation	Percentile			Standard Deviation
	25%	50%	75%		25%	50%	75%		25%	50%	75%		25%	50%	75%	
1991	2,452	5,400	12,330	486,960	2,000	5,000	20,000	295,178	10,433	27,520	117,000	1,350,696	5,000	17,000	70,000	1,762,427
1992	2,960	6,000	14,250	154,110	2,500	10,000	25,000	239,001	10,057	25,224	108,400	787,693	5,000	15,000	50,800	325,068
1993	3,600	8,250	20,007	237,964	2,214	9,569	25,000	275,802	11,090	29,000	120,945	984,457	5,000	15,000	66,420	1,273,345
1994	1,800	5,876	15,695	137,303	1,000	5,000	15,000	404,997	10,038	23,972	101,600	2,489,298	4,411	15,000	60,000	740,129
1995	733	4,700	11,674	110,393	241	2,684	11,993	822,083	9,620	25,000	126,276	1,217,512	3,906	12,000	70,000	1,972,656
1996	4,000	8,350	19,250	343,071	2,239	6,102	20,000	1,033,993	15,000	46,760	249,000	5,514,542	5,500	24,359	125,000	3,162,381
1997	4,650	9,900	23,575	197,890	3,000	9,000	21,227	274,323	14,850	48,500	220,000	2,946,687	5,500	20,189	100,000	1,834,281
1998	5,100	11,001	27,400	167,282	3,328	10,000	30,000	540,197	16,575	52,500	322,000	1,876,747	6,100	25,000	100,000	1,204,236
1999	2,975	9,000	22,000	212,492	1,103	5,000	20,000	192,621	16,000	66,665	320,000	2,822,347	6,414	26,500	130,000	1,105,839
2000	1,050	6,947	19,938	528,433	300	3,026	15,000	333,811	20,700	110,300	580,000	9,229,150	10,000	37,639	165,000	1,854,409
2001	5,800	12,500	29,000	306,339	5,000	10,261	40,000	696,355	13,990	45,363	233,100	5,321,366	5,000	19,970	100,000	1,499,249
2002	5,625	11,925	29,835	1,177,586	5,000	15,000	60,000	1,595,282	16,199	59,863	313,901	########	8,260	35,847	225,000	4,562,390
2003	5,000	11,590	30,400	698,070	4,800	13,000	50,000	1,030,258	23,920	94,950	457,950	1,950,285	12,000	70,000	308,112	8,539,101
2004	5,649	13,000	32,650	323,438	3,500	10,000	43,105	605,272	31,517	126,144	540,000	4,022,094	12,729	60,000	340,991	########
2005	6,297	15,000	40,000	638,972	4,060	12,270	50,000	1,130,204	23,578	119,654	600,000	########	9,436	49,430	250,000	########
2006	7,582	17,400	42,500	6,501,517	5,000	18,584	61,724	1,174,216	28,812	121,275	552,500	########	7,149	40,000	200,000	5,376,912
2007	9,874	21,261	53,460	########	5,000	15,000	50,000	2,212,263	40,000	173,182	770,250	########	10,175	55,000	300,000	3,719,684
2008	8,125	19,360	49,627	8,262,725	8,600	25,000	100,000	1,002,329	44,163	178,391	639,899	3,363,891	13,809	58,152	254,597	2,286,556
2009	6,338	15,470	39,604	598,271	7,500	25,000	100,000	2,075,130	44,029	140,012	558,062	4,371,144	12,216	50,000	200,000	3,670,763
2010	9,400	19,868	49,706	834,677	8,414	24,069	83,333	2,996,531	54,533	232,000	866,100	########	18,739	65,000	250,000	3,321,670

3.4.2.1 Directors' Age

It is also interesting to see how directors' trades vary with the age of the director. This section presents summary statistics as well as it highlights how directors' trades vary with age. Due to the lack of available data on director age, we are only able to cover the periods 1991-1997 and 2002-2010. There are a total of 37,743 trades by directors over the sample period, divided into 26,839 purchases of company stock and 10,904 sales – meaning there are approximately two times more buy trades than sale trades. This covers approximately 42% of total number of trades[10].

Table (3.12) presents summary statistics related to our sample. There are approximately two times as many buy trades as sells (26,839 buy trades versus 10,904 sell trades). Although buy trades are more than sell trades, the average value of sell trades is approximately eight times bigger, which suggests that directors sell less frequently but in larger monetary amounts (a similar argument can be made for volume).

The average age of directors who buy (measured by mean and median) is 55 years old. This is slightly higher than the average for sell which is 54 years old. The most frequent age of directors who buy (measured by mode) is 59 years old. This is slightly higher than the mode for sell which is 57 years old.

Table 3.12: Summary Statistics Categorised by Transaction Type

Transaction type	*No Of Trades*	*Average Value*	*Average No of Shares*	*Max Age*	*Min Age*	*Mean Age*	*Median Age*	*Mode Age*
Buy	10,904	119,790	142,205	92	20	55	55	59
Sell	26,839	856,977	476,358	87	20	54	54	57
Total	37,743							

Average value for each type represents the total value for that type divided by the number of trades**.** The number of event days is the number of days during the period in which at least one trade takes place. Age presents the mean age for each type. Number of shares in the table is in terms of billions.

Table (3.13) reports summary statistics related to our sample categorised by both age groups and transaction type during the sample period. There are more buy trades than sell trades in all age groups. The majority of buys and sales

[10] There will be further examination on the impact of director's age upon the informativeness of directors' trades in chapter five.

occurred between the age 45 and 65. Buys and sales under 40 and over 70 are much less frequent. Directors engage in buy transactions most frequently between the age 55 and 59, but sell more often between 50 and 54.

The average value of directors' buy transactions (and sell transactions) above the age of 65 is the highest. This is perhaps driven by a greater requirement for liquidity after 65 (sales) and an increased desire for the income from investments (i.e. dividends) at retirement age (hence greater value buys)[11].

Table (3.14) reports additional statistics related to our sample categorised by both age groups and transaction type during the sample period. This table also shows that .the standard deviation is higher than the mean for both value and volume of trades.

table (3.14) also shows that 75% of directors' buys as measured by value are under £25,000 for the age group 40-44 and only 25% of trades' value are under £5,112 for the same age group (the same argument can be made for the volume of buy trades).

Similarly, table (3.14) shows that 75% of directors' sells as measured by value are under £275,000 for the age group 40-44 and only 25% of trades' value are under £11,680 for the same age group.

[11] Psychology, cognitive abilities and finance studies provide two opposing views on the impact of age on decision making. In one hand, studies by Baltes and Lindenberger (1997), Spaniol and Bayen (2005) and Gomes and Michaelides (2005) suggest that older people are less able to make right decisions. On the other hand, studies by Korniotis and Kumar (2011) and Graham et al., (2013) suggest that older people are more able to make right decisions because of experience and more knowledge of financial fundamentals. Besides, Fidrmuc et al., (2006) and Gregory et al., (2009) implies that sell trades by insiders are likely to be driven by liquidity/diversification needs, whereas buy trades are likely to be driven by advanced knowledge of future firm's prospective. However, a further illustration and discussion is going to be made in Chapter 5 when examining the impact of director's age on the informativeness of directors' trades.

Table 3.13: Summary Statistics Categorised by Age and Transaction Type

Age	Buy			Sell		
	No of Trades	Average Value (£)	Average No of Shares	No of Trades	Average Value (£)	Average No of Shares
Age under 40	1,427	78,372	181,844	621	544,682	779,494
Age between 40 And 44	2,579	96,365	179,697	1,192	656,252	481,517
Age between 45 And 49	4,336	63,469	169,742	2,067	624,021	392,346
Age between 50 And 54	5,032	178,132	160,612	2,382	609,613	371,791
Age between 55 And 59	5,697	67,428	98,541	2,046	1,076,722	536,632
Age between 60 And 64	4,770	59,849	117,058	1,477	943,970	329,375
Age between 65 And 69	2,182	324,446	125,450	728	1,194,823	558,369
Age over 70	816	374,482	191,206	391	2,595,841	1,147,463
Total	26,839			10,904		

Volume represents the number of traded stocks for each age and type during the sample period, so the average volume represents the total number of shares over the number of trades. Average value for each type represents the total value for that type divided by the number of trades.

Table 3.14: Additional Summary Statistics Categorised by Age and Transaction Type

Age	Buy								Sell							
	Value				Volume				Value				Volume			
	Percentile			S Dev	Percentile			S Dev	Percentile			S Dev	Percentile			S Dev
	25%	50%	75%		25%	50%	75%		25%	50%	75%		25%	50%	75%	
Age under 40	4,300	14,489	60,000		4,995	10,000	20,000		10,500	21,376	135,000		5,000	20,000	200,000	
Age between 40 And 44	5,112	10,593	25,000	617,560	3,540	10,000	40,000	1,183,794	11,860	30,199	275,000	3080770	5,000	15,756	146,023	2309404
Age between 45 And 49	5,000	10,300	24,825	279,238	3,219	10,000	32,752	1,303,289	10,480	22,500	221,600	3368961	4,000	12,500	100,000	2037661
Age between 50 And 54	4,830	10,000	22,005	6,729,804	2,500	10,000	25,872	1,335,448	10,700	26,460	263,713	3186612	4,108	13,711	100,000	4718626
Age between 55 And 59	4,884	9,975	21,750	495,475	2,500	8,865	25,000	540,014	10,970	36,757	303,000	1.24E+07	4,439	15,000	100,000	3842617
Age between 60 And 64	4,860	10,146	26,232	7,664,507	2,500	10,000	27,100	1,104,093	11,663	45,000	335,602	1.39E+07	5,000	20,000	100,000	3496005
Age between 65 And 69	4,350	9,800	24,500	230,857	2,441	9,966	30,000	360,317	13,000	51,860	450,432	6819579	5,000	20,000	166,837	3763818
Age over 70	4,500	12,250	37,715	6,651,693	3,000	10,000	50,000	1,308,531	23,426	83,250	361,528	1.14E+07	10,000	37,000	170,750	4900369

3.4.2.2 Transaction Size

Previous empirical studies suggest that the informativeness of directors' trades varies with trade size (Barclay and Warner, 1993). More specifically, medium-sized trades (where the information exists) are more informative than other-sized trades (Barclay and Warner, 1993, and Friederich et al.et al., 2002). Seyhun (2000) assumed that insiders worry about the regulatory implications of their large transactions (more so purchases than sales), so they might break up their large transactions into smaller lots and spread these over a period of time. By breaking up their purchases orders into smaller lots over longer time horizons, insiders make it harder for regulators to detect unusual purchasing activity. In contrast, insiders are less concerned about the size of their sell transactions. Again, a possible explanation for this finding is that insiders can easily come up with reasons as to why they need cash due to liquidity reasons. Making the same argument for purchases could be more difficult (Seyhun, 2000).

To address these issues, the relation between trade size and buy-sell activities need be analysed. If regulatory concerns are not important at all, there should be no relation between buy and sell transactions and volume of trades. Our data shows that small transactions tend to be purchases while large transactions tend to be sells (Table 3.15). For those trades where the number of shares is less than 100, about 78% are buys. In contrast, when the trading volume (number of shares) increases, selling becomes more predominant. For those trades where the volume exceeds 10 million shares, only 35% are purchases and 65% are sells.

Table 3.15: Summary Statistics Categorised by Transaction Types

1991-2010

No of Shares	BUY		SELL		Buy Proportion
	No Of Trades	Total Value (£)	No Of Trades	Total Value (£)	
1-100	2,376	901,171	97	258,322	77.72 (%)
101-1000	5,254	14,300,000	542	3,302,693	81.24 (%)
1001-10000	24,048	283,000,000	6,008	130,000,000	68.52 (%)
10001-100000	27,850	1,070,000,000	8,303	1,260,000,000	45.92 (%)
100001-1000000	9,049	1,510,000,000	5,482	4,970,000,000	23.30 (%)
1000001-10000000	1,372	1,710,000,000	1,419	6,760,000,000	20.19 (%)
Over 10000000	118	3,960,000,000	175	7,310,000,000	35.14 (%)

Buy proportion is equal to the total value of buy trades divided by the total value of buy and sale trades combined.

For those trades where the volume is less than 100 shares, the total value of directors' purchases was over £900,000, but the cumulated total value of sell transactions was £258,322, making directors net buyers of corporate equity for this category. This continued to be the case for less than 10,000 shares where the total value of purchases exceeded the total value of cells. In contrast, directors who trade more than 10,000 shares are net sellers since the total value of their sells are higher than the total value of their purchases.

3.4.2.3 Directors' Type

The general features and characteristics of UK directors' transactions categorised by director type are examined in this section. Because of data availability, the analysed sample covers only 37% of total available trades during the sample period. More specifically, the period under examination starts at January 2002 and ends at December 2010.

Table (3.16) shows how trades are distributed across directors' types and also highlights this by transaction type (buy and sale). There are a total of 35,300 transactions. The majority of these are by former directors (for both transaction types) followed by executive and non- executive directors. This pattern is repeated for buy transactions but not for sales. PDMRs account for 24% of sell transactions and only 10% of buy transactions.

Another interesting observation is that, whereas there are five times as many non-executive buys as there are sales, for PDMRs, they are roughly equal.

Table 3.16: The Total Number of Trades Categorised by Director Type for Buy and Sell Trades

Type	Executive	Former	Non-Executive	PDMR	Total
Buy	5,816	12,007	6,125	2,538	26,486 (76%)
Sell	2,178	3,280	1,217	2,139	8,814 (24%)
Total	7,994 (23%)	15,287 (45%)	7,342 (22%)	4,677 (10%)	35,300

Table (3.17) gives more detailed information on how directors' trades vary with director types. In particular, we show how the total (and average) value as well as volume of shares varies with director type for both buy and sell transactions. Focusing on the average value of transactions reveals immediately that the average value of sell transactions is much higher than that of buys. This is true for all directors' categories except for PDMRs. For buy transactions, the average amount per trade of executive and PDMR directors dominate those of former and non-executive directors (about three times larger).

For sell transactions, the average money spent per trade by executive directors is approximately six times than that of PDMRs.

Table 3.17: Additional Summary Statistics Categorised by Director Type

Type	Buy				Sell			
	No of Trades	Total Value £m	No of Shares #m	Average Value £	No of Trades	No of Shares #m	Total Value £m	Average Value £
Executive	**5,816**	2,134	4,266	27001	2,178	5,237	3,603	318,389
Former	**12,007**	1,368	1,063	11385	3,280	5,835	6,668	210,793
Non-Executive	**6,125**	1,393	1,482	12203	1217	1,559	1,421	140,960
PDMR	**2,538**	611	312	31025	2,139	1,005	1,407	50,044
Total	**26,486**	5,506	7,123		8,814	13,635	13,099	

Average value for each type represents the total value for that type divided by the number of trades.

3.4.2.4 Directors' Industries/Sectors

Categorising directors' trades by the industry (and sector) in which the firm operates may shed light on directors' activities across industries (and sectors)[12]. Therefore, this section looks at general patterns and characteristics of directors' trades across industries[13].

Again, due to the lack of available data on director industry/sector, we are able only to cover the period 2000-2010. There is a total of 59,123 trades by directors over the sample period, divided into 47,434 buy trades and 12,689 sale trades – meaning there are approximately three times more buy trades than sale trades. This covers approximately 64% of total available trades.

Table (3.18) provides summary statistics related to our sample categorised by industry (and sector) groups and transaction type during the sample period. There are more buy trades than sell trades in all industry (and sector) groups. The majority of buys and sales occurred in Financials industry (and Industrial Goods and Services sector). Buys and sales in Utilities industry (and Automobiles sector) are much less frequent.

Another interesting observation is that, whereas the total value of buy trades in all industries (and sectors) is lower than those of sales for oil and gas industry, they are not (the same argument can be made for the volume).

[12] Industry refers to a few general segments in the economy within which a large group of companies can be categorised, whereas sector describes a much more specific grouping of companies with highly similar business activities. In other words, industry contains many sectors.

[13] The impact of industry classifications on the informativeness of directors' trades are examined further in chapter six.

Table 3.18: Summary Statistics Categorised by Directors' Trades in Different Sectors and Industries

Industry	Sector	BUY			SELL		
		No of Trades	Total Value £m	No of Shares #m	No of Trades	Total Value £m	No of Shares #m
Basic Materials	Basic Resources	1,709	635	541	485	2,799	521
	Chemicals	789	14	22	153	40	18
Total		2,498	649	563	638	2,839	539
Consumer Goods	Automobiles	245	7	7	46	10	8
	Food and Beverage	1,691	97	119	515	340	146
	Personal and Household Goods	1,169	66	140	398	348	145
Total		3,105	170	266	959	698	299
Consumer Services	Media	2,786	217	739	762	731	677
	Retail	2,523	1,413	333	818	1,641	627
	Travel and Leisure	2,622	406	768	789	1,580	1,328
Total		7,931	2,036	1,840	2,369	3,952	2,632
Financials	Banks	1,142	970	120	272	415	50
	Financial Services	7,669	493	1,105	1,714	1,739	1,172
	Insurance	1,677	81	65	365	366	91
	Real Estate	2,538	299	412	655	490	301
Total		13,026	1,843	1,702	3,006	3,010	1,614
Health Care	Health Care	1,826	96	207	472	351	190
Industrials	Construction	1,908	107	160	364	291	100
	Engineering	1,101	25	50	118	30	13
	Industrial Goods and Services	9,013	371	989	2,431	2,369	1,599
Total		12,022	503	1,199	2,913	2,690	1,712
Oil and Gas	Distributors	588	31	104	127	104	31
	Oil and Gas	1,646	2,090	395	450	1,451	425
Total		2,234	2,121	499	577	1,555	456
Technology	Technology	3,397	256	807	1,246	1,251	1,096
Telecommunications	Telecommunications	763	60	91	236	263	289
Utilities	Utilities	632	46	17	273	206	114

3.5 Conclusions

The purpose of this chapter was to describe the dataset used in this thesis to analyse the information content of director trading. The objective was to familiarise the reader with some important characteristics of insider trading activities.

Previous studies have used directors' trades to examine various hypotheses in the general area of insider trading. One focus of previous literature has been to examine how the informativeness of directors' trades varies with trade, firm and director characteristics.

Based on the findings of the literature that has attempted to distinguish between information driven from noisy insider trades, we presented and examined insider trading characteristics and patterns based on transaction (type and size), director (type and age), and firm characteristics (industry to which the firm belongs).

These effects are comprehensively reviewed insider trading behaviour, describing the general characteristics, patterns, and activities of UK directors over the period 1991-2010. To the best of our knowledge, this exercise has never been conducted before.

Using a dataset of more than 5,000 UK companies covering the period January 1991 to December 2010 comprising a total of 181,276 transactions distributed over 20 different transaction types, we present quantitative statistics to highlight insider trading patterns.

Focusing only on ordinary buys and sales, we observed certain patterns; Directors buy more frequently than they sell but the average value of sell trades is approximately seven times larger, which suggests that directors sell less frequently but in larger monetary amounts (a similar argument was made for volume). Also, the total value of shares sold peaked in 2007. This is perhaps due to the financial crisis which occurred at that year. Interestingly, the value of shares sold was similar in 2006, perhaps indicating that directors, collectively, were anticipating the crisis.

Categorising directors' trades by the age of the director showed that the majority of buys and sales occurred between the age 45 and 65. Buys and sales under 40 and over 70 are much less frequent. Directors engage in buy transactions most frequently between the age 55 and 59, but sell more often between 50 and 54. The average value of directors' buy transactions (and sell transactions) above the age of 65 is highest. This may be driven by a greater requirement for liquidity after 65 (sales) and an increased desire for the income from investments (i.e. dividends) at retirement age (hence greater value buys). Another pattern can be seen where small transactions tend to be purchases while large transactions tend to be sells.

Categorising directors' trades by directors' types showed that the majority of the trades were by former directors (for both transaction types) followed by executive and non- executive directors. This pattern is repeated for buy transactions but not for sales. For buy transactions, the average amount per trade of executive and PDMR directors dominate those of former and non-executive directors (about three times larger). For sell transactions, the average money spent per trade by executive directors is approximately six times that of PDMRs.

Accounting for the industry (and the sector) in which the firm operates revealed the following. The majority of buys and sales occurred in the financial industry (and Industrial Goods and Services sector). Buys and sales in Utilities industry (and Automobiles sector) are much less frequent. Another interesting observation is that, whereas the total value of buy trades in all industries (and sectors) is higher than those of sales, for Oil and Gas industry, they are not (the same argument can be made for the volume).

As well as these general findings, a few unexplained patterns have identified; firstly, there are five times as many non-executive buys as there are sales, for PDMRs, they are slightly equal. Secondly, the total value of shares sold reached a peak in 2007. We suggest that this could be an avenue for future researches.

Chapter 4: Seasonal Patterns in Aggregate Directors' Trades

4.1 Introduction

The efficient market hypothesis (EMH) suggests that at any given time, prices fully reflect all available information on a particular stock market. The weak form of the market efficiency hypothesis suggests that the current price fully incorporates all the information contained in the record of past share prices. Thus, no investor can gain an advantage in predicting the return on a stock using past price observations. The empirical literature in this area is vast. For example, a number of seasonality or calendar anomalies in equity trading, such as the Day-of-the Week[14], Month-of-the Year, or turn of the year[15] (January effect), amongst others, have challenged the weak form of the EMH. The existence of these anomalies may indicate market inefficiency, which in turn provides a possibility for market participants to gain abnormal returns by creating a set of trading rules.

Two of the most documented anomalies in equity markets are the day of the week effect (also known as Monday effect) and turn of the year effect (known as the January effect). The Monday effect occurs when returns are lower, or negative, on Monday in comparison with returns on other days of the week. The January effect is another common anomaly that is inconsistent with the EMH. This calendar effect happens when certain stocks generate higher returns in January compared to other months of the year.

Following on from the previous chapter, which examined the patterns and characteristics of insider trading activities, one aim of this chapter is to specifically test for seasonal patterns in aggregate insider trading transactions

[14] See for example Cross (1973), French (1980), and Dalvi and Nath (2004).
[15] See for example Rozeff and Kinney (1976) and Choudhry (2001).

(as measured by the aggregate insider number and value of insider transactions). Specifically, do insiders prefer to trade on any particular day of the week or month of the year?

The previous literature on calendar anomalies has been on returns i.e. do returns vary by month of the year or day of the week. This literature has attempted to simply identify whether these anomalies exist and/or to try to explain their existence. For example, Cross (1973) and French (1980) reported negative returns on Monday. This may be due to the methodology employed or the way of calculating returns (Connolly, 1989), investor psychology (Rystrom and Benson, 1989), the difference in trading patterns of individual and institutional investors (Lakonishok and Maberly, 1990), or settlement procedures (Keef and McGuinness, 2001)[16].

The day of the week anomalies in trading volume has also been examined by Lakonishok and Maberly (1990) and Sias and Starks (1995) with the aim of explaining calendar anomalies in stock returns. These studies suggested that Monday trading volume is higher compared to other days of the week. More specifically, there are more tendencies to sell on Mondays than to buy for individual investors or more tendencies to buy than to sell for institutional investors (Lakonishok and Maberly, 1990). The reason for this anomaly, as given by these studies, is related to the private information hypothesis and the behaviour of individual and institutional investors[17]. To the best of our knowledge, no examination of the day of the week effects in aggregate insider activities as measured by the aggregate number of directors' trades has yet been carried out.

Similarly, studies by Rozeff and Kinney (1976), Keim (1983) and Gu (2003) documented positive returns on January. The existence of this anomaly can be explained by a tax loss selling hypothesis (Fountas and Segredakis, 2002), window dressing hypothesis (Haugen and Lakonishok, 1987), new information provided by the firms at the end of the financial year (Barry and Brown, 1984), or insider trading activities (Seyhun, 1988b, and Hillier and Marshall, 2002a)[18].

[16] These explanations are discussed further in literature review section.
[17] This is further discussed in literature review section.
[18] These explanations are also highlighted and discussed in literature review section.

Trading volume anomalies in aggregate insider activities was also examined by Seyhun (1988b) and Hillier and Marshall (2002a). Seyhun (1988b) examined the monthly pattern of aggregate insider transactions in the US over the period 1975-1981with the aim of testing two competing explanations of the January effect (the price pressure hypothesis[19] and the risk premium hypothesis[20]). The results indicated that some insiders tend to accelerate their planned stock purchases and postpone their stock sales in December. Therefore, this enables insiders to capture a return that is more positive in January. Also, using aggregate insider trading, Hillier and Marshall (2002a) examined the January effect in UK securities and found that it was significant, but not persistent through time. Furthermore, the results showed that the seasonality in insider trading was not the main determinant of the turn of the year effect. Both of these studies used the aggregate number of insider trades as their measure of insider trading activity. Hillier and Marshall (2002a) used only six years insider trading data. We re-examined this in the UK by using a much longer time period (20 years), which may allow us to test for the persistence of this effect. Furthermore, we introduced another measure of insider trading activities, namely, the aggregate value of directors' trades. To the best of our knowledge, the day of the week effect in aggregate insider trading activity has not been examined yet.

A second aim of this chapter, given that such seasonal patterns exist, is to attempt to relate these patterns to explanations drawn from the literature on calendar anomalies (in returns and volumes).

Although the purpose of this chapter is purely to identify whether such anomalies exist, we do not attempt to explain why they do. We suggest this is an avenue for further research in this area.

The chapter is organised as follows. Section (4.2) reviews previous studies on stock market anomalies and the explanations provided for both daily and monthly patterns in these anomalies. Section (4.3) sets the hypotheses. Sections

[19] This hypothesis states that the large positive return at the turn of the year arises due to price pressure from predictable: seasonal changes in the demand for different securities.
[20] This hypothesis states that the large positive returns in January observed among small firms compensate for the increased risk of trading against informed traders.

(3.4) and (3.5) present the data and methodology. Section (3.6) discusses the results while Section 7 presents the conclusions.

4.2 Literature Review

The previous literature in calendar anomalies has focused on returns (and volumes) i.e. whether returns (and volumes) vary by month of the year or day of the week. This section reviews the literature which identifies whether these anomalies exist and/or tries to explain their existence. More specifically, Section (4.2.1) reviews the literature which identify whether day of the week anomalies exist and/or tries to explain their existence, whereas Section (4.2.2) reviews the literature which identifies whether month of the year anomalies exist and/or tries to explain their existence. Section (4.2.3) reviews the existence literature of calendar anomalies in trading volume which aims of explaining stock returns anomalies. This literature will help us, later, setting our hypotheses in section (4.3).

4.2.1 Day of the Week Effects in Returns

The day of the week anomaly (known as Monday effect) refers to the tendency of stocks to exhibit relatively negative returns on Mondays compared to other days of the week. This section reviews the studies which identified the existence of the day of the week anomalies and/or studies which try to explain their existence.

When examining US markets, Cross (1973), French (1980), Gibbons and Hess (1981), Keim and Stambaugh (1984), Lakonishok and Smidt (1988), Bessembinder and Hertzel(1993) and Siegel (1998) reported significantly negative mean return on Mondays and high mean returns at the end of the week (Friday).

Using data collected from the US, Canada, and the UK stock markets, Jaffe and Westerfield (1985 a, b) reported negative returns on Mondays, whereas the data collected from Japanese and Australian stock markets showed negative returns on Tuesdays. In Paris Stock Exchange, Solnik and Bousquer (1990) reported similar strong and negative returns on Tuesday. Agrawal and Tandon

(1994) examined the seasonality patterns in stock returns considering eighteen countries other than the US such as Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Singapore, Sweden, Switzerland, and the UK and found lower (or negative) mean returns on Mondays and Tuesdays and higher (and positive) returns from Wednesdays to Fridays in almost all of these countries. Additionally, Arsad and Coutts (1997), Mehdian and Perry (2001), Gregoriou, Kontonikas and Tsitsianis, (2004), and Linton (2006) examined the day of the week effect in the UK and found negative Monday returns.

Also, when examining emerging markets, Aggarwal and Rivoli (1989) and Wong et al., (1992) noticed lower mean stock returns on Mondays and Tuesdays in Hong Kong, Singapore, Malaysia, Thailand and the Philippines. Balaban (1995, 1996) and Dicle and Hassan (2007) found that the lowest, and negative, mean returns were on Tuesdays, and the highest returns and the lowest standard deviations were on Fridays in Turkish stock market. Martikainen and Puttonen (1996) reported negative and statistically significant average return on Tuesdays and Wednesdays in Finnish stock market. This pattern was repeated in studies by Goswami and Anshuman (2000), Kumari and Mahendra (2006), Elango and Al Macki (2008) and Hussain et al. (2011) for Indian Stock Exchange, whereas Lian and Chen (2004) and Ajayi et al. (2004) analysed the calendar behaviour of Vietnamese, Estonia and Lithuania stock market respectively and confirmed the same pattern (i.e. negative average returns on Tuesday).

These studies, however, contradicted the presence of Day of the Week anomalies in stock market returns.

Another strand of literature tried to explain these seasonal patterns by examining various hypotheses such as calendar time hypothesis, trading time hypothesis, and time zone hypothesis. According to calendar time hypothesis, Monday's average return is three times higher than other days' average returns. This is because Monday's average return is estimated from the closing price on Friday until the closing price on Monday. (French, 1980). On the other hand, Trading Time Hypothesis states that all days average return (Monday through Friday) should be the same because each day's return represents one day's

investment (Draper and Paudyal) whereas Time Zone Hypothesis states that Tuesday's effect is due to time difference between US market and other markets (Jaffe and Westerfield, 1985; and Condoyanni, O'Hanlon, and Ward, 1987).

Other studies (e.g., Connolly, 1989; Sullivan, Timmerman, and White 2001; Hansen, Lunde and Nason, 2005) assumed that the day of the week effect might be a result of used methodology of estimation and testing. Investor's psychology is, as well, viewed as a cause of Day of the Week anomalies (Rystrom and Benson, 1989). Specifically, investors would be more likely to sell (buy)more stocks on Monday (Friday) if they felt pessimistic (optimistic) and, therefore, create downward (upward) pressure in prices. Similarly, Nath and Dalvi (2004) suggested that investors avoid trading against informed traders on Mondays who might have more information received during the weekend. Thus, investors would likely to buy less on Monday.

Based on these priors, one aim of this chapter is to examine the presence of Day of the Week effect in insider trading activities as measured by aggregate number and value of insiders' trades.

4.2.2 Month of the Year Effects in Returns

The month-of-the-year effect is a calendar anomaly according to which stock returns show a rise or fall during certain months as compared to the mean. These seasonal effects are modelled using time series data and tend to be repeated every calendar year. Month of the year is also called January effect; this is particularly due to the tendency of stocks to perform better in January compared to any other time of the year (Rozeff and Kenney, 1976). This section reviews the studies which identified the existence of the month of the year anomaly and/or studies which try to explain their existence.

Using different US indices, Rozeff and Kinney (1976), Lakonishok and Smidt (1988), Haugen and Jorion (1996), Mehdian and Perry (2002), Moosa (2007) and Sharma and Narayan (2011) found that the mean January return is higher

than mean return of other months. Similarly, but using UK data, Reinganum and Shapiro (1987), Arsad and Coutts (1997) and Hillier and Marshall (2002a) showed significantly positive returns in January for the entire period under examination and positive returns also in the months of April and December.

January effect is also conducted by Choudhry (2001) and Gu (2003) using data from the pre-World War I era for the US, UK, and Germany, Canada, France, and Japan.

The January effect has also been detected in many other countries, India (Pandey, 2002; Bodla and Jindal, 2006), Greece (Mills et al., 2000; Flores, 2008), Nepal (Bahadur and Joshi, 2005), Poland, Romania, Hungary and Slovakia (Asteriou and Kovetsos, 2006), and Argentina (Rossi, 2007).

Empirical literature on stock return anomalies provided many explanations to the turn of the year effect (the January effect). Among these explanations are tax loss selling, capital gains taxation, and new information release hypotheses.

Tax loss selling hypothesis is the most frequent explanation to the turn of the year anomalies. According to this hypothesis, investors, in order to avoid taxes on capital gains, realise capital losses to offset capital gains by selling losers stocks in December. This would cause high selling pressure in December which is relieved in January bringing about large capital gains for losers (Fountas and Segredakis, 2002; and Chen and Singal, 2004).

Another related explanation is called capital gains taxation hypothesis. This hypothesis states that if investors realise capital losses to offset capital gains, it is also possible to delay capital gains realisation, so that they can delay tax payment on capital gains. By doing so, investors might postpone tax payment by one year. Thus, investors would sell winners (shares) in January. Hence, the selling pressure in December would be small causing the price to rise.

Both of these hypotheses are based on tax purposes .i.e. investors, in order to avoid taxation, sell more in December or delay selling to January causing an increase in January returns.

Studies by Roll (1983), Reiganum (1983), Brown et al. (1983), Eakins and Sewll (1993), Johnston and Cox (1996) and Sharma and Narayan (2011) suggested that tax loss selling hypothesis is the main driver of high January

returns. These studies focused on small firms where price variation is high compared to other firm sizes (medium or large).

Additional evidence for the tax-loss hypothesis in countries such as UK and Australia with a tax year-end other than the end of December has been also provided by many studies. For example, Brown, Kleidon and Marsh, (1983) reported July effect in Australia following a June tax year end. Reinganum and Shapiro (1987), Arsad and Coutts (1997), Draper and Paudyal (1996), and Baker and Limmack (1998) reported April effect in UK following 5th of April tax year end for individuals. These studies concluded that January (and April) anomaly may be due in part to a tax-loss-selling hypothesis.

Constantinides (1984) and Chen and Singal (2004) suggested that rational investors should realise long-term capital gains to re-establish a short-term status to make short-term capital losses in the future. Moreover, investors should sell losers in December to realise capital losses and sell winners in December to re-establish a short-term status. Similarly, Poterba and Weisbenner (2001) examined whether January anomaly is driven by capital gains hypothesis. They found that the turn-of-the-year return is positively related to the difference between short-term and long-term capital gain tax rates.

Rozeff and Kinney (1976) and Chen (1988) provided another explanation to January anomalies which is the information release hypothesis. This hypothesis states that January effect is caused by the information released by the company at the end of the financial year. The release of information in 1st of January creates and then resolves uncertainty and lead to (temporary) risk. Penman (1987) hypothesised that firms release good news in the beginning of each quarter and delay the releasing of bad news until the second half of the quarter. Thus, if the market reacts automatically to the news, stocks should earn higher returns in the first few days of each quarter. Also, Brennan and Subrahmanyam (1995) suggested that stocks with high information suffer less compared to stocks with poor information.. That is to say, if the information hypothesis is true, the January effect should relate negatively to the number of analysts forecasts. Hence, the smaller the number of analysts' forecasts, the greater the January returns.

Based on these priors, another aim of this chapter is to examine the presence

of Month of the Year effect in insider trading activities as measured by aggregate number and value of insiders' trades.

4.2.3 Calendar Anomalies in Trading Volume

The purpose of this section is to review the literature on calendar anomalies in trading volume in order to provide a rationale to our research. Lakonishok and Maberly (1990) provided another reason for the negative Monday returns. They argued that the difference in trading patterns of individual and institutional investors[21] is one of the driving forces behind the negative Monday returns. They documented low trading volume on Monday for institutional investors and the opposite pattern for individual investors (.i.e. high trading volume on Monday). For buy and sell transactions, the increase in individuals activity on Mondays is not symmetric. Hence, individuals tend to sell more than to buy on Monday which, partially, might explain weekend effect. Osborne (1962) and Kamara (1997) predicted that, individual investors spend more time on financial decisions during the weekend, whereas institutional investors are less active in the market on Monday because Monday tends to be a day of strategic planning. Therefore, individual investors are relatively more active in the market on Monday. Another reason why individual investors tend to sell more at the beginning of the week than to buy is that individual investors might decide to not engages in a buy transaction before his or her sell transactions are executed. Similarly, Abraham and Ikenberry (1994) studied the trading patterns of individual investors and supported the results of Lakonishok and Maberly (1990) that individual investors tend to sell more on Mondays. Based on the hypothesis that private information is received throughout the week while public information is received only on working days, informed trader might have more information on Monday than on other days of the week (Sias and Starks, 1995). Hence, more informed trading would occur on Monday than on other days of the week leading liquidity trades to avoid Mondays.

[21] This study differentiates between institutional and individual investors based on trade size. Moreover, large stocks are mostly be held by institutional investors, whereas small stocks are likely to be held by individual investors.

Furthermore, without public information, informed traders carry information from Monday to other days, so that price sensitivity is the same each day (to the order flow). The presence of public information reduces the effects of private information. Thus, more information is released through trading early in the week (Monday) because price sensitivity to the order flow would be low. In the presence of liquidity traders, the concentration of the trading is going to be on two days each week (Monday and Friday)[22]. In this case, the trading volume by liquidity and informed traders might form a U-Shape. The U-Shape in intraday and interday trading volume patterns was previously found by Foster and Viswanathan (1990), Jain and Joh (1986), and Admati and Pfleiderer (1988). These studies showed high trading volume on Monday and Friday (Foster and Viswanathan, 1990) and in the first and the last hours of the trading day (Admati and Pfleiderer, 1988). Similarly, Blau, Van Ness and Van Ness, (2009) documented that the U-shaped pattern in intraday returns is caused by large trades because changeling in prices from larger (smaller) trades are higher (lower) at the beginning and end of the day. This is attributed to the fact that smaller trades, in periods of low volume, would move prices because informed traders do not want to reveal their information to the market. When volume is high, informed traders are able to increase the size of their trades because their information would be hidden by high volume.

Badhani (2006) analysed the intraweek trading patterns of Foreign Institutional Investors in India and found low buying and selling volumes on Tuesdays. This Tuesday-effect may be a reflection of Monday-effect on institutional investors trading activities documented in US.

Turning to monthly anomalies, the window dressing hypothesis offers another explanation of the January effect. According to this hypothesis which is developed by Haugen and Lakonishok (1987) and Lakonishok et al. (1991), institutional managers' performance and investment philosophy are used to evaluate them. To improve their performance, the institutions buy both risky and small stocks but sell them before the year ends. Therefore, their year-end holdings will not show these stocks. In January, investment managers replace winners, large, and low risk stocks with losers, small and risky stocks. Musto

[22] This is the case when there are high public information signals. When public information signals are poor, liquidity traders would concentrate their trading on Friday.

(1997) examined the window-dressing among money market instruments and found a January effect among those instruments that do not generate capital losses. He concluded that window-dressing activities of the institutional investors could explain the January effect at least partially. Similarly, Ritter and Chopra (1989) and Meier and Schaumburg (2004) provided supporting evidence for the window-dressing hypothesis. On the other hand, Sias and Starks (1997) evaluated the tax-loss-selling and the window-dressing hypotheses by looking at transaction data for stocks dominated by institutional investors versus those dominated by individual investors. Although they found that institutions tend to buy recent winners, which is consistent with the window-dressing hypothesis, they did not find any evidence of institutions selling losers, and their data did not show whether the winner buying institutions have year-end disclosures. Chen and Singal (2004) found no evidence for the window-dressing hypothesis by examining the stocks' return and volume patterns at the end of the semi-annual period (June-July) when tax-loss-selling is not expected.

Lower volume of sales tends to be associated with losers (stocks, the prices of which have decreased) on December because investors, by postponing their sales by a month or two, postpone payments of capital tax by a full year. On the other side, the volume of sales for winners stocks tends to be higher on December because investors would apply these losses against their taxable incomes soon as possible (Dyl, 1977 and Henderson, 1990). Lakonishock and Smidt (1986) assumed that there is a positive correlation between price and trading volume. Moreover, if the trading volume is affected by the degree of attention the company received, thus companies with large increase (decrease) in price might experience increase (decrease) in trading volume. Based on that, investors, who believe that price and trading volume are positively correlated, may be attracted by winners stocks and avoid losers ones.

Seyhun (1988b) tried to relate January effects with insider trading activities by examining two competing hypotheses; price pressure and risk premium hypotheses. More specifically, the increase in insiders buying activities in December as a response to January's positive returns would enable insiders to capture price increase in January. Hence, price pressure hypothesis assume insiders in small firms to be net buyers in December (the opposite pattern can

be observed for insiders in large firms). On the other hand, risk premium hypothesis assume high buying or selling activities by insiders in january. However, the results showed that insiders buy more and delay selling shares in December to benefit from price running up in January. In contrast to the US studies, Hillier and Marshall (2002a) examined the January effect in the UK listed securities and found that it was significant but not persistent through the time. Moreover, the results showed that seasonalities in insider trading were not the main determinant of the turn of the year effect.

4.2.4 Summary of the Literature

To summarise, previous empirical literature in stock returns anomalies supports the existence of the day of the week effect i.e. negative returns in the beginning of the week and high returns at the end of the week. These anomalies might be driven by the methodology employed or the way of calculating returns, investor psychology, the difference in trading patterns of individual and institutional investors, or settlement procedures. Also, the literature on trading volume suggests that Monday's trading volume is higher compared to other days of the week. More specifically, investors sell more on Monday if they are individual investors and sell less if they are institutional investors. This is perhaps due to the private information hypothesis and the behaviour of individual and institutional investors. Similarly, previous empirical literature in stock returns anomalies supports the existence of the month of the year effect i.e. high returns on January. These anomalies might be driven by the tax loss selling hypothesis, window dressing hypothesis, or new information provided by the firms at the end of the financial year. Also, the turn of the year effect might be due to director trading activities as measured by the aggregate number of directors' trades (Seyhun, 1988b, and Hillier and Marshall, 2002a).

The first aim of this chapter is to specially test for seasonal patterns in aggregate insider trading transactions (as measured by the aggregate insider number of trades and the aggregate value of insider transactions). Specifically, do insiders prefer to trade on any particular day of the week or month of the year? Secondly, given that such seasonal patterns exist, we are going to attempt

to relate these patterns to explanations drawn from the literature on calendar anomalies in returns (and trading volume).

4.3 Hypotheses

The previous literature on the day of the week and month of the year anomalies in stock returns has attempted to identify whether these anomalies exists and/or to try to explain their existence. We examine the existence of the day of the week and month of the year anomalies in aggregate director trading activities as measured by the aggregate number and value of insider transactions. We commence by examining whether insiders have more preference for trading in any particular day of the week. In other words, we test the following hypothesis;

Hypothesis (1): There is no day of the week effect in aggregate insider activities as measured by the aggregate number and value of directors' trades

Sias and Starks (1995) suggested that more informed investors tend to trade on Mondays than other days of the week because private information is available all days of the week including weekends while public information are only available on working days. Given that insider trading literature is ambiguous and suggests that informed trades are likely to be buy trades, we might expect;

Hypothesis (2): The aggregate volume of directors' buy (sell) trades is higher (lower) on Monday than on other days of the week.

Focusing on the turn of the month, we first examine simple whether directors have preferences to trade at any particular month of the year. Therefore;

Hypothesis (3): There is no month of the year effect in aggregate insider activities as measured by the aggregate number and value of directors' trades

In the UK, the tax year for the firms corresponds to the calendar year, whereas the tax year for the individuals ends at 5th of April. The tax loss selling literature, which is often used as an explanation for the turn of the year anomaly, suggests that firms and individuals sell more in the month before the

end of the year and buy more after[23] (Seyhun, 1988b; Hillier and Marshal, 2002a; and Chen, Jack and Woods, 2007). Thus, our fourth hypothesis is:

Hypothesis (4): Directors tend to sell more in March and buy more in April compared to other months of the year

4.4 Data

This study is based on data collected between January 1991 and December 2010 by two different data sources,

1) Directus Ltd compiled a complete record of director's trades in the United Kingdom (1991-2001).

2) Directors Deals, which monitors and analyses share transactions made by directors in their own companies (sometimes known as Insider Deals).

The original dataset provides information on various transaction types, but we removed trades[24] other than open market purchases and sales of ordinary shares by directors. Open market sales and purchases are more likely to represent actions taken because of special insider information (Seyhun, 1988a; Gregory et al., 1994; and Friederich et al., 2002).
This period yields a sample of 91,970 trades for every publicly disclosed transaction by UK directors in their own firms.

4.5 Methodology

This study uses daily values (and numbers) of directors' trades from 1 January 1991 to 31 December 2010. Using daily data allows us to examine the relationship between the changes of trades' value (number of trades) from one

[23] Tax loss selling hypothesis states that investors sell stocks that have declined in value in December/March (one month before the taxation date) to realise capital loss and offset it against capital gain tax. In January, the stocks that have been sold would recover resulting high returns in January/April.
[24] We removed trades such as option exercise, derivative, script dividends or bonus shares, rights issue, awards made to directors under Incentive plans or reinvestment plans, gifts, transfers and purchase, and sales of shares under personal equity plans, operations derived from tax or "bed & breakfast"

trading day to the other. In order to avoid possible bias of missing information due to public holidays, five observations per week were used.

The linear regression model and the ordinary least squares-method (OLS) were employed. Brooks (2002) suggested several assumptions for the classical linear regression model. They included for example homoscedasticity of the residuals and zero autocorrelation among residuals. We decided to use the OLS method because it has been used largely in anomalies testing. For example, Gibbons and Hess (1981) and Ajayi, Mehdian and Perry, (2004) used this method while Brooks (2002) suggested that this is the basic method for studying calendar anomalies.
Classical assumptions are necessary for the OLS to be the best linear estimation method for the regression model.

Our sample contains transactions whose values are more than £15 million and transactions whose values are £1 or less. These transactions might (or might not) have an impact on our results. Thus, to examine whether these observations have an influence on regression estimates, we run the OLS regression and test for the heteroscedacity of residuals.
Formally, we used the following regression model;

$$Value_t = \beta_{Monday}D_{Monday} + \beta_{Tuesday}D_{Tuesday} + \beta_{Wednesday}D_{Wednesday} + \beta_{Thursday}D_{Thursday} + \beta_{Friday}D_{Friday} + e_t \quad (4.1)$$

$Value_t$ = insider aggregate value on day t;
$D_{Tuesday}$= dummy variable equal to 1 if t is a Tuesday and 0 otherwise,
$D_{Wednesday}$ = dummy variable equal to 1 if t is a Wednesday and 0 otherwise,
$D_{Thursday}$ = dummy variable equal to 1 if t is a Thursday and 0 otherwise,
D_{Friday} = dummy variable equal to 1 if t is a Friday and 0 otherwise,
e_t= Error term
Table (4.1) shows the results of the regression models of whether aggregate value of directors' trades as a whole (buy and sell combined) varies across days of the week. The results indicate high average value for directors' trades as well as a significant t-statistics. When testing for heteroscedacity, the results show that the variance is not constant and the model perhaps needs to be adjusted.

Table 4.1: Day of the Week Effects: the Results of the Dummy Variable Regression of Directors' Trades (Buys and Sales Combined)

value	Coefficients	Standard Errors	t-statistics
Monday	6,310,110	1,233,764	5.11
Tuesday	7,064,410	1,179,178	5.99
Wednesday	4,707,077	1,173,995	4.01
Thursday	5,271,727	1,172,853	4.49
Friday	5,695,275	1,189,754	4.79
Heteroscedacity Test		0.000	

Diagrammatically, figure (4.1) shows the distribution of directors' aggregate value of trade across days of the week. This figure shows that some trades in Monday and Tuesday are extremely high in value which might bias our results.

Figure 4.1: The Distribution of Insiders' Aggregate value across Days of the Week

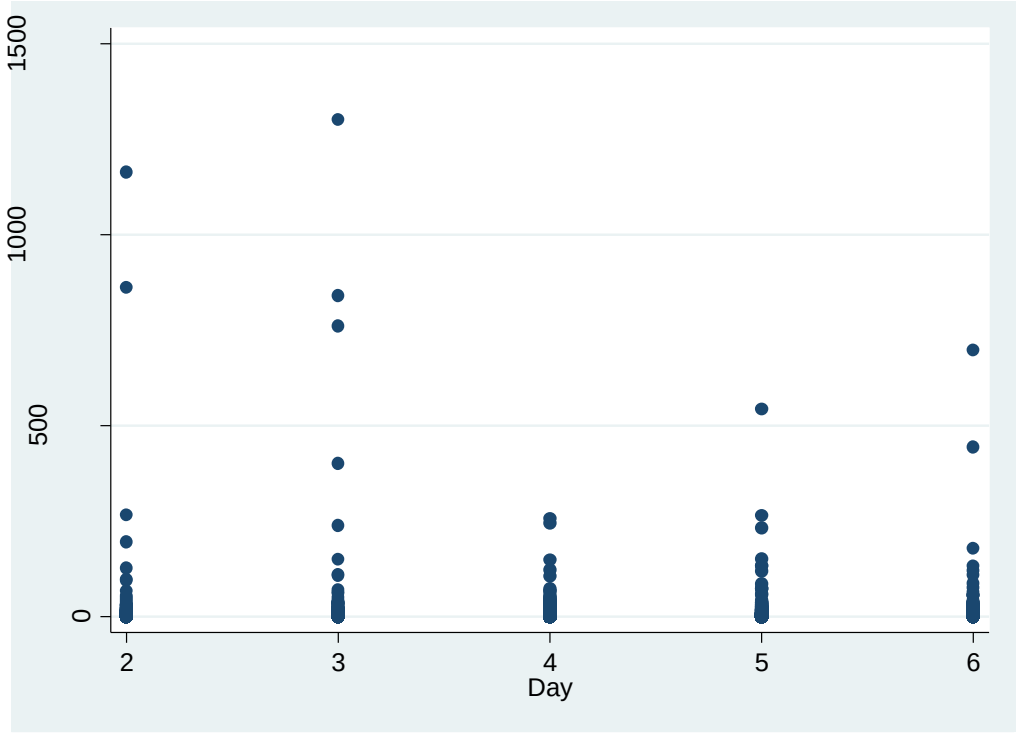
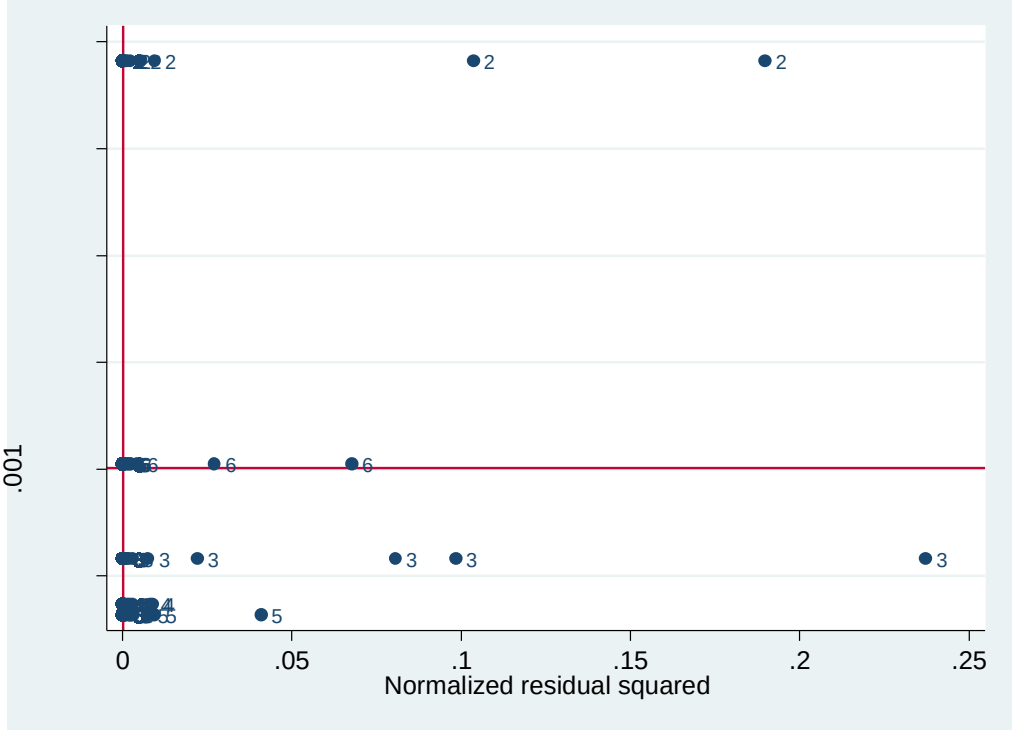


Figure (4.2) plots regression residuals against regression leverage[25]. This figure shows that some observations have high residuals, some observations have high leverage and some of them have the both. For example, there are many trades on Tuesday which have high residuals and high leverage (see the

[25] Leverage is a measure of how far an independent variable deviates from its mean.

upper right observation). Another example is an observation on the bottom right with high residual, but low leverage.

Figure 4.2: Regression Residuals and Leverages



Therefore, to avoid the bias that might occur because of these transactions, we are going to:

1) Re-run the OLS model by using the logarithm value instead of the total value (as a dependent variable) to reduce the effects of these transactions on our results. This method was previously used by Nghiem et al., (2012).
2) Re-run the OLS model after excluding transactions whose values are more than £15 million. In this case, the total value of directors' trades is the dependent variable ; and
3) Re-run a TOBIT regression model which is a censored form of OLS model normally used when the sample is biased to the left or to the right. This model would automatically eliminate the values that might cause biases to the results[26]. This step is similar to the previous one except that it would exclude transactions with small values. Thus, the results for the last two methods, sometimes,

[26] In the cases where the values are not biased to the left or to the right, the results are similar to those calculated using OLS model.

might be the same or might have small differences. Sometimes TOBIT Regression Model is considered as a Robust Regression Model to control for Heteroscedacity and normality problems.

However, the methodology used in this chapter is to test whether there is a day of the week or month of the year anomalies in aggregate directors' trades as measured by the aggregate value (and number) of insider transactions [hypotheses (1) and (3)], whether directors' buy volume on Monday is higher compared to other days of the week [hypothesis (2)] and whether directors sell more in March and December [hypothesis (4)] by estimating the following regression models:

$$Value_t = \beta_{Monday}D_{Monday} + \beta_{Tuesday}D_{Tuesday} + \beta_{Wednesday}D_{Wednesday} + \beta_{Thursday}D_{Thursday} + \beta_{Friday}D_{Friday} + e_t \quad (4.2)$$

$$Number\ of\ trades_{t=} \beta_{Monday}D_{Monday} + \beta_{Tuesday}D_{Tuesday} + \beta_{Wednesday}D_{Wednesday} + \beta_{Thursday}D_{Thursday} + \beta_{Friday}D_{Friday} + e_t \quad (4.3)$$

Where,

$Value_t$ = the logarithm of insider aggregate value (or the total value of directors' trades) on day t;

$Number\ of\ trades_t$ = Insider aggregate number of trades on day t;

To test the linear combination of coefficients of the OLS model, we conducted an F-test. The null hypothesis is that all the coefficients in the regression model are the same

$$H_0 : \beta_{Monday} = \beta_{Tuesday} = \beta_{Wednesday} = \beta_{Thursday} = \beta_{Friday}$$

against the alternative hypothesis that at least one of the coefficients is not equal.

Similarly, to test the monthly patterns, we construct almost an identical model. This model has been used by, for instance, Mehdian and Perry (2001). Therefore, we employ the following regression:

$$Value_t = \beta_{January}D_{January} + \beta_{Febuary}D_{Febuary} + \beta_{March}D_{March} + \cdots + \beta_{November}D_{November} + \beta_{December}D_{December} + e_t \quad (4.4)$$

$$No\ of\ Trades_t = \beta_{January}D_{January} + \beta_{Febuary}D_{Febuary} + \beta_{March}D_{March} + \cdots + \beta_{November}D_{November} + \beta_{December}D_{December} + e_t \quad (4.5)$$

where Value_t is the logarithm of the aggregate value of directors' trades (or the total value of directors' trades). $D_{January}$ through $D_{December}$ are dummy variables for each month of the year, such that $D_{January}$ takes a value of 1 for all January observations and zero otherwise, and so on. e_t is the disturbance term. Again, we can consider our null hypothesis as follows:

$$H_0: \beta_{January} = \beta_{Febuary} = \beta_{Wednesday} = \beta_{March} = \cdots = \beta_{December}$$

Our purpose here is to examine whether the aggregate value (and number) of directors' trades is statistically different on a particular month compared to other months of the year. The alternative to the null hypothesis would indicate statistically significant monthly seasonality.

Similar to previous studies in colander anomalies such as Chukwuogor-Ndu (2006), Lim (2010), Högholm et al., (2011) and Khan et al., (2013), we used Kruskal–Wallis one way analysis of variance by ranks which is a non-parametric method To test equality of means across groups and Kruskal–Wallis test assumes that the residuals are not necessary to be normally distributed.

The Kruskal Wallis test statistic is:

$$H = \frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(n+1) \quad (4.6)$$

Where R is the sum of the ranks for group i.

The null hypothesis is that the average values (numbers) of directors' trades across all the trading days are equal. If the Kruskal-Wallis statistic is less than the critical chi value, it implies that the null hypothesis should not be rejected, and that average values (number) of directors' trades across the week-days are not significantly different from each other.

4.6 Results

This section reports the empirical results of the study. First, summary statistics is resented to highlight the trends and patterns of UK directors' trades. Second, we test the hypotheses whether directors' aggregate value (and number) of trades are significantly different across days of the week or months of the year using the dummy variable regression and K-W statistic test, which was discussed earlier in the methodology section.

4.6.1 Summary Statistics

Table (4.2) presents summary statistics categorised by transaction type (buys and sales only) during the sample period. The sample includes 91,970 trades divided into 69,967 buy trades and 22,003 sale ones over the period 1991 to 2010, with a total monetary value of £28.9 billion. There are approximately three times as many buy trades as sells. Although buy trades are more frequent than sell trades, the average value of sell trades is approximately seven times larger, which suggests that directors sell less frequently but in larger monetary amounts (a similar argument can be said to volume). The average value of directors' purchases was £122,184, but the average value of sales was £928,788, so directors' sales are fewer in number but much larger in value.

The last column of table (4.2) shows the number of days during the period in which at least one buy (sell) takes place. There are approximately 4,979 event dates (99.5% of sample days) for buy trades and 4,583 event dates (91.6% of sample days) for sell trades. During our sample period, there are trades of on average of thirteen buy trades (five sell trades) per event date.

Table 4.2: Summary Statistics Categorised by Transaction Type

1991-2010

Type	No of Trades	Total Value (£)	Total Volume	Average Value £	Average Volume	No of Days
BUY	69,967	8,548,845,389	8,615,507,651	122,184	123,137	4979
SELL	22,003	20,436,128,362	11,044,602,967	928,788	501,959	4583
Total	91,970	28,984,973,750	19,660,110,618			

Average value of buy (sell) trades is the total value of buy (sell) trades divided by the total number of buy (sell) trades. Volume of buy (sell) trades presents the total number of shares that directors buy (sell).

Average volume of buy (sell) trades the volume of buy (sell) trades divided by the total number of buy (sell) trades.

Table (4.3) reports summary statistics related to our sample categorised by both days and transaction type during the sample period. There are more buy trades than sell trades in all days. The majority of buys and sales occurred on Fridays. Buys and sales on Mondays are much less frequent. Although it is not shown in table (4.3) directly, the number of buy trades by day is approximately three times the total number of sell trades per day. The average value (per day) of directors' buy transactions (and sell transactions) on Mondays (and Tuesday) is the highest whereas the average value (per trade) of directors' buy transactions (and sell transactions) on Mondays (Tuesdays) is the highest.

Table 4.3: Summary Statistics of Daily Directors' Buys and Sells over the Period 1991-2010

Days	Directors' Buy Trades			Directors' Sell Trades		
	No of Trades	Average Value per Day (£)	Average Value per Trade (£)	No of Trades	Average Value per Day (£)	Average Value per Trade (£)
Monday	12,750	3,086,676	223,693	4,091	3,524,595	735,762
Tuesday	13,715	2,192,718	161,956	4,327	5,406,626	1,147,049
Wednesday	14,274	878,470	62,774	4,555	4,180,045	863,539
Thursday	14,508	935,616	66,037	4,397	4,720,915	1,014,616
Friday	14,720	1,626,303	110,151	4,633	4,402,765	878,082

Average value per day is the total value of the trade (buy or sell) divided by the number of days. For example, the average value of buy trades on Mondays is equal to the total value of buy trades on that day divided by the number of Mondays in our sample. Average value per trade is equal to the total value of the trade (buy or sell) on a specific day divided by the number of trades on that day. The same thing can be said for the average volume per day and per trade.

Table (4.4) reports summary statistics related to our sample categorised by both months and transaction type during the sample period. There are more buy trades than sell trades in all months. The majority of buys and sales occurred in March. Buys and sales on February and August respectively are much less frequent.

Although it is not shown directly in table (4.3), the number of buy trades by month is approximately three times the total number of sell trades per month. The average value (per month) of directors' buy transactions (and sell transactions) in April (and June) is the highest whereas the average value (per trade) of directors' buy transactions (and sell transactions) on May (October) is the highest.

Table 4.4: Summary Statistics of Monthly Directors' Buys and Sells over the Period 1991-2010

Months	Directors' Buy Trades			Directors' Sell Trades		
	No of Trades	Average Value per Month (£)	Average Value per Trade (£)	No of Trades	Average Value per Month (£)	Average Value per Trade (£)
January	5,155	14,900,000	57,841	1,676	47,600,000	568,458
February	4,099	21,900,000	106,757	1,625	48,900,000	602,434
March	7,109	27,800,000	78,290	2,907	114,000,000	781,381
April	6,003	72,500,000	241,460	2,911	74,900,000	514,875
May	5,254	66,500,000	253,197	1,841	66,100,000	717,934
June	6,345	20,700,000	65,392	1,974	139,000,000	1,411,424
July	6,301	51,500,000	163,555	1,508	93,300,000	1,237,655
August	4,659	49,100,000	210,744	1,198	44,500,000	743,339
September	6,941	22,100,000	63,701	1,796	106,000,000	1,179,106
October	6,437	17,000,000	52,673	1,430	119,000,000	1,664,113
November	5,439	19,100,000	70,065	1,415	88,200,000	1,246,490
December	6,225	44,400,000	142,508	1,722	80,400,000	933,944

Average value per month is the total value of the trade (buy or sell) divided by the number of months. For example, the average value of buy trades on January is equal to the total value of buy trades on that month divided by the number of January in our sample. Average value per trade is equal to the total value of the trade (buy or sell) on a specific month divided by the number of trades on that month. The same thing can be said for the average volume per day and per trade.

4.6.2 Day of the week effect

The previous literature on calendar anomalies has been on returns. This literature has attempted to simply identify whether these anomalies exists and/or to try to explain their existence. For example, Cross (1973), French (1980), Arsad and Coutts (1997), and Gregoriou, Kontonikas and Tsitsianis (2004) reported negative returns on Monday, whereas Solnik and Bousquer (1990) indicated strong and negative returns on Tuesday. Also, studies such as Agrawal and Tandon (1994) and Balaban (1995, 1996) reported positive returns on Friday. These anomalies are perhaps due to the methodology employed or the way of calculating returns, investor psychology, the difference in trading patterns of individual and institutional investors, or settlement procedures.

Lakonishok and Maberly (1990), Abraham and Ikenberry (1994) and Sias and Starks (1995) found low trading volume on Monday for institutional investors and the opposite pattern for individual investors (i.e. high trading volume on Monday). They reasoned that individual investors have more time to devote to financial decisions during the weekend, whereas institutional investors are less active in the market on Monday because Monday tends to be a day of strategic planning. Also, Sias and Starks (1995) found that informed investors tend to trade more on Mondays because private information is available all days of the week including weekends.

Based on these priors, this section examines the seasonal patterns in aggregate insider trading transactions (as measured by the aggregate insider number and value of insider transactions). Specifically, do insiders prefer to trade on any particular day of the week [hypothesis (1) and hypothesis (2)]? Given that such seasonal patterns exist, we attempt to relate these patterns to explanations drawn from the literature on calendar anomalies.

We use the regression model discussed earlier in the methodology section (*Equations 4.2, and 4.3)* where the dependent variable is the logarithm value (or the total value of directors' trades) and the aggregate number of directors' trades, whilst the independent variables are dummy variables which present days of the week.

Beside examining the day effects on directors' trades as a whole, we deliberately chose to split our sample into directors' buys and sells in order to examine hypothesis (2) which indicates that trading volume of directors' buys on Mondays are higher relative to other days of the week. .

Tables (4.5), (4.6), and (4.7) show the results of the different regressions on the aggregate value (and number) of directors' trades during the sample period. More specifically, table (4.5) shows the results of the regression models of whether aggregate value (and number) of directors' trades as a whole (buy and sell combined) varies across days of the week, table (4.6) shows the results of the regression models of whether aggregate value (and number) of directors' buys varies across days of the week, and table (4.7) shows the results of the regression models of whether aggregate value (number) of directors' sells varies across days of the week.

One clear pattern emerges from table (4.4) where, for the period 1991-2010, director trading value is the lowest on Tuesday relative to other days of the week. The null hypothesis that director trading value is the same across all days of the week can be rejected at the five per cent level (based on an F-test). In addition, director trading value appears to be slightly higher on Friday. A comparison of Tuesday versus other days indicates a tendency for Tuesday to become less active. Excluding Tuesday, the null hypothesis that the trading value is the same can be accepted. These results are repeated after excluding trades with more than £15 million and also after using TOBIT Model. Moreover, the average value of Tuesday trades is £2.52 which is approximately 15% less than the average value of Friday and Monday trades.

Similarly, Tuesday's (Friday's) average number of directors' trades is the lowest (the highest) relative to the other remaining four days. The results of the F-test confirm the latter. These results support *Hypothesis (1),* which states that there is no difference in aggregate director trading activities as measured by the aggregate number and value of directors' trades across days of the week. The results show that Tuesday's number of trades (and value) is less frequent, whereas Friday's number of trades (and value) is more frequent. In other words, *Hypothesis (1)* is rejected for director aggregate value and number of directors' trades. Another pattern emerges from the results of OLS after excluding large trades, and from the TOBIT regression model; the pattern is that the distribution of the average value of directors' trades across the week days forms a U shape i.e. high trading value on the beginning of the week (Monday) and the end of the week (Friday).

Table 4.5: Day of the Week Effects: the Results of the Dummy Variable Regression of Directors' Trades (Buys and Sales Combined)

Day	OLS Model (logarithm Values)		OLS Model (Total Values Excluding Outliers)		TOBIT Model (Total Values)		Number of trades	
	Coefficient	t-test	Coefficient (Millions)	t-test	Coefficient (Millions)	t-test	Coefficient.	t-test
Monday	14.08	277.41	3.002	21.51	3.003	22.21	18.13	49.98
Tuesday	13.99	288.39	2.527	18.94	2.527	18.94	17.74	51.17
Wednesday	14.10	292.13	2.700	20.33	2.700	20.33	18.35	53.17
Thursday	14.12	292.67	2.934	22.11	2.934	22.11	18.39	53.33
Friday	14.22	290.59	3.039	22.57	3.036	22.55	19.37	55.38
Heteroscedacity Test	0.25		7.59				0.00	
	(0.6167)		(0.1077)				(0.9694)	
$\beta_{Monday} = \beta_{Tuesday} = \beta_{Wednesday} = \beta_{Thursday} = \beta_{Friday}$	2.96		2.65		2.65		2.98	
(F-test)	0.0187		0.0313		0.0313		0.018	

The results of OLS Model excluding trades whose values are more than £15 million are similar to those obtained using TOBIT Model except for Friday. This is because TOBIT Regression Model excludes small trades in addition to the large ones. The results of F-test in the last row represent the test of the hypothesis whether the coefficients are statistically different from each other and not whether the coefficients jointly different from zero. The F-test, for example, for testing the hypothesis whether the coefficients are jointly different from zero is 2.96 (0.0187) for the first regression. The Heteroscedacity test shows that the variance is constant.

To summarise, there seems to be a day of the week anomaly in aggregate insider transactions as measured by the aggregate value and number of insider transactions. More specifically, lower Tuesday and higher Friday trades. Therefore, insiders have a preference to trade more on Friday and less on Tuesday. The aggregate value of director transactions, which is higher on Friday and lower on Tuesday, is consistent with the previous studies such as Agrawal and Tandon (1994) and Balaban (1995, 1996) which reported positive returns on Friday and negative returns on Tuesdays.

Previous studies on trading volume anomalies found that informed investors tend to trade more on Mondays because private information is available all days of the week including weekends, whereas other studies indicates Tuesday effect in trading volume in other markets rather than US and reasoned that as a reflection of trades by informed investors on Monday. On the other side, studies by lakonishok and Maberly (1990), Abraham and Ikenberry (1994) and Chan et al. (2004) suggested that individual investors sell more (buy less) on Monday because they have more time to think about their decisions during the weekends. Our results find Friday and Tuesday effects in average number of directors' trades which reflects the desire for insiders to trade more on Friday and less on Tuesday. One possible explanation, based on the previous studies, is that insiders act like institutional investors who trade less on Tuesday as a reflection of insiders' trades on Monday in US. Also, bearing in mind that the aim of the previous studies in trading volume anomalies is to explain the calendar anomalies in stock returns, our results were consistent with studies on stock returns anomalies that show high returns on Friday and lower returns on Tuesdays. Therefore, these results might explain the seasonal pattern in stock returns.

The U shape pattern (in average value of directors' trades) observed when running OLS (excluding trades over £15 million) and TOBIT model can be attributed to price changes from larger(smaller) trades which are higher (lower) at the beginning and end of the day[27]. This is attributed to the view that smaller trades would move prices during periods of low volume because informed traders do not want to reveal their information to the market. When volume is

[27] In our case, to price changes from larger (smaller) trades are higher (lower) in the beginning and at the end of week.

low, informed traders are able to increase their trade sizes because high volume hides their information (Blau et al., 2012).

Directors' buys

Table (4.6) reports the results of the regression models on daily aggregate value (number) of directors' buys during the sample period. One clear pattern emerges from Table (4.5) is that the coefficient of Friday is higher than the coefficients of other days of the week, whereas the coefficient of Tuesday is the lowest compared to other days' coefficients. The null hypothesis that the director trading value is the same across all days of the week cannot be rejected at the five per cent level (based on an F-test). Again, the results of OLS Model (after excluding outliers) and TOBIT Model confirm the previous findings that there is no day of the week anomaly in aggregate value of directors' buy transactions.

Table (4.6) also shows that the average number of directors' trades is lowest on Tuesday relative to other days of the week. The null hypothesis that the average number of directors' trades is the same across all days of the week can be rejected at the five per cent level (based on an F-test). In addition, the average number of directors' trades appears to be slightly higher on Friday. A comparison of Tuesday versus other days indicates a tendency for Tuesday to become less active and tendency for Friday to be more active.

These results fail to support *Hypothesis (1)* since they indicate no day of the week effect in aggregate directors' trading value. The results also show that Tuesday's number of trades is less frequent, whereas Friday's number of trades is more frequent. In other words, *Hypothesis (1)* is rejected for director aggregate number of directors' trades, but it isaccepted for directors' aggregate value.

Hypothesis (2) states that buy trading volume is higher on Monday compared to other days of the week. Our results show that Friday's average number of trades is higher (and Tuesday average number of trades is lower) compared to other days of the week. Hence, we rejected hypothesis (2). Thus, the buy trading volume on Friday is higher than other days of the week. Again, the distribution of the average value of directors' buy trades across the week days forms a U shape i.e. high trading value on the beginning of the week (Monday) and the end of the week (Friday).

Table 4.6: Day of the Week Effects: the Results of the Dummy Variable Regression of Directors' Buys

Day	OLS Model (logarithm Values)		OLS Model (Total Values Excluding Outliers)		TOBIT Model (Total Values)		Number of Trades	
	Coefficient	t-test	Coefficient (Millions)	t-test	Coefficient (Millions)	t-test	Coefficient	t-test
Monday	12.66	240.83	0.824	17.99	0.819	17.83	13.72	43.98
Tuesday	12.58	250.46	0.697	15.92	0.693	16.12	13.49	45.21
Wednesday	12.64	252.78	0.731	16.76	0.725	16.59	13.91	46.85
Thursday	12.65	253.06	0.770	17.68	0.767	17.55	14.11	47.57
Friday	12.77	251.86	0.794	17.97	0.792	17.88	14.73	48.96
Heteroscedacity Test	0.14		2.63				2.36	
	(0.7130)		(0.6219)				(0.1248)	
$\beta_{Monday} = \beta_{Tuesday} = \beta_{Wednesday} = \beta_{Thursday} = \beta_{Friday}$	1.69		1.28		1.31		2.36	
(F-test)	0.1484		0.2757		0.2649		0.0514	

The results of F-test in the last row represent the test of the hypothesis whether the coefficients are statistically different from each other and not whether the coefficients jointly different from zero.

To summarise, it looks like there is no day of the week anomaly in aggregate value of directors' trades. Also, the aggregate number of directors' trades is higher on Friday and lower on Tuesday which indicates the existence of the day of the week effect in insider aggregate number of trades. This reflects the desire of directors to trade more on Friday (and less on Tuesday).

Directors' sells

Table (4.7) reports the results of the regression models on the aggregate value (number) of directors' sells during the sample period. One clear pattern emerges from table (4.7) is that the coefficient of Friday is higher than the coefficients of other days of the week, whereas the coefficient of Tuesday is the lowest compared to other days' coefficients. The null hypothesis that the director trading value is the same across all days of the week cannot be rejected at the five per cent level (based on an F-test). These results are again repeated after excluding trades with more than £15 and also after using TOBIT Model. Moreover, the average value of Tuesday sells is £1.55 which is approximately 20% less than the average value of Friday and Monday trades.

In the same vein, it appears that there is no day of the week effect in director trading selling activities as measured by the aggregate number of directors' sell trades. Back to *Hypothesis (1),* the results indicate no day of the week effect in aggregate directors' trading value and number. In other words, *Hypothesis (1)* is accepted for directors' aggregate value, number and volume. Given that there is no day of the week anomaly in director trading volume, *Hypothesis (2)* is also rejected.

Table 4.7: Day of the Week Effects: the Results of the Dummy Variable Regression of Directors' Sells

Day	OLS Model (logarithm Values)		OLS Model (Total Values Excluding Outliers)		TOBIT Model (Total Values)		Number of Trades	
	Coefficients	t-test	Coefficients (Millions)	t-test	Coefficients (Millions)	t-test	Coefficients	t-test
Monday	12.36	95.65	2.177	17.08	1.962	14.7	4.40	32.92
Tuesday	12.14	98.36	1.830	15.02	1.559	11.89	4.25	33.28
Wednesday	12.40	100.87	1.969	16.23	1.737	13.34	4.44	34.88
Thursday	12.42	101.16	2.163	17.85	1.945	14.96	4.28	33.64
Friday	12.59	101.08	2.244	18.25	2.042	15.5	4.64	35.95
Heteroscedacity Test	0.03		5.53				0.02	
	(0.8549)		(0.2372)				(0.8938)	
$\boldsymbol{\beta_{Monday} = \beta_{Tuesday} = \beta_{Wednesday} = \beta_{Thursday} = \beta_{Friday}}$	1.29		1.97		2.26		0.4	
(F-test)	0.2732		0.0964		0.0599		0.7563	

The results of F-test in the last row represent the test of the hypothesis whether the coefficients are statistically different from each other and not whether the coefficients jointly different from zero.

To summarise, the aggregate value (number) of sale trades does not vary across days of the week. Instead, we can say that directors' trades, in general, on Tuesdays and Wednesdays are the lowest relative to other days of the week.

Summary of Day of the Week Anomalies Results

To summarise, the results show that there is no day of the week effects in aggregate value of directors' buys and sells, but it looks like there is a Tuesday effect in aggregate value of directors 'trades when buys and sells are combined together. An examination of the existence of Tuesday effects was previously conducted in stock returns (Agrawal and Tandon, 1994; Martikainen and Puttonen, 1996; and Brooks and Persand, 2001) and in trading volume (Badhani, 2006).

The distribution of the average value of directors' trades (buys and sells) across the week days forms a U shape i.e. high trading value on the beginning of the week (Monday) and the end of the week (Friday). The U shape pattern (in average value of directors' trades) is perhaps due to price changes from larger (smaller) trades which are higher (lower) at the beginning and end of the week. This is because smaller trades would move prices during periods of low volume because informed traders do not want to reveal their information to the market. When volume is low, informed traders are able to increase their trade sizes because high volume hides their information (Blau et al., 2012).

Also, the aggregate number of directors' trades (buy and sell combined and buy transactions) is higher on Friday and lower on Tuesday which means that there is a day of the week effect in insider aggregate number of trades. One possible explanation, based on the previous studies, is that insiders act like institutional investors who trade less on Tuesday as a reflection of insiders' trades on Monday in US. Taking into accounts that the aim of the previous studies in trading volume anomalies was to explain the calendar anomalies in stock returns, our results were consistent with studies on stock returns anomalies that show high returns on Friday and lower returns on Tuesdays. Therefore, these results might explain the seasonal pattern in stock returns.

4.6.3 Results of Monthly Patterns

The previous literature on calendar anomalies has focused on returns. This literature has attempted to simply identify whether these anomalies exists and/or to try to explain their existence. For example, Rozeff and Kinney (1976), Keim (1983), Mehdian and Perry (2002) and Gu (2006) found positive returns in January. The existence of this anomaly can be explained by a tax loss selling hypothesis, window dressing hypothesis, new information provided by the firms at the end of the financial year, or insider trading activities.

The volume of sales tends to be lower for losers stocks in December because investors, by postponing their sales by a month or two, postpone payments of capital tax by a full year, whereas the volume of sales for winners stocks in December because investors would apply these losses against their taxable incomes soon as possible (Dyl, 1977 and Henderson, 1990).

Seyhun (1988b) examined the monthly pattern of aggregate insider transactions in the US over the period 1975-1981, whereas Hillier and Marshall (2002) examined the January effect in UK securities. Both of these studies use the aggregate number of insider trades as their measure of insider trading activity, and both of these studies found that January returns are positive and significant[28].

Based on these previous findings, this section examines the seasonal patterns in aggregate insider trading transactions (as measured by the aggregate insider number and value of insider transactions). Specifically, do insiders prefer to trade on any particular month of the year [hypothesis (3)]? Given that such seasonal patterns exist, we attempt to relate these patterns to explanations drawn from the literature on calendar anomalies in returns (and volumes).

We use the regression model discussed earlier in the methodology section (*Equations 4.4, and 4.5)* where the dependent variable is the logarithm value (and volume) and the aggregate number of directors' trades, whilst the independent variables are dummy variables which represent months of the year. In addition to examining the monthly effects on directors' trades as a whole, we

[28] In case of Hillier and Marshall (2002), the January effect is not persistent over time.

deliberately chose to split our sample into directors' buys and sells in order to examine hypothesis (4).

I. Directors' Trades

Table (4.8) presents the results of the different regression models on monthly aggregate value (number) of directors' activities during the sample period.

One clear pattern emerges from table (4.8) which indicates that, for the period 1991-2010, director trading value in March is the highest relative to other months of the year. The null hypothesis that director trading value is the same across all months of the year can be accepted at the five per cent level (based on an F-test). In addition, director trading value appears to be slightly lower in February. A comparison of March versus other months indicates a tendency for March to become more active. The results of OLS Model (when excluding outliers) and the results of TOBIT Model show that March trading value is higher and significantly different from other months trading value. More specifically, the average value of directors' trades on March is £84 million which reflects the tendency for directors to trade more in March.

Table (4.8) also shows that the average number of directors' trades in March is the highest relative to other months of the year. The average trading number on March is 500 transactions, versus an average of 450 transactions for April. This implies a decrease of more than ten per cent in trading number in April. March's trading number is significantly different from the trading number of the remaining months. The null hypothesis that the average number of directors' trades is the same across all months of the year can be rejected at the five per cent level (based on an F-test).

Back to *Hypothesis (3),* which states that there is no month of the year effect in aggregate insider activities as measured by the aggregate number, value and volume of directors' *trades,* the results indicate no month of the year effect in aggregate directors' trading value when using logarithm value as a depended variable, but when excluding large trades and running TOBIT regression the results show March anomaly. The results also show that March's number of trades is higher.

To summarise, the average number of directors' trades varies across months of the year. More specifically, March trades' number is higher and significantly different compared to other months of the year. These results are also confirmed

for directors' aggregate value of trades when excluding trades with sterling value more than £15 million and when using the TOBIT regression model. Thus, directors prefer to trade more in March (either buy or sell).

In UK, April is the month of taxation. According to the tax-loss hypothesis, investors sell more in the month before the taxation and buy more after taxation. Therefore, these results might be due to directors selling more to avoid taxes. More details are given in the next two sections when examining directors' buys and sells separately.

Table 4.8: Monthly Effect: the Results of the Dummy Variable Regression on Directors' Trades

Month	OLS Model (logarithm Values)		OLS Model (Total Values Excluding Outliers)		TOBIT Model (Total Values)		Number of Trades	
	Coefficients	t-test	Coefficients (Millions)	t-test	Coefficients (Millions)	t-test	Coefficients	t-test
January	17.63	77.79	44.600	5.14	43.597	5.14	341.55	9.5
February	17.59	77.62	46.100	5.31	46.035	5.31	286.2	7.96
March	18.30	80.74	84.100	9.69	84.140	9.69	500.8	13.93
April	18.08	79.77	61.900	7.13	62.020	7.13	445.7	12.4
May	18.15	80.08	65.500	7.55	65.315	7.55	354.75	9.87
June	18.32	80.8	79.200	9.13	79.923	9.13	415.95	11.57
July	17.95	79.17	53.300	6.14	53.510	6.14	390.45	10.86
August	17.64	77.84	39.400	4.54	38.934	4.54	292.85	8.14
September	18.17	80.15	67.000	7.72	66.900	7.72	436.85	12.15
October	18.04	79.6	50.000	5.75	50.089	5.75	393.35	10.94
November	17.99	79.38	54.200	6.24	54.090	6.24	342.7	9.53
December	18.09	79.79	64.000	7.36	64.120	7.36	397.35	11.05
Heteroscedacity Test	1.34		6.03				19.69	
	(0.2479)		(0.8715)				(0.0498)	
$\boldsymbol{\beta_{January} = \beta_{Febuary} = \beta_{March} = \cdots . = \beta_{December}}$	1.21		2.51		2.51		3.08	
(F-test)	0.2782		0.0054		0.0054		0.0007	

The results of F-test in the last row represent the test of the hypothesis whether the coefficients are statistically different from each other and not whether the coefficients jointly different from zero.

II. Directors' buys

Table (4.9) reports the results of the OLS Model (with the usage of the logarithm of value as a dependent variable and after excluding the outliers) and the TOBIT Model on monthly aggregate value (and number) of Directors' buys during the sample period.

One clear pattern emerges from table (4.9) which indicates that, for the period 1991-2010, director trading value in December is the highest relative to other months of the year. The null hypothesis that director trading value is the same across all months of the year can be accepted at the five per cent level (based on an F-test). In addition, director trading value appears to be slightly lower on February. A comparison of December versus other months indicates a tendency for December to become more active. These results are repeated (the non-existence of monthly anomalies) after excluding trades with more than £15 and also after using TOBIT Model.

Table (4.9) also shows that the average number of directors' trades in March is the highest relative to other months of the year. The average trading number for March is 355 transactions, versus an average of 321 transactions for October. This implies a decrease of approximately ten per cent in trading number in October. March's trading number is significantly different from the trading number of the remaining months. The null hypothesis which assumes that the average number of directors' trades is the same across all months of the year can be rejected at the five percent level (based on an F-test).

Turning to *Hypothesis (3), the* results indicate no month of the year effect in aggregate directors' trading value. The results also show that March's number of trades is more frequent, whereas February's number of trades is less frequent. In other words, *Hypothesis (3)* is rejected for director aggregate number of trades, but it is accepted for directors' aggregate value.

Also, *hypothesis (4),* which suggests that Directors tend to sell more in March and buy more in April compared to other months of the year, is rejected. Thus, insiders have preferences to buy more in March.

Table 4.9: Monthly Effect: the Results of the Dummy Variable Regression on Directors' Buys

Month	OLS Model (logarithm Values)		OLS Model (Total Values Excluding Outliers)		TOBIT Model (Total Values)		Number of Trades	
	Coefficients	t-test	Coefficient (Millions)	t-test	Coefficients (Millions)	t-test	Coefficients	t-test
January	16.20	66.92	12.500	4.45	12.465	4.5	257.75	7.91
February	16.09	66.48	10.100	3.59	10.025	3.62	204.95	6.29
March	16.73	69.11	19.500	6.95	19.580	7.07	355.45	10.9
April	16.39	67.73	13.600	4.85	13.670	4.93	300.15	9.21
May	16.56	68.42	18.400	6.54	18.415	6.65	262.7	8.06
June	16.46	67.99	19.700	7.03	19.987	7.2	317.25	9.73
July	16.55	68.38	16.300	5.8	16.300	5.88	315.05	9.67
August	16.13	66.63	10.700	3.81	10.269	3.68	232.95	7.15
September	16.44	67.91	17.700	6.29	17.715	6.39	347.05	10.65
October	16.29	67.3	17.000	6.04	17.049	6.14	321.85	9.87
November	16.45	67.94	16.300	5.79	16.285	5.88	271.95	8.34
December	16.85	69.61	18.900	6.72	18.920	6.83	311.25	9.55
Heteroscedacity Test	0.70		8.81				5.81	
	(0.4026)		(0.6395)				(0.8858)	
$\boldsymbol{\beta_{January} = \beta_{Febuary} = \beta_{March} = \cdots . = \beta_{December}}$	0.90		1.44		1.58		1.97	
(F-test)	(0.5435		0.1561		0.1067		0.0321	

The results of F-test in the last row represent the test of the hypothesis whether the coefficients are statistically different from each other and not whether the coefficients jointly different from zero.

To summarise, there is no monthly anomalies in aggregate insider buying activities as measured by the aggregate value of insider transactions. For director trading number of trades, March's number of buy trades is higher, which suggests that directors are more likely to trade on March than on other months of the year. According to tax loss hypothesis, we expected to find high buy trades in April, but instead we found high buying activities in March. One possible explanation is that 5th of April is the taxation date for individuals in the UK; therefore, insiders might buy till the last two weeks of March. Hence, March effect in the aggregate number of directors' trades is perhaps due to buy activities in the first twenty days of March[29].

III. Directors' sells

Table (4.10) reports the results of the OLS Model (with the usage of the logarithm value as dependent variable and after excluding the outliers), and the TOBIT Model on monthly aggregate value (and number) of directors' sells during the sample period.

One clear pattern emerges from table (4.10) which indicates that, for the period 1991-2010, the director trading value in June is the highest relative to other months of the year. The null hypothesis which states that director trading value is the same across all months of the year can be accepted at the five per cent level (based on an F-test). In addition, director trading value appears to be slightly lower in August. A comparison of June versus other months indicates a tendency for June to become more active. These results are repeated (the non-existence of monthly anomalies) after excluding trades with more than £15 but not after using TOBIT Model. The results of TOBIT Regression Model show that the average value of directors' selling activities in March is higher and significantly different relative to other months of the year. The average value of March's sells is £64 million, which suggests that directors prefer to trade more in this month.

Table (4.10) also shows that the average number of directors' trades in March and April is the highest relative to other months of the year. The average trading number on March and April are approximately the same (145 transactions). March and April's trading numbers are significantly different

[29] This is examined further in the next section.

from the trading numbers of the remaining months. The null hypothesis which assumes that the average number of directors' trades is the same across all months of the year can be rejected at the five per cent level (based on an F-test).

Excluding March and April, the null hypothesis which assumes that the average number of directors' trades is the same cannot be rejected. Back to *Hypothesis (3),* the results indicate no month of the year effect in aggregate directors' trading value (when using OLS Models). These results changed when using TOBIT Model suggesting the existence of March effects. The results also show that March's and April's number of trades are more frequent. In other words, *Hypothesis (3)* is rejected for director aggregate number of trades and accepted for directors' aggregate value and volume.

Also, *hypothesis (4),* which suggests that Directors tend to sell more in March compared to other months of the year, is accepted. These results can be explained by tax loss selling hypothesis (March sell pressure) which suggests that investors sell more in the month prior to taxation date or capital gain hypothesis which states that investors delay capital gains realisation so that they can delay tax payment on capital gains. By doing so, investors might postpone tax payment by one year. Thus, investors would sell winners (shares) in April. Hence, the selling pressure in March would be small causing the price to rise.

Table 4.10: Monthly Effect: the Results of the Dummy Variable Regression on Directors' Sells

Month	OLS Model (logarithm Values)		OLS Model (Total Values Excluding Outliers)		TOBIT Model (Total Values)		Number of Trades	
	Coefficients	t-test	Coefficients (Millions)	t-test	Coefficients (Millions)	t-test	Coefficients	t-test
January	17.19	68.15	32.100	4.41	31.132	4.32	83.8	8.44
February	17.25	68.39	36.000	4.94	36.010	5.02	81.25	8.19
March	17.92	71.04	64.600	8.87	64.560	9.01	145.35	14.64
April	17.77	70.45	48.300	6.63	48.350	6.74	145.55	14.66
May	17.72	70.25	47.100	6.47	46.900	6.54	92.05	9.27
June	18.04	71.52	59.500	8.17	59.936	8.35	98.7	9.94
July	17.58	69.7	37.000	5.09	37.210	5.19	75.4	7.6
August	17.13	67.91	28.700	3.94	28.665	4	59.9	6.04
September	17.81	70.61	49.300	6.78	49.185	6.86	89.8	9.05
October	17.62	69.86	33.000	4.53	33.040	4.61	71.5	7.2
November	17.60	69.76	37.900	5.2	37.805	5.27	70.75	7.13
December	17.56	69.62	45.100	6.19	45.200	6.31	86.1	8.67
Heteroscedacity Test	0.06		9.30				8.81	
	(0.8139)		(0.5938)				(0.6393)	
$\boldsymbol{\beta_{January} = \beta_{Febuary} = \beta_{March} = \cdots . = \beta_{December}}$	1.28		1.63		2.46		7.53	
(F-test)	0.2350		0.0988		0.0063		0.000	

The results of F-test in the last row represent the test of the hypothesis whether the coefficients are statistically different from each other and not whether the coefficients jointly different from zero.

Hillier and Marshall (2002a) suggested that insiders sell more 20 days before taxation date. In the UK, 5th of April is the taxation date. Therefore, we might expect insiders to sell more in the last two weeks of March and first week of April. For that reason, we re-examined calendar anomalies in aggregate insider activities as measured by the aggregate number of insider transactions in the last two weeks of March and First week of April (weeks 12, 13, 14 and 15). The evidence indicates, as can be seen from table (4.11), that the average number of sell transactions in these weeks is significantly different from the average number of sell trades in other weeks. The average trading number on weeks 12, 13, 14 and 15 are approximately 53 transactions.

Table 4.11: The Results of Dummy Variable Regression on Directors' Sells on Weekly Basis

Weeks	Coefficients	Standard Error	T-test	P-Value	F-test
Weeks 12, 13, 14 and 15	52.84	2.15	24.59	0	207.49
Other Weeks	20.59	0.63	32.75	0	

The estimation equation is;

$$The\ Aggregate\ Number\ of\ Trades_t = \beta_{Weeks\ 12,13,14,and\ 15} W_{Weeks\ 12,13,14,and\ 15} + \beta_{Other\ Weeks} W_{Other\ Weeks}$$

Where $W_{Weeks\ 12,13,14,and\ 15}$ is a dummy variable that takes the value of 1 if the trade occurred in weeks 12, 13, 14, and 15 and 0 otherwise.

Figure (4.3) shows the distribution of the average number of sell trades over the weeks of the year. The figure shows that the average number of sell trades increase at week 12 and peak at week 15. Thereafter, a decrease in the average number of sell trades in the following three weeks (weeks 16, 17, and 18). This supports the view that directors sell more before the taxation.

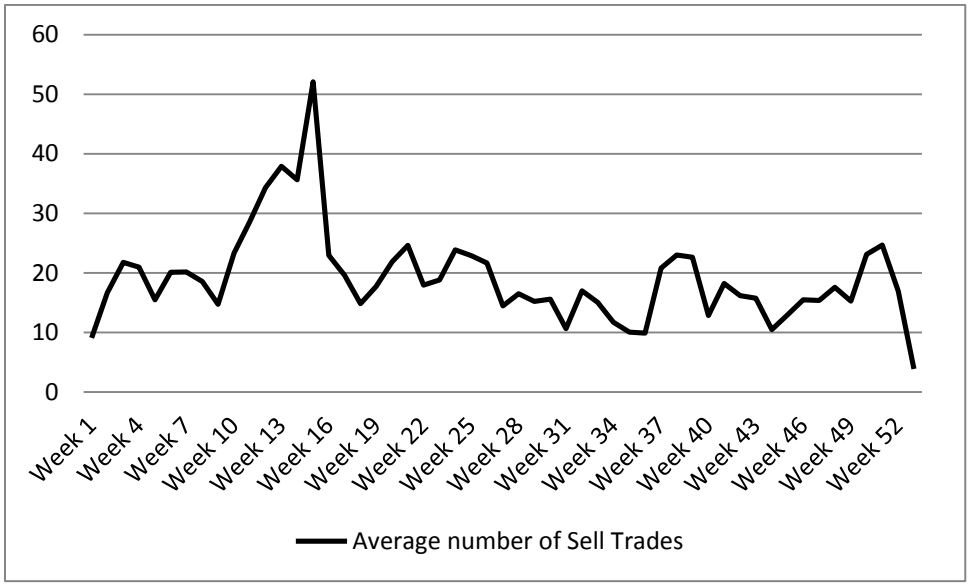


Figure 4.3: The Distribution of the Average Number of Directors' Sells over Sample Weeks

To summarise, the results of OLS Regression Model indicate that there is no monthly anomalies in aggregate insider selling activities as measured by the aggregate value of insider transactions. The results of TOBIT Regression Model show that the average value of directors' selling activities in March is higher and significantly different relative to other months of the year.

In UK, April is the month of taxation. According to the tax-loss hypothesis, investors sell more in the month before the taxation and buy more after taxation. Therefore, these results might be due to directors selling more to avoid taxes. This is confirmed when we looked at directors' sell 20 days before the taxation.

4.6.4 The results of K-W statistic test

Table (4.12) reports the results of ***K-W*** statistic test for insider aggregate value and number of directors' buys and sells. The table supports the results of the OLS regression model and confirms the existence of monthly anomaly in aggregate director trading activities (measured by the number of director transactions). Also, when considering buy and sell transactions as a whole, the results indicate a kind of day of the week anomaly.

Unlike the previous findings, there seems to be a day of the week effect in director aggregate value of buy trades. This difference might happen normally when OLS regression model assumptions are not met completely (Brook, 2002; and Lim et al., 2010).

Table 4.12: The Results of K-W Statistic Test

	Buy		**Sell**		**All Trades**	
	Value	No of Trades	Value	No of Trades	Value	No of Trades
Day-Of-The week						
chi-squared	11.05	13.21	7.75	11.72	13.712	18.539
p-value	0.0259	0.0102	0.101	0.0196	0.0083	0.001
Month-Of-The year						
chi-squared	14.81	27.98	13.49	55.62	13.08	43.44
p-value	0.1912	0.0032	0.2625	0.0001	0.2879	0.0001

To summarise, the results show the following:

1) There is a day of the week anomaly in aggregate insider activities (as measured by number and value of insider transactions). More specifically, insiders tend to trade more on Fridays and less on Tuesdays. This anomaly disappeared for directors' aggregate value when splitting the sample to directors' buys and sells. The existence of Tuesday effects was previously conducted in stock returns (Agrawal and Tandon, 1994; Martikainen and Puttonen, 1996; and Brooks and Persand, 2001) and in trading volume (Badhani, 2006).
2) The distribution of the average value of directors' trades (buys and sells) across the week days forms a U shape i.e. high trading value on the beginning of the week (Monday) and the end of the week (Friday).
3) There is a month of the year anomaly in aggregate insider activities (as measured by the number of insider transactions). More specifically, insiders tend to trade more in March (in the aggregate

number) and trade less in August. For directors' buys, insider aggregate buying activities are higher in December and March, whereas, for directors' sells, insider aggregate selling activities are higher in April. These results are consistent with Seyhun (1988b) and Hillier and Marshall (2002a).

4) The results of ***K-W*** statistic test confirm the nonexistence of monthly anomaly in aggregate director trading (measured by value of director transactions). Unlike the previous findings, there seems to be a day of the week effect in director aggregate value of buy trades, which might happen normally when OLS regression model assumptions are not met completely.

4.7 Conclusions

Following on from the previous chapter, which examined the patterns and characteristics of insider trading activities, one aim of this chapter was to test for seasonal patterns in aggregate insider trading transactions (as measured by the aggregate insider number and value of insider transactions). Specifically, do insiders prefer to trade on any particular day of the week or month of the year?

The previous literature on calendar anomalies has focused on returns i.e. do returns vary by month of the year or day of the week? This literature has attempted to simply identify whether these anomalies exists and/or to try to explain their existence. This literature indicates the existence of the day of the week effect .i.e. negative returns in the beginning of the week and high returns at the end of the week. These anomalies might be driven by the employed methodology or the way of calculating returns, investor psychology, the difference in trading patterns of individual and institutional investors, or settlement procedures. Furthermore, the literature on trading volume suggests that Monday's trading volume is higher compared to other days of the week. More specifically, investors sell more on Monday if they are individual investors and sell less if they are institutional investors. This is perhaps due to private information hypothesis and the behaviour of individual and institutional investors. Similarly, previous empirical literature on stock returns anomalies

supports the existence of the month of the year effect i.e. high returns in January. These anomalies might be driven by the tax loss selling hypothesis, window dressing hypothesis, or new information provided by the firms at the end of the financial year. Also, the turn of the year effect might be due to director trading activities as measured by the aggregate number of directors' trades.

A second aim of this chapter, given that such seasonal patterns exist, was to attempt to relate these patterns to explanations drawn from the literature on calendar anomalies. Using a dataset of more than 5,000 UK companies over the period January 1991 to December 2010 resulting in 91,970 trades, 70,067 buys and 22,026 sells, we carried out a series of parametric (OLS) and non-parametric (***Kruskal-Wallis***) tests to determine whether there is a calendar effects or not.

Our results indicated the following: There is a day of the week anomaly in aggregate insider activities (as measured by number and value of insider transactions). Specifically, insiders tend to trade more on Fridays and less on Tuesdays. The distribution of the average value of directors' trades (buys and sells) across the week days forms a U shape i.e. high trading value on the beginning of the week (Monday) and the end of the week (Friday). There is a month of the year anomaly in aggregate insider activities (as measured by the number of insider transactions). Specifically, insiders tend to trade more in March (in the aggregate number) and trade less in August. For directors' buys, insider aggregate buying activities are higher in December and March, whereas, for directors' sells, insider aggregate selling activities are higher in April. These results are consistent with Seyhun (1988b) and Hillier and Marshall (2002a). The average number of sell transactions in the three weeks before taxation date is significantly different from the average number of sells trades in other weeks

These results are also confirmed by the results of ***K-W*** statistic test which supported the non-existence of monthly anomaly in aggregate director trading (measured by the value of director transactions). Unlike the previous findings, there seems to be a day of the week effect in director aggregate value of buy trades.

The existence of Friday (Tuesday) effects was previously conducted in stock returns (Agrawal and Tandon; Martikainen and Puttonen, 1996; and Brooks and Persand, 2001). One possible explanation, based on the previous studies, is that insiders act like institutional investors who trade less on Tuesday as a reflection of insiders' trades on Monday in US. Taking into accounts that the aim of the previous studies in trading volume anomalies was to explain the calendar anomalies in stock returns, our results were consistent with studies on stock returns anomalies that show high returns on Friday and lower returns on Tuesdays. Therefore, these results might explain the seasonal pattern in stock returns.

The U shape pattern (in average value of directors' trades) is perhaps due to price changes from larger (smaller) trades which are higher (lower) at the beginning and end of the week. This is because smaller trades would move prices during periods of low volume because informed traders do not want to reveal their information to the market. When volume is low, informed traders are able to increase their trade sizes because high volume hides their information (Blau et al., 2012).

The existence of March and April anomalies can be explained by tax loss selling hypothesis (March sell pressure) which suggests that investors sell more in the month prior to taxation date or capital gain hypothesis which states that investors delay capital gains realisation so that they can delay tax payment on capital gains. By doing so, investors might postpone tax payment by one year. Thus, investors would sell winners (shares) in April. Hence, the selling pressure in March would be small causing the price to rise. Tax loss selling hypothesis, as an explanation of March and April anomalies, further supported when we examined directors' sell transactions twenty days before taxation date. Although the purpose of this chapter is purely to identify whether such anomalies exist, we do not attempt to explain why they do. We believe that this is an avenue for further research in this area.

Chapter 5: The Informativeness of Director' Age

5.1 Introduction

Previous studies have used directors' trades to examine various hypotheses in the general area of insider trading. One focus of this literature has been to examine how the informativeness of directors' trades varies with trade, firm, and directors characteristics. For example, King and Roll (1988) examined a small sample of insider trades and found significant abnormal returns from buying. Likewise, with a larger sample over the same period, Pope et al. (1990) reported positive, but much smaller, abnormal returns from buying, and negative abnormal returns from selling. Hamill et al. (2002) indicated that directors' purchases and sales possess significant information content. In general, the literature in this area suggests that the informativeness of directors' trade depends on the type of trade (buy or sell) which directors engage in.

Furthermore, assuming that insiders in small firms might be more informed about their trades than insiders in large firms, Seyhun (1988a) found that insiders in small firms earn significantly greater abnormal returns than insiders in large firms. In this context, Gregory et al. (1997) also found that firm size has a positive impact on UK insider trading. Moreover, insiders in small firms earn positive abnormal returns than insiders in other firm size. Similarly, Friederich et al. (2002) reported that insider trades in smaller firms are more informative over the short term.

Additionally, considering that executive directors might be more informed about their trades or have better access to private information, Fidrmuc et al. (2006) tested whether the informativeness of a director's trade depends on the category of the director making the trade, and found no evidence of differences in returns across categories of director. Similarly, Gregory et al. (2012)

examined whether the category and the gender of the director influence the information they possess about their own firms. They found no difference in the trading patterns and stock market response to directors' gender differences, after conditioning on the category of director. A thorough review of these studies reveals that no one has yet dealt with the issue of whether the informativeness of the director varies with age.

There are many reasons why financial decisions may vary with life cycle. Psychological and physical studies concerning age suggested that memory and cognitive abilities decline with age (Gunesh, Broihanne and Merli, 2010; Fair 2007; and Grady and Craik, 2000). Intelligence level also declines with age (Baltes and Lindenberger, 1997). Introducing socioeconomic and demographic factors such as education, income, wealth, race, ethnicity, and gender can lower the adverse effects of cognitive aging (Korniotis and Kumar, 2011). Financial literature also suggests there are opposing effects of age. On the one hand, older investors who have more experience and greater investment knowledge are more likely to make effective financial decisions (Goetzmann and Kumar, 2008; Korniotis and Kumar, 2011). On the other hand, the possibility to make unsuitable decisions increases as the director gets older due to the decline of memory (Lusardi and Mitchell, 2007; Van Rooij et al. 2007).

By using certain type of individuals, who are directors, the purpose of this chapter is to examine whether the informativeness of UK directors' trades varies with age or whether the age has an impact upon the informativeness of directors' trades. The question is: are directors of a particular age more informed about their trades than directors of other ages.

This study is the first that takes into account the director's age as a factor in determining insider abnormal returns. This is also different from previous studies since it uses 2,300 UK firms which are larger than what have been examined before. For example, Fidrmuc et al. (2006) used the FTSE all small firms, Gregory et al. (2009) used the FTSE 350 companies, whilst others have used the FTSE 100 firms.

Our sample period covers the years 2002 to 2010. Over this period, there is a total of 25,096 trades by directors divided into 20,312 purchases of company

stock and 4,784 sales. Standard event study methodology based on the market model would be employed using announcement dates as the event dates.

The chapter is organised as follows. Section (5.2) reviews the previous studies concerning age using physical, biological, and financial evidence, and presents an overview of the literature on insider trading is given. Section (5.3) presents the data and methodology. Section (5.4), (5.5), and (5.6) discuss the results while the conclusions are presented in Section (5.7).

5.2 Literature Review

This section reviews the literature on age, drawing on studies in psychology and finance. This literature suggests that the impact of age on informativeness may be mixed. Following that, the literature on insider trading in general is reviewed in order to rationalise the control variables that are necessary for our analysis.

5.2.1 Age in Psychological and Physical Studies

Both physical and cognitive abilities, especially memory, decline with age (Agarwal et al., 2009). For example, to estimate the rate at which men's physical abilities vary with age, Fair (2007) used a very large sample of athletic records. The age range in his study is 35 to 100 years old for swimming and 35 to 98 years old for long and short distance running[30]. The results showed a linear per cent decline between age 35 and about age 70 for all activities (swimming and running) and then a quadratic decline after that age. More specifically, the rates of decline were larger for the longer distances and, for swimming, they were larger for women than for men.

In the context of cognitive abilities, individual's ability to process information declines with weakening memory, which slows down the ability to distinguish conditional probabilities[31] for older people (Spaniol and Bayen, 2005). For

[30] They used track, field and running records

[31] An example of conditional probabilities is when people reason with meaningful, causal conditionals in daily life (e.g., ''If the brake is pushed, then the car slows down'') they rely on

instance, suppose a company gives the investor the following choice: if you buy two stocks, then your gain will be £2 a month, but if you buy more than four stocks, you will get £6 within two months. According to Spaniol and Bayen (2005), older investors will be less effective in distinguishing these conditional statements, and thus less able to make the right decision at the right time. Moreover, older people might be less able to concentrate and recognise the correct and incorrect information as a result of declining in attention ability (Gunesh et al., 2010). Both studies also implied that, because the abilities to process and integrate new information for older people are slower and less efficient, their reaction to this kind of information might not be right.

In addition, the memory's ability to perform tasks declines with age from early to late adulthood[32]. This decline in performance, as a result of age increase, is much greater for some tasks than others (Grady and Craik, 2000). For example, there is a small association between age-related declines and short-term memory tasks such as repeating a short string of words, letters or numbers, whereas there is a large association between age-related losses and tasks involving free or cued recall and those involving recollection of the original context in which an event occurred (Grady and Craik, 2000).

Similarly, Spaniol, Madden and Voss, (2006) examined adult age differences in episodic[33] and semantic[34] long-term memory tasks, as a test of the hypothesis of specific age-related decline in context memory. Examples of information stored in episodic memory are: I remember hearing a woman screaming a short while ago, followed by a sound of ambulance a few seconds later; last month, while on an Easter holiday, I met Roy who knew more about statistics than any other person I have ever met. Examples of semantic memory information are: I know that springs are usually warm in Mediterranean countries; I remember that the chemical formula for water is H_2O. The results indicated that younger people were faster and exhibited lower episodic

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stored background knowledge about the conditional. This kind of background knowledge has an impact on the inferences people draw (Neya et al, 2005).

[32] Early 20 to late 90.

[33] Episodic memory is the name given to the capacity to consciously remember personally experienced events and situations. It is one of the major mental (cognitive) capacities enabled by the brain.

[34] Semantic memory refers to the memory of meanings, understandings, and other concept-based knowledge unrelated to specific experiences.

accuracy than older people. They also revealed, for both episodic and semantic retrieval, an increase in age-related in time of non-decisional reaction. Therefore, consider the following statements: two years ago, at a London Accounting Conference, I met a young accountant who knew more about accounting principles than any other person I have ever met (episodic memory); I know that the abnormal return on the announcement date is equal to the normal return minus the expected return on that date (semantic memory). Based on the findings of Spaniol et al. (2006), the ability to remember when or where I met that accountant would slow down as I get older. Moreover, the time spent in calculating the abnormal return (use of semantic memory) would increase as age increases.

Psychological evidence also indicates that intelligence level is likely to decline as people get older. Baltes and Lindenberger (1997) examined the relationship between measures of sensory functioning (visual and auditory sharpness) and intelligence. Intelligence was assessed with 14 tests measuring five cognitive abilities (speed, reasoning, memory, knowledge, and fluency). The results indicated that age worsens the sensory (vision and hearing) functions as well as intelligence level. The decline in intelligence is much sharper after the age of 70; the increase in the age-associated link between sensory and intellectual functioning may be due to brain aging.

In addition to psychological factors, socioeconomic and demographic factors, such as education, income, wealth, race, ethnicity, and gender, can lower the adverse effects of cognitive aging. For example, people who are more educated, more resourceful (have higher income and are wealthier), and undertake intellectually stimulating jobs experience a slower decline in cognitive abilities because they are able to compensate actively for the adverse effects of aging (Korniotis and Kumar, 2011). In their study Korniotis and Kumar (2011) demonstrated that cognitive abilities increase with education, wealth, and income but decline with age. Moreover, there is a sharp decline after the age of 70. The decline of cognitive abilities is higher among older individuals who are also less educated and have lower income. In other words, Older investors who are more educated and more resourceful (i.e., have higher income levels and are wealthier) might be able to better compensate for their declining information processing abilities.

According to previous literature, we may expect the ability of directors to make correct decisions (e.g. whether to buy or to sell shares) to decline with age. Older directors may be less effective in recognising different information signals, and, therefore, less able to make the correct decision compared to younger directors. On the other hand, introducing some factors such as education, income, wealth, race, ethnicity, and gender can offset the adverse effects of cognitive aging making older directors more able to make better decisions.

Based on these priors, we might expect either older directors to be less informed about their trades because of memory and cognitive abilities decline with age, or older directors to be more informed about their trades because of factors such as race, education, and wealth which lower the cognitive ability effects.

5.2.2 Age in the Finance Literature

While old age is likely to have an adverse effect on people's ability to make effective investment decisions, older investors are likely to have greater investment experience and greater awareness of the fundamental principles of investing. Their accumulated investment wisdom could help them make efficient investment decisions. Graham, Harvey and Puri, (2013) found that past career experience and education[35] are correlated with corporate decision making. They also provided evidence consistent with matching between the behavioural traits of executives and the kinds of companies they join; firms with high historical or future growth rates are more likely to be run by risk-tolerant CEOs. These chief executives are likely to be younger.

In addition to these channels, trading process and experience might lead investors to learn more and to be less prone to behavioural biases as they grow older. The extant empirical evidence from the individual investor literature indicates that older investors exhibit a weaker disposition effect. Portfolio diversification could also increase with age because, in addition to experience, investors acquire more information about the market (e.g., King and Leape,

[35] They assumed that an MBA degree may represent valuable knowledge gleaned from a good business education.

1987). Goetzmann and Kumar (2008) examined the factors that might influence portfolio diversification decisions such as age, income, and occupation. The results indicated that older investors are more diversified than younger investors and high-income investors are better diversified than low-income investors. Furthermore, investors with greater experience hold better diversified portfolios. They used three age categories in their analysis which are: investors aged under 45, investors aged between 45 and 65, and investors aged over 65. Therefore, investors aged over 65 are more diversified than investors of other ages (the same can be said for investors between the ages of 45 and 65).

The role of experience was also studied by Korniotis and Kumar (2011). They examined the impact of cognitive abilities on financial decisions. The results indicated a negative relationship between investment skill and age. Investment skill declines with age and this decline is stronger for low income, low education investors who cannot successfully compensate for the adverse effects of aging.

Gunesh et al. (2010) analysed the disposition effect of 20,379 individual investors over the period 1999-2006. Using the difference between investors' propensity to realise winning stocks and losing stocks in their portfolios to measure investors' disposition effects, the coefficient of the age was negative and significant. Thereby, older investors are less prone to the disposition effect.

Korniotis and Kumar (2011) examined whether older investors possess greater knowledge about investing. The results indicated that older and more experienced investors hold less risky portfolios, exhibit stronger preference for diversification, trade less frequently, and exhibit weaker behavioural biases such as the disposition effect. Thus, their choices reflect greater knowledge about investing. Additionally, investment skill of older investors deteriorates sharply around the age of 70 due to the adverse effects of cognitive aging.

Another strand focused on financial literacy. Lusardi and Mitchell (2007) examined three fundamental concepts related to financial literacy, such as the working of interest rates, the effects of inflation, and the concept of risk diversification. The results also indicated that older individuals exhibit low level of financial literacy (their results indicate an inverse U-shape). This

means that older individuals are less able to make the correct decisions. Van Rooij et al. (2007) found that younger individuals who have financial knowledge are more likely to invest in stock markets. Graham et al. (2008) found that younger CEOs who have prior experience in finance/accounting are in companies that have a high debt ratio. This is because they are more likely to see the value in using debt and are more comfortable with this outcome. Kyriacou and Mase (2003) investigated the use of private information by insiders in their decision to exercise executive stock options. They found that younger executives' signals are more informative than older executives' signals.

To summarise, the literature suggests there are opposing effects of age. On the one hand, older and more experienced directors may use information to trade and gain higher abnormal returns. On the other hand, the possibility to make unsuitable decisions increases as the director gets older. Therefore, younger directors may make more efficient decisions and earn higher returns than older directors.

5.2.3 Insider Trading Studies

The aim of this chapter is to examine whether the informativeness of directors' trades varies with age. Previous studies have examined how the informativeness of directors' trades varies with trade, director, and firm characteristics. For instance, studies focusing on transaction type find positive abnormal returns associated with buy trades, and negative abnormal returns associated with sell trades. For example, Finnerty (1976) found that, when insiders buy shares of their own firms, they earn positive abnormal returns and when they sell their sells generate significantly negative returns. Similarly, King and Roll (1988) examined the profitability of insider trading in the UK over the period January 1986 to August 1987. They found that the abnormal returns for buy trades were greater than the abnormal returns for sell trades. This is because insider sell decisions are much more likely to happen for non-information-based reasons than purchase decisions. Moreover, sell transactions by directors are usually viewed by market participants to be driven by liquidity or diversification needs, whereas buy transactions are likely to be driven y

superior information of firm's future prospective. For example, Ma and Sun (1998) indicates that Insiders might trade (sell) because of portfolio diversification or liquidity needs. Pope et al. (1990) reported positive, but much smaller, abnormal returns from buying, and negative abnormal returns from selling.

Another variable that determines the informativeness of the trade is firm size. Williams (1986) examined directors' trades in small and large-sized firms. He documented that insiders in small firms possess more information, and this can give rise to increased returns on the firm's shares. Also, Seyhun (1988a) indicated that firm size and insider returns were negatively related, because insiders in small firms are more informed about their trades than insiders in large firms. Rozeff and Zaman (1988) found that insiders in small firms with high earning-to-price ratios tend to buy, whereas insiders in large firms tend to sell. In this context, Gregory et al. (1994) suggested that directors' trades are associated with abnormal returns. Furthermore, insiders in small and medium-sized firms earn higher abnormal returns than insiders in large firms.

Jeng et al. (2003) tested the informativeness of three directors' types. These types were top executives[36], other officers, and directors. The results indicated that top executives do not earn higher abnormal returns than do other officers and directors. Fidrmuc et al. (2006) added new insight to the literature on the informativeness of directors' trades by considering five types of directors (CEOs, other executive directors, chairmen, other incumbent directors, and former directors). The results implied that there is no significant difference in the cumulative abnormal returns for the various categories. Besides, CEOs seem to be less informed about their trades than other directors' types, though they suppose to have more information about their company's prospects.

Similarly, Gregory et al. (2012) examined whether director type (executive or non-executive) and director gender (male or female) have an impact on the informativeness of directors' trades. They found that director gender has no impact upon the informativeness of directors' trades, whereas director type does. . Knewtson (2011) examined whether trading skills or the ability to exploit asymmetric information, which exists between executives and

[36] Top executives include chief executives, chairman, or president.

outsiders, can be reflected by the trades of informed executive directors. In other words, does the informativeness of directors' trades due to executives' trading skills or abilities to exploit information asymmetry? Knewtson considered buy activities by three types of directors (CEOs, CFOs and COOs. The results indicated higher abnormal returns are associated with CFOs trades which might due to that they are either more skilled at trading or are more willing to use asymmetric information.

In summary, insider trading literature implies that directors' trades depend on various factors such as transaction type (buy or sell), director type (executive or non-executive), or firm size (small, medium, and large). However, the literature on cognition abilities implies that age effects should also be taken into account and controlled. Therefore, this study will examine whether age has an impact upon the informativeness of UK directors' trades over the period 2002-2010. In other words, are directors of a particular age more informed than directors of any other ages?

5.3 Data and Methodology

This study is based on data collected between January 2002 and December 2010 for UK companies by the data company Directors Deals. This database monitors and analyses share transactions made by directors in their own company. This dataset gives details of director's identity, transaction and announcement dates, the volume and the value of directors' trades, as well as trade price, director's type (Executive, Non-Executive, Former[37] or PDMR[38]), the director's holdings, and the director's age. Daily returns and daily market values for the event firms, and the benchmark FTSE All Share Index returns are sourced from DataStream. Additionally, the original dataset includes information on various transaction types, but we removed trades[39] other than open market purchases and sales of ordinary shares by directors. Open market

[37] Former is no longer a board member.

[38] Person Dispensing Managerial Responsibility (PDMR) is not a member of the board but an employee considered to be a party to price sensitive information and therefore subject to the same rules as Board members

[39] We removed trades such as option exercise, derivative, script dividends or bonus shares, rights issue, awards made to directors under Incentive plans or reinvestment plans, gifts, transfers and purchase, and sales of shares under personal equity plans, operations derived from tax or "bed & breakfast"

sales and purchases are more likely to represent actions taken because of special insider information (Seyhun, 1988a).

Because of data availability on directors' ages and company ISIN (International Securities Identification Number) codes, our sample period is limited to nine years. However, there are a total of 25,096 trades by directors over the sample period, divided into 20,312 purchases of company stock and 4,784 sales – meaning there are approximately four times more purchases than sales. The methodology we employ is similar to what is used in other studies of this type, meaning the event study methodology (Calvin and Lasfer, 2002; Fidrmuc et al., 2006; and Gregory et al., 2009).

When conducting an event study methodology based on daily data, we need to decide whether to use single signal or multi-signal for directors' trades. In single signal approach, if more than one director trades on the same day in the same firm we aggregate the net number of shares traded by each director on that day. Moreover, if insiders' number of shares bought is higher than insiders' number of shares sold, we will consider insiders to be net purchasers of their firm's shares. However, this approach is not suitable when multiple directors with multiple characteristics (age and type) are trading on the same day. For example, what if two directors with two different ages are trading on the same day and the same direction (buying or selling)? Our approach is, therefore, to:

1. Split the sample according to directors' trades in ordinary shares into ordinary purchases and ordinary sales.
2. Consider multiple, but similar types of, transactions (e. g. buy) of a given director on the same day as one (buy) transaction.
3. Consider multiple, but similar types of, transactions (e. g. sell) by different directors from the same company on the same day not as one (sell) transaction. For example, suppose two directors from the same company were selling their firm shares on the same day; we have considered this transaction as two different sell transactions.
4. Consider multiple, but different types of, transactions (e. g. buy and sell) of a given director on the same day as one transaction. However, the volumes of these transactions are subtracted. If the volume of the buy (sell) transactions is

more than that of sell (buy), then such a transaction is considered a buy (sell) transaction, and the number of buying directors (selling) is reported[40].

The use of event study methodology has become more popular after the research by Fama et al. (1969). Event study is usually used to assess the impact of an event or a particular type of event on firm's value. Since that, in efficient market, share price reflects the impact of an event, using share prices observed over a relatively short period around or after the event date can be used to measure this impact. This technique measures the difference between the observed return in the event and the expected one around or after the event date. Any significant difference is defined as abnormal return (or loss). Also, this technique is useful because it shows the reaction of a security to a particular event, and therefore, predicts the reaction of other securities to different events.

Standard event study methodology based on the market model is employed to examine the patterns in daily stock prices around directors' buys and sell signals.

In our analysis, only restrictions due to data availability are considered. Then, we defined the estimation window by using the 200 days prior to the event window as the estimation window (Fidrmuc et al., 2006; Friederich et al., 2002). The estimation period does not include event period in order to avoid the event from influencing the estimates of model parametes.

There is also an argument whether to use the announcement date or the transaction date as the event date. For example, Hillier and Marshall (2002) assumed that some outside investors are expected to have some detailed information when directors buy or sell. Thus, they defined the transaction date as the event date.

On the other hand, Fidrmuc et al. (2006) defined the announcement date as the event date because it is the date when the information about directors' trades reaches the market Therefore, in this chapter, we consider the announcement date as the event date.

The event period, in our study, ranges from 0 to +10 days after the announcement date. The estimation period for the parameters in the market

[40] This case was for a little number of transactions (not more than 20 transactions).

model starts on day -1 and is 200 days in length. The abnormal return $AR_{i,t}$ is obtained by subtracting the realised rate of return from the expected return:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (5.1)$$

Where $R_{i,t}$ denotes the realised rate of return for stock i on day t. The realised return was calculated as:

$$R_{i,t} = Ln(P_{i,t}) - Ln(P_{i,t-1}) \quad (5.2)$$

Where $P_{i,t}$ refers to the closing price of stock *i* at day t, and $P_{(i,t-1)}$ the closing price of stock i at day t-1. $E(R_{i,t}$ denotes the expected return for stock i on day t. The simple Market Model (MM), is used to estimate the intercept term α and systematic risk β of a security and expected return, by regressing the market return at time t, to the security's return during the estimation period [-1, -200].

We used the FTSE All-Share return index as a proxy of market return. Sharpe's (1964) simple Market Model expresses the actual rate of return (R) on the security (i) at time (t) as a function of market return (R_m), in the context of past time series, such that:

$$E(R_{i,t}) = \alpha + \sum_{t=t-n}^{t=n} \beta * R_m + e_t \quad (5.3)$$

Where α is the intercept term, β the systematic risk of security i, and e_t is the error term, with $\sum e_t = 0$.

We also denote $CAR_{(t,t+T)}$ as the cumulative abnormal return of stock *i* at day t to the day t+T, then $CAR_{(t,t+T)}$ is calculated

$$CAR_{(t,t+T)} = \sum_{t}^{t+T} AR_{i,t} \quad (5.4)$$

When estimating the mean abnormal return across all events for a specific event window (t, t+T), we first calculate the abnormal return for each event for each day (in calendar time) on which that abnormal return occurs. For every calendar day, we calculate a mean abnormal return for a portfolio of firms that have qualified abnormal return on that day. This gives a time series of abnormal returns for one specific event window:

$$AAR_{(t,t+T)} = \Sigma\frac{AR}{N} \qquad (5.5)$$

Where N is the number of days with a qualifying abnormal return during the event window. To illustrate the previous point, let us consider the following example: consider three companies are trading on the same day (day 0) and the event window is one day after the announcement date (after day 0). The average abnormal return in this case is equal to the sum of abnormal returns for each company at the announcement date divided by the number of companies (the average abnormal return at day +1 would be calculated similarly). Another way to calculate the average abnormal return is to sum the abnormal returns for each company at day 0 and day +1 (event window) and divide the output by two (number of days in the event window). Average abnormal returns are cumulated to yield the cumulative average abnormal return measure centred around the event date, denoted CAAR (t, t+T)

$$CAAR_{(t,t+T)} = \sum_{t}^{t+T} AAR_{i,t} \qquad (5.6)$$

Back to the previous example, the cumulative average abnormal return is equal to the average abnormal return on the announcement date (day 0) plus the average abnormal return at day 1. Also, the cumulative average abnormal return can be calculated by summing the average abnormal return for each company. Both methods lead to the same results.

For example, suppose there were three transactions by three companies on 4th January 2002. To calculate the average and cumulative abnormal returns for the event window [0, 1], we sum the abnormal returns for each company on the event date which is January 4th and divide the output by the number of companies and we got the average abnormal return for that day. Similarly, we

calculated the average abnormal returns for the next day. By summing the average abnormal returns for the event day and the day after, we got the cumulative average abnormal returns for the event window [0, 1].

However, in this chapter we test whether age has an impact upon the informativeness of directors' trades or whether directors of a particular age are more informed than directors of any other ages.

5.4 Results

This section reports the empirical results of the study. First, summary statistics is presented to highlight the trends and patterns of UK directors' trades. Second, we test whether the informativeness of directors' trades varies with age using a Univariate analysis controlling for only one factor that is likely to af

fect the informativeness, namely transaction type.

5.4.1 Summary Statistics

Table (5.1) and table (5.2) present summaries statistics related to our sample. Initially, there are approximately four times as many buy trades as sells (20,312 buy trades against 4,784 sell trades). Although buy trades are more than sell trades, but the average value of sell trades are approximately ten times bigger which suggests that directors sell less frequently but more in value (similar argument can be said to volume). The average value of directors' purchases was almost £147,373 (with the maximum buy being £575 million in 2007), but the average value of a sale was over one million pounds (with the maximum sell being £437 million in 2006), so directors' sales are fewer in number but much larger in value.

The number of event days is the number of days during the period in which at least one buy (sell) takes place. There are approximately 2,251 event dates (99%) for buy trades and 1,756 event dates (78%) for sell trades. Our sample average is eight shares buy (four shares sell) per event.

Table (5.1) also shows that in our sample the 25,096 events (buys and sells) are related to 2300 separate firms. Specifically, the 20,312 buy transactions were conducted by directors in 2,314 separate firms. Thus, each firm had an average of just over eight transactions. On the other hand, the 4,784 sell transactions were conducted by directors in 1,882 separate firms. Thus, each firm had an average of two transactions.

Besides, 6,700 different directors conducted by transactions during our sample period that give an average of approximately three buy transactions per director (this can be constructed with sells). The median age of directors who buy is 55 years old and 54 for sell trades – which make these medians the same as the means[41].

Table 5.1: Summary Statistics Related to our Sample Categorised by Transaction Type

Transaction type	No Of Trades	Average Value (£)	Volume	No of Event Days	No of Firms	Mean Age	Median Age	Max Value £m	No of Directors
Buy	20,312	147,373	168,944	2,251	2,314	55	55	575	6,700
Sell	4,784	1,488,536	834,731	1,756	1,082	54	54	437	2,414
Total	25,096				2300				

Volume presents the number of stocks traded for each type during the sample period**.** Average value for each type represents the total value for that type divided by the number of trades**.** The number of event days is the number of days during the period in which at least one trade takes place. Age represents the mean age for each type. Number of shares in the table is in terms of billions.

Table (5.2) reports summary statistics related to our sample categorised by both age and transaction type during the sample period. The total number of buy and sell trades by directors between the ages of 55 and 59 was larger than the total number of buy and sell trades by directors of any other group. The average value of buy trades of directors aged between 60 and 65 is £68,000 – which is approximately six times less than the average value of directors over the age of 65 years. Hence, buy trades by directors aged between 60 and 65 are larger in number but much smaller in value.

[41] The average age was equal to the median age.

Turning to director's sells, the average value of director sales over 70 years of age is higher than the average value of other age groups. This average value was roughly £4.1 million, which was at least twice as much as the nearest average value (the second highest value was £1.67 million for directors aged between 65 and 69). On the other hand, the average value for directors under 40 years of age was only £986,948. This means that older directors sell, on average, more than younger directors. This may imply greater liquidity requirements or more desire to diversify with old age. Consistent with table (5.1), the average value of sell transaction is much higher than that of a purchase. This is confirmed across all age groups.

Table 5.2): Summary Statistics Categorised by Age and Transaction Type

Age			*Buy*				*Sell*	
	No of Trades	Average Value (£)	Average Value Without Outliers (£)	Average Volume	No of Trades	Average Value (£)	Average Value Without Outliers (£)	Average Volume
Age under 40	1,008 (5%)	84,043	72,200	188,653	247 (5%)	986,948	670,719	1,774,209
Age between 40 And 44	1,949 (10%)	124,637	105,273	214,828	483 (10%)	1,314,316	872,421	928,730
Age between 45 And 49	3,153 (16%)	69,891	71,109	187,355	830 (17%)	1,013,137	690,214	566,505
Age between 50 And 54	3,547 (17%)	234,513	73,563	216,751	892 (19%)	1,143,304	698,431	804,521
Age between 55 And 59	4,353 (21%)	74,386	63,991	118,071	924 (19%)	1,651,876	706,647	863,279
Age between 60 And 64	3,728 (18%)	68,000	61,135	137,081	761 (16%)	1,566,791	175,128	504,095
Age between 65 And 69	1,858 (9%)	378,755	68,324	144,219	403 (8%)	1,677,346	659,032	762,102
Age over 70	715 (4%)	409,203	175,128	201,723	244 (5%)	4,045,909	896,072	1,763,527
Total	20,312				4,784			

Volume presents the number of stocks traded for each age and type during the sample period, so the average volume presents the total number of shares over the number of trades. Average value for each type represents the total value for that type divided by the number of trades.

The average value of each trade for directors under 40 is £986,948 (sell) and £84,043 (buy). As one can see there is a considerable variation in the average value per transaction across age groups. For example, group 50 to 54 is approximately three times larger than group 60 to 64 although they have similar number of trades. These differences may be driven by a small number of extreme observations. Since these few transactions are unlikely to affect the average abnormal return, we decided not to exclude them.

The number of trades (buys and sells) also increased positively with directors' age just before the age of 60 (the number of trades reaches its highest point for directors who are aged between 55 and 59). After that age, the number of trades decreased as the director became older (this is the case for both directors' buys and sells). Therefore, it looks like age distribution according to number of trades forms an inverse U shape.

5.4.2 Univariate Analysis

Similar to earlier studies (Friederich et al., 2002; Fidrmuc et al., 2006; and Gregory et al., 2009), we conduct a Univariate analysis to test market reactions to directors' trades. Unlike the previous studies, we measure the informativeness of directors' trades using the CAARs associated with different event windows ranging between one and ten days after the announcement date. Table (5.3) and table (5.4) show how the informativeness varies with age and transaction type. Specifically, table (5.3) shows how the informativeness of buy transactions varies with age and table (5.4) examines how the informativeness of sell transactions varies with age. Based on previous literature which finds, as the whole, only buy transactions are informative, we have deliberately split our sample into two. One clear pattern emerges from table (5.3) and table (5.4) which is consistent to our previous patterns, and indicates that sells are negative and insignificant (uninformative) whereas purchases of directors are positive and, as the whole significant. This is consistent with the view that directors' purchases are motivated by market participants containing good information about firm future prospects. Furthermore, the insignificance of sell transactions indicates that market

participants view this as uninformed trades likely to be motivated by liquidity/diversification.

Turning to our original hypothesis, table (5.3) shows how the informativeness of buy transactions varies with director's age. To examine this, we chose eight age categories across five event window.

Based on the previous literature examined in section (5.2), financial decisions are expected to vary with age. On the one hand (Goetzmann and Kumar 2008; Korniotis and Kumar, 2011; and Graham et al., 2013), the informativeness of trades should increase with director's age and therefore experience is likely to be offset by a decline in cognitive ability which may decline with age. By empirically examining how the informativeness varies with age, we may be able to shed light on the effect which dominates.

Since our aim is to examine how the informativeness varies with age, our focus is only on transactions that are likely to be informed by directors' buys. One clear pattern emerges from table (5.3) - informativeness across all windows for the youngest (under 40 age group) is the highest. In general, the informativeness then declines with age until 60 to 64 age groups. This is consistent with the decline in cognitive ability effects dominating the increase in experience. However, this decline in the informativeness seems to stop between the age 60 and 64 suggesting that the role of experience is becoming more prominent. Turning to the age distribution of CAARs for buy trades, we notice that directors who are less than 40 years old generate higher CAARs than all other age groups. Moreover, this trend becomes stronger as the event window increases.

To summarise, our results are consistent with the UK studies by King and Roll (1988), Gregory et al. (1994), and Pope et al. (1990) which find positive (significant) abnormal return associated with buy trades, and negative (insignificant) abnormal return associated with sell trades for different event windows.

When focusing only on informative trades (buy trades), it appears that the market perceives younger directors' (under 40) trades to be more informed than directors' trades of other ages. This declines until 60 to 64 and then levels off. This pattern is perhaps consistent with Agarwal et al. (2009), Fair (2007),

and Grady and Craik, (2000) who suggested that directors' ability to make better decisions decline with age.

Then, the increase in cumulative average abnormal returns after the age of 65 might be due to factors such as experience, education, income, wealth, race, ethnicity, and gender (King and Leape, 1987; Goetzmann and Kumar 2008; and Korniotis and Kumar, 2011) which may lower the adverse effects of cognitive aging.

Table 5.3: The Results of the Univariate Analysis for Directors' Buys

Age		**Event Windows**					**N**
		Announcement Day	[0, 1]	[0, 3]	[0, 5]	[0, 10]	
Age under 40	CAARs	2.32%	3.01%	3.39%	3.49%	4.19%	1,008
	T - Student	6.36	9.08	8.33	7.73	7.49	
Age between 40 And 44	CAARs	1.50%	2.20%	2.74%	2.92%	3.78%	1,949
	T - Student	2.54	8.44	8.02	8.44	9.17	
Age between 45 And 49	CAARs	1.31%	2.09%	2.70%	2.90%	3.41%	3,153
	T - Student	1.47	9.4	9.7	10.08	9.84	
Age between 50 And 54	CAARs	1.38%	2.06%	2.67%	2.88%	3.38%	3,547
	T - Student	2.09	9.75	9.91	10.48	10.93	
Age between 55 And 59	CAARs	1.10%	1.72%	2.28%	2.55%	2.95%	4,353
	T - Student	0.12	7.89	8.21	8.62	8.79	
Age between 60 And 64	CAARs	1.12%	1.67%	2.01%	2.09%	2.31%	3,728
	T - Student	2.5	7.64	7.94	6.83	5.13	
Age between 65 And 69	CAARs	1.31%	1.81%	2.39%	2.46%	2.81%	1,858
	T - Student	1.27	6.04	6.65	6.35	6.32	
Age over 70	CAARs	1.30%	2.04%	2.28%	2.28%	2.94%	715
	T - Student	0.85	5.11	4.6	4.42	4.96	
Total	CAARs	1.50%	2.09%	2.54%	2.72%	3.26%	20,311
	T - Student	3.58	5.78	6.82	6.71	5.86	

This table reports the cumulative average abnormal returns for directors' buys categorised by different age groups for different event windows ranging between one day after the announcement date and +10 days after the announcement date. N refers to the number of trades for each age category.

Table 5.4: The Results of the Univariate Analysis for Directors' Sells

Age		*Event Windows*					*N*
		Announcement Day	[0, 1]	[0, 3]	[0, 5]	[0, 10]	
Age under 40	CAARs	-0.48%	-0.53%	0.22%	-0.26%	-0.81%	247
	T - Student	-0.13	-0.15	0.06	-0.07	-0.22	
Age between 40 And 44	CAARs	0.14%	-0.39%	-0.53%	-1.21%	-1.71%	483
	T - Student	0.06	-0.16	-0.22	-0.51	-0.72	
Age between 45 And 49	CAARs	-0.25%	-0.39%	-0.57%	-0.96%	-1.34%	830
	T - Student	-0.12	-0.19	-0.28	-0.47	-0.66	
Age between 50 And 54	CAARs	-0.27%	-0.58%	-0.2%	-0.45%	-0.82%	892
	T - Student	-0.14	-0.31	-0.1	-0.24	-0.43	
Age between 55 And 59	CAARs	-0.19%	-0.32%	-0.32%	-0.56%	-0.96%	924
	T - Student	-0.13	-0.22	-0.22	-0.39	-0.67	
Age between 60 And 64	CAARs	0.03%	-0.26%	-0.48%	-0.73%	-0.71%	761
	T - Student	0.01	-0.10	-0.18	-0.27	-0.26	
Age between 65 And 69	CAARs	-0.14%	-0.34%	-0.68%	-0.63%	-1.65%	403
	T - Student	-0.07	-0.17	-0.34	-0.32	-0.83	
Age over 70	CAARs	-0.42%	-0.45%	-0.59%	-0.88%	-1.15%	244
	T - Student	-0.19	-0.20	-0.26	-0.39	-0.51	
Total	CAARs	-0.19	-0.26%	0.07%	-0.42%	-0.93%	4,784
	T - Student	-0.07	-0.12	0.03	-0.19	-0.43	

This table reports the cumulative average abnormal returns for directors'' sells categorised by different age groups for different event windows ranging between one day after the announcement date and +10 days after the announcement date. N refers to the number of trades for each age category.

5.5 Multivariate Analysis

Section (5.4) analysed how the informativeness of directors' trades varies with age controlling for only one factor that is likely to affect the informativeness, namely transaction type. However, the previous literature highlighted many factors that may have impact upon the information contained in directors' trades. In this section, our aim is to examine the same hypothesis whilst controlling for other factors. The results and conclusions from our Univariate analysis should be viewed tentatively and are mainly included for comparison with other Univariate studies in this area (Seyhun, 1986; Gregory et al., 1994; Friederich et al., 2002; Fidrmuc et al., 2006; and Gregory et al., 2009).

In this section, we examine how the informativeness of directors' trades varies with age controlling not only for transaction type, but also for firm size measured by market value (see for example, Seyhun, 1988a; Gregory et al., 1994; and Friederich et al., 2002), trade size measured by the value of the trade divided by the market value (Fidrmuc et al., (2006) and Gregory et al., (2009) used value of the trade as a measure of trade size), and holding percentage (see Gregory et al., 2009).

Studies, such as Seyhun (1986), Gregory et al.(1994) and Friederich et al.(2002), examined the impact of firm size upon the informativeness of directors' trades. They argued that directors of smaller companies are more predictable of their company's future prospects than directors of larger companies. This is perhaps because larger companies tend to include more non-executive directors or because directors' trades of larger companies are more public so that stock market reaction is faster (Gregory et al., 1994). Therefore, insiders of smaller firms are more informed about their trades than insiders of larger firms (Seyhun, 1988a; Gregory et al,. 1997; Huddart and Ke, 2007a; and Gregory et al,. 2009).

Besides, trade size has an impact upon the informativeness of directors' trades. Informed traders prefer to trade larger amounts at any given price, whereas uninformed traders do not share this quantity bias. The larger the trade size, the more likely it is that the market maker is trading with an informed trading (Easley and O'Hara, 1987). Informed trades are more concentrated in medium sizes and that price movements are due mainly to informed traders' private

information (Barclay and Warner, 1993). Medium-sized trades as a whole seem more informative than large ones (Friederich et al, 2002). Gregory et al. (2009) used the value of the trade divided by the market value percentage as a measure of trade size (that was in their summary table). Similarly, we used this percentage to control for trade size effects in our multivariate regression.

Scott and Xu (2004) used shares traded as a percentage of insiders' holdings to separate sells driven by liquidity or diversification needs from sells driven by information advantage. Gregory et al. (2009) found that when directors are buying more shares as a percentage of their holdings, buys produce strong signals,

Formally, our hypothesis is tested within the context of the following model;

$$CAAR_{\mathrm{i}} = Age \times Transaction\ Type + Value\ of\ trades + Holding + Market\ Value \qquad (5.7)$$

The dependent variable is the cumulative average abnormal return for the windows (0, 1), (0, 3), (0, 5) and (0, 10). The independent variables are as follows: Value of trades is the natural logarithm of the value of the trade; Holding is the number of shares transacted as a percentage of total holding; Market Value is the natural logarithm of the market value of the firm on the event day; Age is a dummy variable which presents different directors' age categories. In this analysis, as with the Univariate, we have eight age groups. Transaction type is a dummy variable which takes the value of 1 if the transaction is "Buy" or 0 if the transaction is "Sell". In our analysis, we interact Age with Transaction Type to identify whether the informativeness of directors' trades varies with age. Therefore, we used eight age dummies interacted with buy trades and another eight dummies interacted with sell trades assuming no constant term to avoid dummy variables trap. This regression equation will allows us to clearly interpret the parameter estimates.

Table (5.5) shows the results of the multivariate regression for directors' trades. On the whole, our results for buy trades confirm the pattern found in the Univariate analysis. Namely, ceteris paribus, informativeness is significantly positive across all age groups for buy transactions. The following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns for the younger age group (under 40) are the highest.

Thereafter, they decline until the 60 to 65 age group and then begin to level off. In order to formally test whether the abnormal returns associated with buy transactions are significantly different across age groups, we preformed the following test;

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8$$
$$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8$$

As can be seen from table (5.5), the null was rejected across all event windows. Specifically, although abnormal returns are positive and statistically significant across all age groups, they are also statistically different from each other. For example, an F-test of 3.93 for (0, 1) event window confirms the latter. In order to examine whether the CAARs for old and young directors' buy transactions are different, we conducted the following F-test;

$$H_0: \beta_1 = \beta_2$$
$$H_1: \beta_1 \neq \beta_2$$

Where β_1 refers to the coefficients of the first four age groups, whilst β_2 refers to the coefficients of the last four age groups. The results in the last row of table (5.5) show that there is a significant difference between the CAARs of younger directors buy transactions and those of older directors. Giving the size of the buy coefficients across age groups, it is safe to say that younger directors' buy transactions produce significantly higher abnormal returns than older directors.

Turning to the sell transactions, the first thing we notice is that, unlike the Univariate analysis, there is some evidence of statistically significantly negative CAARs for younger directors. For example, across all event windows the 40 to 44 age group has statistically significantly negative abnormal returns. This pattern is again repeated for longer event window for the 45 to 49 age group. Thus, there is some evidence to suggest that sell transactions may be informative across certain age groups. In order to examine whether the CAARs for older (over 70) and young (under 40) directors' buy transactions are different, we conducted the following F-test;

$$H_0: \beta_1 = \beta_8$$
$$H_1: \beta_1 \neq \beta_8$$

The results show that there is a significant difference between the CAARs of younger directors (under 40) buy transactions and those of older directors (over 70). Furthermore, we examine whether directors aged between 60 and 65 buy trades are different from directors aged over 70 buy trades. The results show that there is no significant difference between the CAARs of directors aged between 60 and 65 buy transactions and those of directors aged over 70.

Table (5.5) also shows the impact of our controlling variables. Consistent to our priors, market value is significantly negative i.e. transactions in smaller firms are more informative. Additionally, the size of the trade does not have an impact. Our post event CAARs do not depend on the size of the transaction[42]. Besides, holding percentage is significantly positive. This suggests the larger the number of shares traded as a percentage of holdings, the higher the abnormal return.

[42] Previous studies used many size categories (small, medium, and large) to examine the impact of trade size upon the informativeness of directors' trades, while in our analysis we used trade size as a continuous variable.

Table 5.5: The Result of the Multivariate Regression for Directors' Trades

		Event Windows								*N*
		[0, 1]		[0, 3]		[0, 5]		[0, 10]		
		coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	
Buy	Age under 40	2.87%	12.45	3.19%	11.76	3.20%	10.67	3.64%	9.76	863
	Age between 40 And 44	2.22%	13.4	2.55%	13.07	2.81%	13.02	3.46%	12.88	1710
	Age between 45 And 49	2.13%	16.48	2.59%	16.98	2.81%	16.66	3.19%	15.25	2742
	Age between 50 And 54	2.11%	17.44	2.53%	17.73	2.79%	17.66	3.34%	17.04	3108
	Age between 55 And 59	1.71%	15.5	2.10%	16.21	2.28%	15.88	2.64%	14.79	3797
	Age between 60 and 65	1.63%	13.77	1.86%	13.34	1.92%	12.46	2.12%	11.07	3268
	Age between 65 And 69	1.80%	10.81	2.26%	11.52	2.34%	10.79	2.65%	9.81	1636
	Age over 70	2.12%	8.13	2.32%	7.55	2.40%	7.05	2.83%	6.69	636
Sell	Age under 40	-0.52%	-1.12	-0.19%	-0.35	-0.36%	-0.6	-0.61%	-0.82	208
	Age between 40 And 44	-0.78%	-2.3	-0.98%	-2.45	-1.09%	-2.46	-1.72%	-3.13	419
	Age between 45 And 49	-0.36%	-1.42	-0.50%	-1.65	-0.79%	-2.37	-1.23%	-2.97	719
	Age between 50 And 54	-0.51%	-2.11	-0.38%	-1.34	-0.43%	-1.37	-0.49%	-1.24	751
	Age between 55 And 59	-0.31%	-1.27	-0.32%	-1.08	-0.51%	-1.58	-0.90%	-2.24	783
	Age between 60 and 65	-0.18%	-0.67	-0.32%	-1.04	-0.45%	-1.32	-0.78%	-1.83	663
	Age between 65 And 69	-0.29%	-0.81	-0.42%	-1.01	-0.51%	-1.1	-1.10%	-1.9	351
	Age over 70	-0.60%	-1.3	-0.54%	-0.99	-0.68%	-1.13	-0.41%	-0.54	217
	Market Value	-0.12%	-5.93	-0.15%	-6.34	-0.19%	-7.32	-0.18%	-5.64	
	Value of trades	0.00%	-1.44	0.00%	-1.64	0.00%	-1.7	0.00%	-1.18	
	%Holding	0.04%	3.87	0.05%	3.96	0.06%	3.82	0.07%	3.91	
	Heteroscedacity Test	32.92 (0.6605)		23.76 (0.9548)		30.06 (0.7837)		27.42 (0.8746)		
	Significance across age groups for buys	3.93 (0.003)		3.50 (0.0009)		3.47 (0.001)		3.64 (0.00)		
	Significance across age groups for sells	0.65 (0.713)		0.45 (0.872)		0.29 (0.959)		0.28 (0.961)		
	Under-40 age directors against over-70 age directors	7.86 (0.005)		6.43 (0.011)		3.58 (0.058)		3.48 (0.061)		
	60 to 65 age directors against over-70 age directors	0.00 (0.973)		0.27 (0.602)		0.33 (0.564)		0.08 (0.775)		
	Younger against older (Buy)	4.6 (0.007)		4.47 (0.007)		3.12 (0.008)		2.07 (0.01)		

Value of trades is the value of the trade divided by the market value for each firm on the event date; Holding is the number of shares transacted as a percentage of total holding before the transaction. N refers to the number of trades. The Significance across age groups for buys (sells) is an F-test result for the hypothesis whether buy (sell) coefficient across all age groups is significantly different from each other.

Diagrammatically, the general pattern found in table (5.5) can be seen below in figure (5.1) which shows the distribution of CAAR over different age groups for buy trades and for the five-day event window. The figure indicates a decline in CAAR up to the age of 60 – which registered the lowest CAAR – then an increase in CAAR as directors gets older.

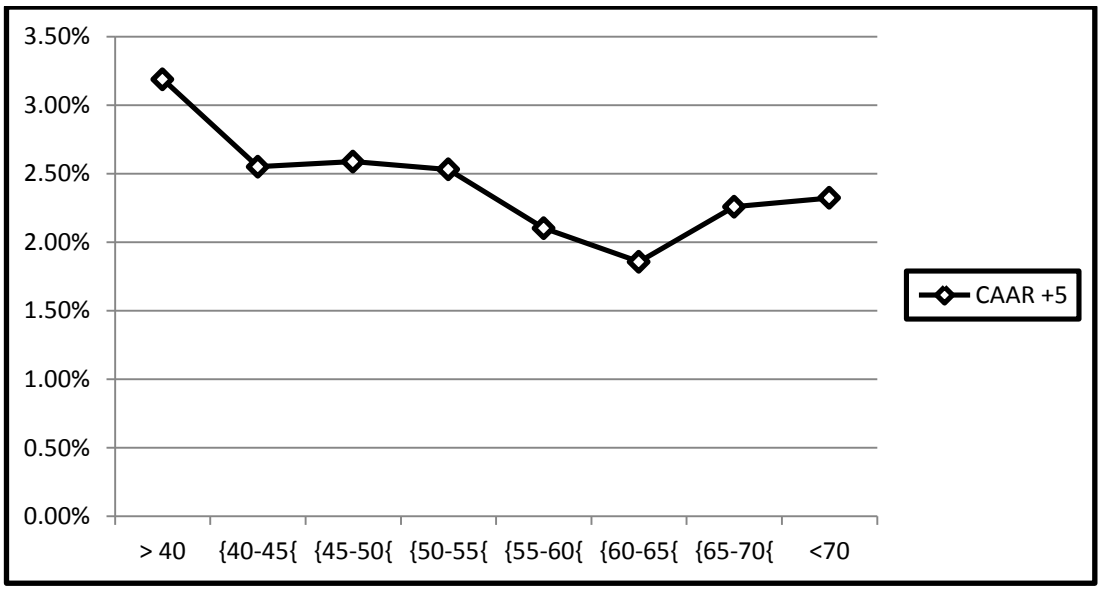

Figure 5.1: The Distribution of CAAR over Different Age Groups for Buy Trades and for the Five-Day Event Window

In conclusion, there appears to be an age-related pattern for buy trades, where directors under 40 were more able to gain high abnormal returns. A decline in the informativeness of directors' trades starting at the under-40 age group, continuing to decrease up to the age group 60 to 65, and then beginning to increase after that age group. Also, there is some evidence of statistically significant negative CAARs for younger directors. For example, across all event windows, the 40 to 44 age group has statistically significantly negative abnormal returns. This pattern is again repeated for longer event window for the 45 to 49 age group. Thus, there is some evidence to suggest that sell transactions are perhaps informative across certain age groups.

These results are in line with the previous literature. For example, Baltes and Lindenberger (1997), and Fair (2007) showed a linear per cent decline in Man (Woman) cognitive and physical abilities between the age of 35 and about age 70 (in our study between ages 40 and 65). After the age of 70, the role of experience, education, wealth, and income may lower the effects of cognitive abilities leading investors to make better financial decisions (King and Leape,

1987; Goetzmann and Kumar 2008; and Korniotis and Kumar, 2011). This might explain the pattern found in Univariate and multivariate analyses for buy trades when examining the informativeness of directors' trades. Our results are also consistent with Kyriacou and Mase (2003), who suggested that the signals generated from executive stock option exercises by younger executives are consistently more informative than those generated from the corresponding exercises by older executives.

5.5.1 Controlling For Director's Type

Another factor that the literature identified and may affect the informativeness of directors' trades is the type of director, e.g. executive director, non-executive director, and former director[43]. It was argued that executive directors are more involved in the daily management of the firm, and have access to more private information than non-executives (Gregory et al., 2009). Using US data, Jeng et al. (2003) tested the informativeness of the trades of three directors' types (top executives[44], other officers, and directors), whereas Fidrmuc et al. (2006) tested the informativeness of the trades of five types of directors in the UK (CEOs, other executive directors, chairmen, other incumbent directors, and former directors). The results implied that the CAARs for the various categories are not significantly different from each other. Gregory et al. (2009) examined whether directors' type (executive or non-executive) has an impact on the informativeness of directors' trades. They found that the market reaction to a director's trade is affected by the category of the director (seniority). Later, Knewtson (2011) found that, for buy activities, Chief Financial Officers (CFOs) generate higher excess returns than Chief Operating Officers (COOs) and Chief Executive Officers (CEOs). This superior trading profitability of CFOs suggested that they are either more skilled at trading or are more willing to use asymmetric information. Based on

[43] Executive directors typically perform operational and strategic functions and are full-time employees of the firm. Non-executives are not generally involved with the operations of the firm; they are mainly hired for their experience and expertise in specific areas to provide advice and objectivity. Former refers to directors who are no longer board members.

[44] Top executives include chief executives, chairman, or president.

these priors, this section also examines the effect of age on the informativeness of directors' trades, whilst also controlling for the type of director.

In our sample, the main three types of directors are: executives, non-executives, and formers. Approximately, 26% of our sample is executives, 39% is non-Executives, and 31% is formers[45].

5.5.1.1 Executive Directors

Table (5.6) shows the results of the multivariate regression for executive directors' trades. On the whole, our results for buy trades confirm the pattern found in the Univariate and multivariate (when we control for firm size, trade size, and holding percentage effects) analyses. In other words, informativeness is significantly positive across all age groups for buy transactions. The following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns for the younger age group (under 40) are the highest. After that, they decline until the 60 to 65 age group and then begin to level off. This is confirmed by the F-test which shows that there is no significant difference between the 60 to 65 age group and over-70 age group.

Similar to table (5.4), table (5.6) shows insignificantly negative CAARs associated with sell trades. Furthermore, table (5.6) indicates the following; market value is significantly negative i.e. transactions in smaller firms are more informative. The size of the trade does not have an impact. Although abnormal returns associated with buy trades are positive and statistically significant across all age groups, they are also statistically different from each other. For example, an F-test of 3.67 for (0, 1) event window confirms the latter. The results in the last row of table (5.6) show that there is a significant difference between the CAARs of younger executives (less than 55) buy transactions and those of older executives (over 55). Given the size of the buy coefficients across age groups, it is safe to say that younger executives' buy transactions produce significantly higher abnormal returns than older executives.

Additionally, the results of F-test show that the abnormal returns associated with buy transactions for the youngest age group (under-40) and the oldest age group (over-70) executives are significantly different; whereas the abnormal returns associated with buy transactions for 60 to 65 and over-70 executives are not.

[45] 4% of our sample is missing or relates to unknown directors' types.

Table 5.6: The Result of the Multivariate Regression for Executives' Trades

		Event Windows								
		[0, 1]		[0, 3]		[0, 5]		[0, 10]		N
		coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	
Buy	Age under 40	3.80%	10.68	4.41%	10.62	4.40%	9.59	5.51%	9.72	295
	Age between 40 And 44	2.61%	9.14	3.15%	9.44	3.28%	8.89	4.13%	9.06	553
	Age between 45 And 49	2.53%	12.4	3.13%	12.19	3.15%	12.16	3.74%	10.66	866
	Age between 50 And 54	2.43%	10.45	2.90%	10.27	3.02%	10.3	3.51%	10.12	891
	Age between 55 And 59	2.07%	7.3	2.55%	7.7	2.87%	7.83	3.34%	7.38	924
	Age between 60 and 65	1.69%	3.95	1.56%	3.72	2.23%	4.03	3.29%	4.8	596
	Age between 65 And 69	1.77%	2.61	1.79%	2.75	1.89%	3.04	3.3%	3.02	251
	Age over 70	1.82%	2.8	1.86%	2.39	1.91%	2.16	1.79%	1.74	173
Sell	Age under 40	-0.81%	-0.99	-1.10%	-1.15	-1.05%	-1	-0.08%	-0.06	63
	Age between 40 And 44	-0.28%	-0.48	-0.65%	-0.95	-0.99%	-1.3	-1.54%	-1.64	100
	Age between 45 And 49	-0.40%	-0.94	-0.55%	-1.11	-0.90%	-1.64	-1.47%	-2.16	211
	Age between 50 And 54	-0.65%	-1.43	-0.65%	-1.23	-0.72%	-1.23	-0.70%	-0.97	216
	Age between 55 And 59	-0.81%	-1.32	-0.86%	-1.2	-0.93%	-1.17	-1.43%	-1.46	171
	Age between 60 and 65	-0.29%	-0.33	-0.68%	-0.68	-0.63%	-0.57	-0.37%	-0.27	122
	Age between 65 And 69	-0.37%	-0.39	-0.69%	-0.62	-0.88%	-0.71	-1.38%	-0.91	92
	Age over 70	-0.01%	0	-0.33%	-0.17	-0.66%	-0.31	-2.80%	-1.06	38
	Value of trades	0.00%	-1.09	0.00%	-0.97	0.00%	-0.61	0.00%	-0.61	
	Holding	0.01%	2.35	0.05%	1.82	0.02%	2.1	0.06%	1.67	
	Market Value	-0.18%	-4.41	-0.23%	-4.72	-0.27%	-5.03	-0.01%	-1.77	
	Heteroscedacity Test	28.37 (0.8447)		23.86 (0.9534)		30.83 (0.7526)		55.01 (0.0286)		
	Significance across age groups for buys	3.67 (0.000)		3.45 (0.001)		1.96 (0.056)		1.67 (0.090)		
	Significance across age groups for sells	0.86 (0.534)		1.01 (0.419)		1.00 (0.427)		0.47 (0.855)		
	Under-40 age directors against over-70 age directors	9.02 (0.002)		7.84 (0.005)		3.87 (0.049)		5.58 (0.018)		
	60 to 65 age directors against over-70 age directors	1.10 (0.294)		0.83 (0.360)		0.54 (0.463)		0.86 (0.355)		
	Young against old (Buy)	7.2 (0,004)		9.09 (0.002)		7.42 (0.005)		9.98 (0.002)		

Value of trades is the value of the trade divided by the market value for each firm on the event date; Holding is the number of shares transacted as a percentage of total holding before the transaction. N refers to the number of trades.

5.5.1.2 Former Directors

Table (5.7) shows the results of the multivariate regression for former directors' trades. On the whole, our results for buy trades confirm the pattern found for executives. In other words, informativeness is significantly positive across all age groups for buy transactions. The following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns for the younger age group (under 40) are the highest. Thereafter, they decline until the age group of 60 to 65 years and then they begin to level off.

Similar to table (5.4), table (5.8) shows insignificantly negative CAARs associated with sell trades. When testing whether the abnormal returns associated with buy trades across all age groups are significantly different, only the results of F-test for three and five event windows show that they are significantly different.

Table 5.7: The Results of the Multivariate Regression for Formers' Trades

		Event Windows								
		[0, 1]		[0, 3]		[0, 5]		[0, 10]		N
Buy		coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	
	Age under 40	2.67%	6.99	2.84%	6.31	2.91%	5.82	3.23%	4.99	343
	Age between 40 And 44	2.33%	8.05	2.58%	7.31	2.76%	7.98	3.19%	7.69	793
	Age between 45 And 49	2.27%	9.79	2.43%	10.41	2.67%	9.81	3.06%	8.95	1125
	Age between 50 And 54	2.15%	9.59	2.28%	10.16	2.59%	9.87	2.70%	9.94	1321
	Age between 55 And 59	1.94%	9.7	2.22%	9.44	2.38%	9.11	2.58%	8.52	1812
	Age between 60 and 65	1.92%	9.26	2.08%	8.27	2.22%	7.97	2.54%	7.6	1465
	Age between 65 And 69	2.12%	7.95	2.38%	7.59	2.52%	7.23	2.63%	6.29	810
	Age over 70	1.78%	4.57	1.90%	4.14	1.97%	3.86	2.76%	4.5	317
Sell	Age under 40	-1.19%	-1.98	-0.95%	-1.34	-1.39%	-1.77	-1.28%	-1.36	123
	Age between 40 And 44	-0.87%	-1.73	-0.94%	-1.59	-0.93%	-1.42	-2.24%	-2.84	216
	Age between 45 And 49	-0.01%	-0.04	-0.29%	-0.6	-0.32%	-0.61	-0.74%	-1.16	301
	Age between 50 And 54	-0.18%	-0.46	-0.09%	-0.21	-0.19%	-0.39	-0.02%	-0.04	360
	Age between 55 And 59	-0.16%	-0.5	-0.20%	-0.53	-0.05%	-0.13	-0.36%	-0.71	503
	Age between 60 and 65	-0.11%	-0.31	-0.08%	-0.19	-0.22%	-0.48	-0.62%	-1.14	433
	Age between 65 And 69	-0.07%	-0.13	-0.39%	-0.67	-0.55%	-0.86	-1.24%	-1.59	191
	Age over 70	-0.15%	-0.24	-0.24%	-0.33	-0.40%	-0.5	-0.84%	-0.88	126
	Market Value	-0.08%	-2.29	-0.07%	-2.05	-0.08%	-1.99	-0.07%	-1.72	
	Value	0.00%	-1.21	0.00%	-1.44	0.00%	-1.55	0.00%	-0.92	
	Holding	0.07%	5.52	0.07%	4.40	0.07%	5.05	0.06%	3.12	
	Heteroscedacity Test	34.26 (0.5982)		35.12 (0.5572)		15.37 (0.9993)		26.03 (0.9114)		
	Significance across age groups for buys	1.22 (0.289)		2.11 (0.039)		2.11 (0.039)		1.17 (0.314)		
	Significance across age groups for sells	1.62 (0.125)		1.02 (0.414)		1.04 (0.399)		0.72 (0.653)		
	Under-40 age directors against over-70 age directors	5.04 (0.024)		3.92 (0.047)		4.62 (0.031)		0.15 (0.701)		
	60 to 65 age directors against over-70 age directors	1.62 (0.203)		1.09 (0.296)		1.13 (0.287)		0.18 (0.668)		
	Young against old (Buy)	4.07 (0.043)		4.43 (0.035)		3.36 (0.066)		2.82 (0.093)		

5.5.1.3 Non-Executive Directors

Non-executives are not generally involved with the day-to-day operations of the firm; they are mainly hired for their experience and expertise in specific areas to provide advice and objectivity. The main role of the non-executives, according to Higgs Reports, is to monitor and support the performance of executives. Non-executives are also board members.

Table (5.8) shows the results of the multivariate regression for non-executive directors' trades. The pattern found in the previous two tables is not repeated for this type of directors. Informativeness is significantly positive across all age groups for buy transactions except for under-40 age group. This is in direct contrast to our previous results.

Secondly, the following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns for the older age group (over 70) are the highest. Therefore, unlike the previous results of Univariate and multivariate analysis, older non-executives' trades seem to be more informative than non-executives of other age groups. This is confirmed by the two F-test results. Although abnormal returns associated with buy trades are positive and statistically significant across all age groups, they are also statistically different from each other. For example, an F-test of 3.80 for (0, 1) event window confirms the latter. The results in the last row of table (5.8) show that there is a significant difference between the CAARs of younger non-executives (less than 55) buy transactions and those of older non-executives (over 55). Given the size of the buy coefficients across age groups, it is safe to say that older non-executives' buy transactions produce significantly higher abnormal returns than younger non-executives.

These results are, perhaps, not as surprising as initially thought because of their very nature, non-executive directors are not involved in everyday operations, but rather employed for expertise and experience the can offer the firm. Our results suggest, but we do not prove, that the market does not view the under-40 group as likely to possess experience or superior expertise. However, the market reacts more strongly to buy transactions of the over-70 non-executives presumably, because they believe experience and expertise is likely to increase with age.

Our results are also consistent with studies by Lusardi and Mitchell (2007), Van Rooij et al. (2007), and Korniotis and Kumar (2011) who found that investors with more experience and more financial knowledge are better decision makers.

Similar to table (5.4), table (5.8) shows insignificantly negative CAARs associated with sell trades.

Furthermore, table (5.8) indicates the following; market value is significantly negative i.e. transactions in smaller firms are more informative. The size of the trade does not have an impact. Holding percentage is significantly positive i.e. the larger the number of shares traded as a percentage of holdings, the higher the abnormal return.

Table 5.8: The Result of the Multivariate Regression for Non-Executives' Trades

		Event Windows								
		[0, 1]		[0, 3]		[0, 5]		[0, 10]		N
Buy		coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	
	Age under 40	0.51%	0.73	0.02%	0.02	0.17%	0.18	-1.32%	-1.12	94
	Age between 40 And 44	2.66%	6.08	2.85%	5.43	3.10%	5.35	3.79%	5.16	249
	Age between 45 And 49	1.14%	3.99	1.37%	3.99	1.63%	4.32	1.93%	4.01	583
	Age between 50 And 54	2.06%	9.53	2.44%	9.41	2.70%	9.44	3.02%	8.32	1,069
	Age between 55 And 59	1.57%	9.06	2.00%	9.64	2.20%	9.59	2.51%	8.64	1,681
	Age between 60 and 65	1.51%	9.24	1.79%	9.12	1.78%	8.22	1.66%	6.05	1,823
	Age between 65 And 69	1.86%	7.75	2.54%	8.8	2.62%	8.23	3.30%	8.15	843
	Age over 70	3.46%	7.28	3.88%	6.81	4.08%	6.49	4.17%	5.21	209
Sell	Age under 40	-1.53%	-0.72	-2.94%	-1.16	-5.12%	-1.82	-4.73%	-1.33	11
	Age between 40 And 44	-1.23%	-1.12	-2.22%	-1.69	-1.62%	-1.12	-0.26%	-0.14	37
	Age between 45 And 49	0.00%	0	-0.15%	-0.13	-0.77%	-0.62	-1.13%	-0.72	50
	Age between 50 And 54	-0.55%	-0.77	-0.73%	-0.84	-0.66%	-0.69	-0.56%	-0.46	89
	Age between 55 And 59	-0.45%	-0.73	-0.50%	-0.68	-0.67%	-0.83	-1.07%	-1.05	161
	Age between 60 and 65	-0.28%	-0.57	-0.66%	-1.1	-0.73%	-1.1	-1.18%	-1.41	191
	Age between 65 And 69	-0.11%	-0.16	-0.29%	-0.38	-0.46%	-0.53	-0.29%	-0.27	114
	Age over 70	-1.09%	-1.4	-0.96%	-1.03	-0.84%	-0.81	-0.25%	-0.19	82
	Value	0.00%	-0.51	0.00%	-0.33	0.00%	-0.55	0.00%	-0.23	
	Holding	0.06%	2.52	0.08%	3.05	0.09%	3.16	0.15%	4.16	
	Market Value	0.10%	-2.97	0.15%	-3.69	0.22%	-4.83	0.26%	-4.44	
	Heteroscedacity Test	57.54 (0.0168)		42.87 (0.2340)		59.23 (0.0116)		38.82 (0.3874)		
	Significance across age groups for buys	3.80 (0.00)		3.49 (0.001)		3.22 (0.002)		3.89 (0.000)		
	Significance across age groups for sells	0.58 (0.773)		0.68 (0.687)		0.77 (0.615)		0.38 (0.914)		
	Under-40 age directors against over-70 age directors	12.29 (0.00)		14.94 (0.00)		14.93 (0.000)		17.48 (0.000)		
	60 to 65 age directors against over-70 age directors	8.50 (0.003)		5.80 (0.016)		5.70 (0.016)		2.98 (0.084)		
	Young against old (Buy)	5.24 (0.022)		4.13 (0.042)		3.7 (0.024)		2.78 (0.062)		

Value of trades is the value of the trade divided by the market value for each firm on the event date; Holding is the number of shares transacted as a percentage of total holding before the transaction. N refers to the number of trades.

To summarise, for executive directors and former directors, the results for buy trades confirm the pattern found in the Univariate and multivariate analysis. In other words, abnormal returns for the younger age group (under 40) are the highest. Thereafter, they decline until the 60 to 65 age group and then they begin to level off.

For non-executive directors, the results for buy trades are unlike the pattern found in the Univariate and multivariate analysis. In other words, older non-executives (over 70) seem to be more informed about their buy trades than younger executives. This result might be due to the older non-executives having more experience or greater financial knowledge or being wealthier or more educated (Lusardi and Mitchell, 2007; Van Rooij et al. 2007; and Korniotis and Kumar, 2011) so they can lower the effects of cognitive abilities and be more informative. Similar to the results of Univariate analysis, the CAARs of directors' sells are insignificant and negative.

5.6 Robustness Check

To confirm that our results are as robust to alternative specifications of the benchmark model, we used the Market Adjusted Returns Model as a robustness check. This robustness check was previously used by Gregory et al. (2009). This benchmark model calculates the abnormal return as follows:

$$\textit{Abnormal return} = \textit{Return } (R_{it}) - \textit{Market Return } (R_{mt}) \qquad (5, 8)$$

This model is an important determinant of the abnormal returns around the event (Benz, 1981; Lin and Howe, 1990; Gregory et al., 2009). The results are presented in table (5.9) only for the multivariate analysis. This is because there is no significant difference in the results except for the size of the coefficients. For example, in a similar fashion to table (5.5) which shows the results of the multivariate regression for directors' trades, table (5.9) confirms the pattern found in the multivariate analysis of directors' trades. The informativeness is significantly positive across all age groups for buy transactions. The following pattern is also noticed; across all windows abnormal returns for the younger

age group (under 40) are the highest. Thereafter they decline until the 60 to 65 age group and then begin to level off.

Turning to the sell transactions, the first thing we notice is that there is some evidence of statistically significantly negative CAARs for younger directors. For example, across all event windows the 40 to 44 age group has statistically significantly negative abnormal returns. This pattern is again repeated for longer event window for the 45 to 49 age group. Thus, there is some evidence to suggest that sell transactions may be informative across certain age groups. Thus, it can be seen the changing in benchmark model has a little impact on our results with only a small quantitative difference between the two methods.

Table 5.9: Robustness Check Results for Directors' Trades

		Event Windows								
		[0, 1]		[0, 3]		[0, 5]		[0, 10]		*N*
		coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	coefficients	T-stat	
Buy	Age under 40	2.73%	16.29	2.72%	14.72	2.64%	13.27	2.62%	11.45	863
	Age between 40 And 44	2.16%	17.88	2.29%	16.34	2.39%	14.91	2.55%	12.89	1710
	Age between 45 And 49	2.04%	20.69	2.17%	20.61	2.37%	19.7	2.44%	17.08	2742
	Age between 50 And 54	2.01%	22.25	2.13%	21.86	2.25%	21.23	2.41%	19.07	3108
	Age between 55 And 59	1.69%	20.29	1.79%	20.59	1.90%	19.9	2.07%	17.39	3797
	Age between 60 and 65	1.65%	18.18	1.65%	16.45	1.68%	15.97	1.64%	14.37	3268
	Age between 65 And 69	1.79%	15.05	2.01%	15.34	2.00%	13.92	2.07%	11.66	1636
	Age over 70	2.20%	12.76143	2.19%	11.59	2.23%	10.99	2.47%	9.71	636
Sell	Age under 40	-0.07%	-1.02	-0.83%	-0.70	-0.37%	-0.72	-0.31%	-0.96	208
	Age between 40 And 44	-0.92%	-3.19	-1.19%	-3.67	-1.07%	-3.45	-1.20%	-3.91	419
	Age between 45 And 49	-0.44%	-2.07	-0.57%	-2.52	-0.78%	-3.27	-1.02%	-3.74	719
	Age between 50 And 54	-0.40%	-2.54	-0.29%	-1.41	-0.17%	-1.43	0.06%	-1.23	751
	Age between 55 And 59	-0.07%	-1.35	-0.21%	-1.71	-0.05%	-1.59	0.00%	-1.82	783
	Age between 60 and 65	-0.06%	-0.72	-0.20%	-1.23	-0.16%	-1.50	-0.15%	-1.65	663
	Age between 65 And 69	-0.13%	-0.88	-0.34%	-1.46	-0.32%	-1.36	-0.40%	-1.73	351
	Age over 70	-0.46%	-1.3	-0.24%	-0.93	-0.20%	-1.02	0.04%	-0.51	217
	Market Value	-0.01%	-2.53	-0.01%	-2.49	-0.01%	-2.76	-0.01%	-2.52	
	Value of trades	0.00%	-1.38	0.00%	-1.62	0.00%	-1.65	0.00%	-1.11	
	%Holding	0.02%	2.97	0.03%	2.99	0.05%	3.14	0.07%	3.2	
	Significance across age groups for buys	4.59 (0.064)		3.53 (0.097)		3.7 (0.096)		4.12 (0.076)		
	Significance across age groups for sells	0.12 (0.737)		0.1(0.759)		0.19 (0.764)		0.41 (o.539)		
	Younger against older (Sell)	0.33 (0.681)		0.89 (0.373)		1.22 (0.301)		1.68 (0.231)		
	Younger against older (Buy)	3.48 (0.09)		3.61 (0.093)		3.87 (0.08)		3.94 (0.08)		

5.7 Conclusions

The previous empirical literature in the general area of information contents of directors' trades has found that the informativeness of directors' trades depends on firm, trade, director characteristics. Regarding the importance of directors' characteristics, to the best of our knowledge, the impact that director's age has on trade informativeness has not yet been examined.

There are many reasons why financial decisions may vary with life cycle. Psychological and physical studies concerning age suggested that memory and cognitive abilities decline with age (Gunesh et al., 2010; Fair 2007; and Grady and Craik, 2000). Intelligence level also declines with age (Baltes and Lindenberger, 1997). Introducing socioeconomic and demographic factors such as education, income, wealth, race, ethnicity, and gender can lower the adverse effects of cognitive aging (Korniotis and Kumar, 2011). Financial literature also suggests there are opposing effects of age. On the one hand, older investors who have more experience and greater investment knowledge are more likely to make effective financial decisions (Goetzmann and Kumar, 2008; Korniotis and Kumar, 2011). On the other hand, the possibility to make unsuitable decisions increases as the director gets older and this might be attributed to the decline of memory (Lusardi and Mitchell, 2007; Van Rooij et al. 2007).

Using a dataset of 2,300 UK companies over the period January 2002 to December 2010 resulting in 25,096 events, we carried out a series of Univariate and multivariate tests to determine the impact of age. Our results indicate the following: the informativeness is significantly positive across all age groups for buy transactions. The following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns for the younger age group (under 40) are the highest. Thereafter they decline until the 60 to 65 age group and then begin to level off. Although abnormal returns are positive and statistically significant across all age groups, they are also statistically different from each other. There is a significant difference between the CAARs of younger directors buy transactions and those of older directors. Giving the size of the buy coefficients across age groups, it is safe to say that

younger directors' buy transactions produce significantly higher abnormal returns than older directors. Turning to the sell transactions, the first thing we notice is that, unlike the Univariate analysis, there is some evidence of statistically significantly negative CAARs for younger directors. For example, across all event windows, the 40 to 44 age group has statistically significantly negative abnormal returns. This pattern is again repeated for longer event window for the 45 to 49 age group. Thus, there is some evidence to suggest that sell transactions may be informative across certain age groups. Consistent with previous findings, market value is significantly negative i.e. transactions in smaller firms are more informative. Also, the size of the trade does not have an impact. Our post event CAARs do not depend on the size of the transaction. Besides, holding percentage is significantly positive. This suggests the larger the number of shares traded as a percentage of holdings, the higher the abnormal return. When controlling for director type, the same pattern found in Univariate and multivariate analysis for buy trades is also identified for executives' and formers' buy transactions. Hence, younger executives (formers) are more informed about their buy trades than executives (formers) of other age groups. Unlike the previous pattern older non-executives (over 70) seem to be more informed about their buy trades than younger non-executives. Regardless the type of director, sells produces insignificantly negative CAARs.

These results are in line with the previous literature on the impact of age on cognitive and physical abilities. For example, Baltes and Lindenberger (1997), and Fair (2007) showed a linear per cent decline in Man (Woman) cognitive and physical abilities between the age of 35 and about age 70 (in our study between ages 40 and 65). After the age of 70, the role of experience, education, wealth, and income may lower the effects of cognitive abilities leading investors to make better financial decisions (King and Leape, 1987; Goetzmann and Kumar 2008; and Korniotis and Kumar, 2011). This might explain the pattern found in Univariate and multivariate analyses for buy trades when examining the informativeness of directors' trades. Our results are also consistent with Kyriacou and Mase (2003), who suggested that the signals generated from executive stock option exercises by younger executives are consistently more informative than those generated from the corresponding exercises by older executives.

The results for non-executive directors' trades are also consistent with studies by Lusardi and Mitchell (2007), Van Rooij et al. (2007), and Korniotis and Kumar (2011) which found that investors with more experience and more financial knowledge are better decision-makers. Therefore, this might indicate that the market reacts more strongly to buy transactions of the over-70 non-executives presumably, because they believe experience and expertise is likely to increase with age.

To summarise, although we have identified age of director as an important determinant of the informativeness of directors' trades, we remain uncertain why the identified pattern exists. We suggest this as an avenue for future researches.

Chapter 6: The informativeness of Directors' Trades: the Impact of Industry Classifications

6.1 Introduction

Previous empirical literature in the general area of insider trading has found that the informativeness of directors' trades differ with trade, firm, and director characteristics. Trade characteristics include the impact of transaction type and trade size. Buy trades are more informative than sell trades because market participants view the insignificance of sell trades is likely to be motivated by liquidity/diversification needs whereas buy trades are likely to be motivated by information advantage type (King and Roll, 1988, Pope et al., 1990; Hillier and Marshall. 2002b; and Gregory et al., 2009). Also, medium-size trades are more informative than other-size trades (Barclay and Warner, 1993; and Friederich et al., 2002).

Firm characteristics include the impact of firm size. For example, insiders' trades in small firms are more informative than insiders' trades in large firms (Seyhun, 1988a, Gregory et al., 1994, Friederich et al., 2002). This is because large firms tend to have more non-executive directors than small firms, but also because directors' trades in large firms are more public which makes market react faster (Gregory et al., 1997).

For director characteristics, previous studies examined the impact of director's type on the informativeness of directors' trades. For example, Jeng et al. (2003) and Fidrmuc et al. (2006) found no impact of directors' types on the informativeness of directors' trades by using US and UK data respectively, whilst Gregory et al. (2009) and Knewtson (2011) reported significant abnormal returns associated with executive directors' trades. They reasoned that executive directors are more involved in daily firm operations than other

directors' types. Recently, Gregory et al. (2012) examined whether the director's gender has an impact upon the informativeness of directors' trades and found that female executives' trades are more informative than male executives' trades.

To the best of our knowledge, an empirical investigation of the effect of industry classification on the informativeness of directors' trades has yet to be examined.

One particular sector has been examined, namely, the bank sector. For example, Madura and Wiant (1995) found that buy transactions by insiders in small banks are more informative than buy trades by insiders in large banks. Other studies, such as Del Brio, Gómez and Perote, (2005), and Lambe (2010), examined whether bank insiders predict future financial crises and found that insiders can predict future crises.

There are many reasons why the informativeness of directors' trades may vary across industries. These are related to information asymmetry differences across industries. Many measures of information asymmetry such as Research and Development expenditure (Aboody and Lev, 2000), industry regulation (Knewtson, 2011), industry concentration (Gugler, 2001; Blair, 1995; Chu and song, 2011), and directors pay (Jung, 2013) have been shown to vary across industries. This variation may enable directors in certain industries to exploit information, trade on the basis of this information and this should manifest itself in higher abnormal returns (Aboody and Lev, 2000).

The aim of this chapter is twofold. Firstly, we examine whether the informativeness of UK directors' trades varies among different industries. Secondly, we investigate whether the level of information asymmetry in an industry influences the informativeness of directors' trades.

We measured information asymmetry by using Research and Development Expenditure, industry volatility, regulation level, competition level, and CEO pays.This study is the first study that takes into account the industry (or the sector) in which a director is employed as a factor in determining the informativeness of directors' trades. Our sample period covers the years 2002 to 2010. There is a total of 40,860 trades by directors over the sample period,

divided into 31,950 purchases of company stock and 8,910 sales distributed over 10 different industries and 19 different super sectors. We examined directors' trades in 3390 UK firms. This is the largest dataset that has ever been used in similar UK studies. For example, Fidrmuc et al. (2006) used the FTSE all small firms, Gregory et al. (2009) used the FTSE 350 companies, whilst others have used the FTSE 100 firms. Standard event study methodology based on the market model is employed using announcement dates as the event dates (Fidrmuc et al., 2006; and Gregory et al., 2011). However, this study uses both industry and sector market indices as proxies for market returns which, to the best of our knowledge, have never been used before.

The chapter is organised as follows. Section (6.2) reviews the previous studies concerning the information content of directors' trades and describes the motivations behind this chapter. Section (6.3) presents the data and methodology. Section (6.4) discusses the results while the conclusions are presented in Section (6.5).

6.2 Literature Review

Since the aim of this chapter is, firstly, to examine whether the informativeness of directors' trades varies across industries, and, secondly, to investigate whether the level of information asymmetry in an industry influences the informativeness of directors' trades, this section is divided into two subsections. Section (6.2.1) reviews the literature on insider trading concerning the informativeness of directors' trades, whereas section (6.2.2) discusses the reasons why information asymmetry varies with industries.

6.2.1 The Informativeness of Directors' Trades

In this section, we review previous studies that examined whether the informativeness of directors' trades varies with trade, firm, and director characteristics.

Lorie and Niederhoffer (1968), Barclay and Warner (1993), Chakravarty (2001), Friederich et al., (2002), and Tavakoli et al. (2012) examined whether the informativeness of directors' trades vary with trade size across insider

groups, and found that medium-size trades are more informative than other-size trades. One proposed explanation is that privately informed traders would concentrate their trades in medium-size trades because small trades are expensive in term of trading cost and large trades might give them away. Moreover, Seyhun (2000) argued that insiders broke up their large trades into smaller medium-size trades to avoid being caught by regulation authorities. However these studies used the number of shares as a measure of trade size. Fidrmuc et al. (2006) and Gregory et al. (2012) used trade value to measure the impact of trade size on the informativeness of directors' trades. The results showed that large trade values are more informative than small trade values.

Also, transaction type has been shown to have an impact upon the informativeness of directors' trades. For example, Finnerty (1976), King and Roll (1988), Pope et al/. (1990), and Degryse et al. (2009) found that buy transactions are more informative than sell transactions. This is because market participants view the insignificance of sell trades to be motivated by liquidity/diversification needs. On the other side, market participants view the significance of buy trades to be motivated by information advantages. Unlike, the previous studies, Hamill et al. (2002) reported significantly negative abnormal returns associated with sell trades implying that directors might sell on the basis of superior knowledge.

The impact of firm size on the informativeness of directors' trades is also analysed by a number of US and UK studies. For instance, studies by William (1986), Rozeff and Zaman (1988), Seyhun (1988), Gregory et al. (1994), and Fidrmuc et al. (2006) found that directors' trades in small firms are more informative than directors' trades in large firms. Gregory et al. (1997) reasoned that because large firms tend to have more non-executive directors than small firms, or because directors' trades in large firms are more public making stock market reactions faster. Also, directors' trades in small firms are more informative because directors in small firms might have more relevant information, or because financial analysts have paid less attention to directors' trades in small firms (Ataullah et al., 2012).

When focusing only on directors' trades in the bank sector, Madura and Wiant (1995) found that directors' buys in small banks are more informative than directors' buys in large banks.

Jeng et al. (2003) and Fidrmuc et al. (2006) examined whether the informativeness of directors' trades varies with director's type. They found no impact of director's type upon the informativeness of directors' trades. On the other side, Gregory et al. (2009) and Knewtson (2011) showed that executive directors' trades are more informative than other directors' trades. This is because executive directors are more involved in firm's daily operations than other directors.

Scott and Xu (2004) added new insight to the literature of insider trading by examining the impact of number of trades as a percentage of directors holding on the informativeness of directors' trades. The main reason is to split sells driven by liquidity needs from sells driven by information advantages. They argued that large sales, as a percentage of holding, reflect superior knowledge of future firm prospects, whereas small sales indicate that insiders sell because of liquidity or diversification needs.

Recently, Gregory et al. (2012) examined the impact of director's gender and found that female executive trades are more informative than male executive trades up to one month event window. Fidrmuc et al. (2012) and Korczak et al. (2012) tested whether country-level shareholder protection has an impact on abnormal returns after directors' trade. Both studies documented that insiders profit more from buying but less from selling in stronger investor protection environments

To summarise, the previous empirical literature in the general area of information contents of directors' trades has found that the informativeness of directors' trades depends on firm characteristics (firm size), trade characteristics (trade size and transaction type), director characteristics (director's type and gender).

To the best of our knowledge, an empirical investigation of the effect of industry classification on the informativeness of directors' trades has yet to be .

Therefore, the first aim of this chapter is to examine whether the informativeness of UK directors' trades varies among different industries.

6.2.2 Industry and Information Asymmetry

Information asymmetry occurs when one or more informed traders have access to private information about the firm future prospects, while other traders have only access to publicly available information (Brown and Hillegeist, 2007). There are many reasons why information asymmetry may vary across industries. These are related to Research and Development Expenditure, industry volatility, competition level, regulation, and Chief Executive Officer (CEO) pays.

6.2.2.1 Research and Development Expenditure

One reason why information asymmetry may vary across industries is Research and Development Expenditure. According to Aboody and Lev (2000) and Joseph and Wintoki (2013), all corporate investments create information asymmetry because insiders can observe investment productivity changes on an individual asset basis, while outside investors can get this information only on specific points in time. Moreover, the extent of information asymmetry is likely to vary across investments. For instance, information asymmetry associated with Research and Development is likely to be higher than tangible and intangible investments. R&D is different from other intangible and physical assets because of a number of reasons. Firstly, many R&D projects such as software programs are unique to the developing firm, whilst other projects related to capital investments such as commercial property share common characteristics across firms within an industry. Thus, observing R&D performance of other firms might not help investors to exploit any useful information about productivity and firm's value of R&D, whereas observing the performance of one retailer would provide investors with valuable information about the performance of other retailers. Secondly, since there is no organised market for R&D similar to other financial assets, there is no specific price to allow investors to exploit information. Thirdly, unlike physical

assets, no information on value and productivity changes of R&D is reported in financial statements.

Additionally, industries with large risky investment in inventive activities, such as Research and Development, where the outcomes are uncertain, idiosyncratic, and long term in nature, exhibit more information asymmetry than industries with low risky investment in Research and Development (Anderson, Banker and Ravindran, 2000; and Barth et al., 2001). In other words, if investment in Research and Development is risky and this risk is priced, then this suggests that industries with high Research and Development earn higher returns. More specifically, in case of uncertainty about firm value, private information held by insiders would be profitable since outsider investors' beliefs about firm value are uncertain (Ke and Huddart, 2007b). In case of R&D, the value of an R&D firms is uncertain for outsider investors which makes the information asymmetry higher in such firms. .

Based on that, Barth et al. (2001) reported that analyst coverage (number of analysts following a firm) is significantly larger for firms with larger research and development and advertising expenses relative to firms with lower or no R&D, because of the private information concerning R&D activities. Additionally, Aboody and Lev (2000) examined whether R&D, as a measure of information asymmetry, can be the source of insider's information. In other words, they examined whether information asymmetry measured by firm's R&D contributes to the relation between insiders and outsider investors which, in turn, enable insiders (formers) to earn from insider activities. However, the results suggest that insider gains in high R&D industries/sectors are higher than insider gains in low or no R&D industries/sectors. Rong (2013) examined insider trading patterns in order to evaluate R&D productivity in 88 U.S. listed firms with the heaviest patenting for the period 1987 -1998. The results showed that insider trading patterns within the firm are significant in explaining the contemporaneous changes in its patent output when controlling for R&D input effects. These results are consistent with the hypothesis that management has privileged knowledge about its R&D productivity which might come from their earlier access to patent-related information. This privileged knowledge increases[46] the information asymmetry between investors

[46] Also, we were aware of the point that it is possible for managers to have some discretion over the allocation of expenses into these categories, for example, increasing R&D expenses

and those managers (insiders). Examples of highly and lightly R&D expenditure industries was previously set by Chauvin and Hirschey (1993). Highly R&D expenditure industries include, for example, industries such as industrial machinery and computing equipment, measuring instruments, photography, electronic equipment, and chemicals, whereas lightly R&D expenditure industries include business and consumer service industries, the financial sector, and retailing.

6.2.2.2 Industry Volatility

Another reason why information asymmetry may vary across industries is industry volatility. The behaviour of stock market volatility is one of the central issues faced by individuals who trade equities, manage portfolios, or engage in capital budgeting (Sadorsky, 2001). This volatility can be caused by private information revealed through trading (French and Roll, 1986; Barclay, Litzenberger and Warner, 1990; and Barclay and Warner, 1993). Moreover, Barclay and Warner (1993) suggested that most of stock market volatility is concentrated in medium-size trades where the private information exists. Campbell et al. (2001), and Crouzille, Lepetit and Tarazi, (2004), under private information assumption[47], studied the characteristics of stock returns at the industry level. Campbell et al. (2001) examined the volatility in utilities, financial services, telecommunications, petroleum/gas, consumer goods, retails, computer, auto, pharmaceutical, and chemicals industries, whereas Crouzille et al.(2003) looked at the volatility of banks, building and construction, chemicals, electrical equipment, pharmaceuticals, and oil engaged companies industries. The results of two previous studies suggested that there is an increase in volatility level in some industries such as petroleum, gas and banks. These results might be due to macro-economic factors or because investment in these industries might be more risky.

To illustrate, a study by Sadorsky (2001) explained why the volatility in sectors such as natural resources is higher than other sectors. One reason is that-investment cost is high (for example, new mining projects can cost millions of

which may have previously been categorised as selling and that it is difficult to align financial numbers with resources used.

[47] They assumed that insiders in high volatility sectors such as Bank and Petroleum and Gas sectors possess large amount of private information.

pounds to build). Another Reason is that - natural resources companies are product producers (such as silver, oil, and gold) these products may have similar properties. For oil and gas, factors such as exchange and interest rates and crude oil price may have an impact on oil and gas sectors stock returns. Boubacar and Morris (2011) stated that bank industry volatility might be due to the nature of their activities and their important role in the economy. However, although these factors might not be related to information asymmetry, they would help in understanding how trades by insiders of these sectors can create information asymmetry between insiders and outsiders.

Moreover, using the same argument of Research and Development Expenditure, investment in high volatile industries is more risky. Thus, information asymmetry would be high in high volatility industries leading insiders to earn higher abnormal returns. For example, banks collect and process information about customers' loans which imply that insiders in bank sector may possess private information, whereas outsiders have limited ability to get valuable information. Another example is the investments in petroleum and gas sector which are uncertain and risky (similar to investments in R&D). Thus, the value of petroleum and gas firms (high volatility firms) is uncertain for outsiders which in turn raise the information asymmetry level between insiders and outside investors.

6.2.2.3 Industry Competition Level

Additional reason why information asymmetry may vary across industries is industry competition (Blair, 1995 and Gugler, 2001). Chu and Song (2011) examined the relationship between industry competition, information asymmetry, and insider trading. They argued that in highly competitive industries (lightly concentrated), market competition forces firms to operate effectively and competitively, and reduce the information asymmetry between minority shareholders and insiders. In low competitive industries (highly concentrated), the tendency for insiders to extract private interests would increase in order to control firm decisions effectively. They argued that information asymmetry is higher in low competitive (highly concentrated) industries compared to high competitive (lightly concentrated) industries. This

suggests that firms in high competition industries are expected to show higher stock returns.

In low competitive industries, returns are less because there is a lack of competition pressure and innovation that motivates firms to become more competitive (Hou and Robinson, 2006). Also, low competitive industries are less risky because they engage in less innovation, and thus lower return is expected (Hou and Robinson, 2006).

Similarly, Guadalupe and Perez-Gonzales (2005) and Ali, Klasa and Yeung, (2009) found that, firms in more concentrated industries provide less informative disclosure to prevent the leakage of useful information to competitors to avoid competition and new rivalry. Therefore, firms in more concentrated industries made less management earning forecasts and less quality disclosure. Hence, these firms should have weak information environment.

Chen and Wang (2012) linked these results with ownership structure of the firm. The results showed high information asymmetry is associated with highly competitive firms if the ownership of managing owners is between 10% and 30%, and low information asymmetry is associated with highly competitive firms if the ownership of managing owners is over 30%.

In the same context, Thomas (2002) found larger information asymmetry in highly concentrated firms. Recently, Ataullah et al. (2012) examined the relationship between information asymmetry and insider trading in high and low diversification industries. The results supported the previous findings of Thomas (2002) and reported that insiders in high concentrated firms may have more information than insiders in low concentrated firms, and therefore have more opportunities to earn higher abnormal returns. These two studies explained the previous findings by the level of forecast errors. Larger forecast errors are associated with highly concentrated firms which lead to higher information asymmetry.

Also, competition level might be influenced by the degree of R&D investments (Ito and Pucik, 1993). For example, in highly competitive industries such as the semiconductor industry, the tendency to invest in R&D is high in order to stay

up-to-date with technological change. Furthermore, less competitive industries tend to invest less in R&D and innovations (Bundell et al., 1999; Gilbert, 2006; and Crespi and Patel, 2008).

6.2.2.4 Industry Regulation

Information asymmetry also varies across firms in different regulated environment. In a highly regulated environment, greater information released to the public reduces the information asymmetry between corporate insiders and outside investors (Knewtson, 2011). Hence, directors' trades are more profitable in lightly regulated environment. Amir, Lev and Sougiannis, (1999) examined how financial analysts contribute to firm value and found that firms in the financial and utilities sectors are considered heavily regulated. Moreover, analysts' contribution is larger in sectors where the informativeness of financial reports is low. McLaughlin and Safieddine (2008) examined whether regulation reduce the information asymmetry between insiders and outsider investors in industrial and utility companies. In this study, industrial firms are likely to be unregulated, whilst utility firms are likely to be regulated. They concluded that regulated utility firms have lower level of information asymmetry and have superior changes in abnormal return performance than unregulated industrial firms which seem to have less negative returns. Knewtson (2011) extended the previous classification of regulated firms to cover financials, utilities, health, pharmaceuticals, consumer food, drink and tobacco. The results indicated that firms in highly regulated industries reduce the information asymmetry between insiders and outsiders by disclosing more information to the markets. Therefore, directors' trades are less profitable in highly regulated industries.

6.2.2.5 Chief Executive Officers Pay

It has been argued that the levels and distributions of CEO pay vary across industries and this variation might be due to industry characteristics, managers' talent, or product market environment (Jung and Subramanian, 2013). This variation is more in industries such as technology, business equipment, and

telecommunication because these industries might be characterised by higher heterogeneity both in firm quality and in managerial talent.

Smith and Watts (1982) suggested that executives in highly growth firms are paid more because of their ability to manage intangible assets. Jo, Li and Pan, (2011) documented that, in highly disclosure environment, CEO are paid more compensation. Increased disclosure might force CEO to reveal more unfavourable information which in turn would demand more compensation. Therefore, firms that pay more compensation to their CEOs have strong information environment which lowers the level of information asymmetry.

Based on a recent study by Demerjian, Lev and McVay, (2012), Wang (2013) examined how the informativeness of directors' trades varies with managerial abilities[48]. The discussion was based on two counter prospects. The first prospect is that trades by high ability managers are more informative (because they might have more private information) and market views their trades to be more credible than those of low ability managers. The other prospect is that trades by low ability managers are more informative because they might have less accurate or less timely reporting and disclosure practices than do high ability managers. In poor information environments, where there are less accurate reporting and disclosure practices, market assessment of firm performance would be poor. Thus, less informative financial reporting leads to higher information asymmetry (which in turn increases insiders' trades).

Linking with Jo, Li and Pan, (2011), high ability managers are expected to receive more share grants as a part of their compensation due to better managerial performance.

The results support the second prospect (trades by low ability managers are more informative than trades by high ability managers). This suggests that firms' information environment is important to explain the informativeness of low ability managers.

Roulstone (2003) and Zhang et al. (2005) found that an increased (decreased) level of insider trading is associated with decreased (increased) pay level. In other words, firms that restrict insider activities pay high compensation rather

[48] Managerial ability is the ability to make accurate and timely assessment of firm future prospects.

than those not restricting insider activities. Denis and Xu (2013) confirmed the previous findings and found that high executive compensation is associated with high insider trading restrictions level.

To summarise, many measures of potential information asymmetry such as Research and Development Expenditure (Aboody and Lev, 2000), industry regulation (Knutson, 2011), industry concentration (Gugler, 2001; Blair, 1995; Chu and song, 2011), and directors pay (Jung and Subramanian, 2013) have been shown to vary across industries. This variation may enable directors in certain industries to exploit information, trade on the basis of this information and this should manifest itself in higher abnormal returns (Aboody and Lev, 2000).

Based on these previous points, the second aim of this chapter is to investigate whether the level of information asymmetry across industry influences the informativeness of directors' trades.

In conclusion, the aim of this chapter is twofold. Firstly, we examine whether the informativeness of UK directors' trades varies among different industries. Secondly, we investigate whether the level of information asymmetry in an industry influences the informativeness of directors' trades.

6.3 Data and Methodology

Similar to previous chapter, the data on insiders' activities for the period 1st January 2002 to 31st December 2010 for UK companies is sourced from the Directors Deals database. This dataset contains information on the industry and super sector in which the director works for all firms listed on the London Stock Exchange. Industry refers to a few general segments in the economy within which a large group of companies can be categorised, whereas sector describes a much more specific grouping of companies with highly similar business activities. In other words, industry contains many sectors[49].

Daily returns, daily market values, Research and Development Expenditure values, and volatility values for the event firms, net sales, total ruminations,

[49] In our study we have 10 industries and 19 sectors.

and the Industry Market indices returns are sourced from DataStream. Since open market sales and purchases are more likely to represent actions taken as a result of special insider information, we only consider ordinary purchases and sales by directors.

After removing duplicate and inaccurate or incomplete transactions, missing announcement dates and transactions dates, there is a total of 40,860 trades by directors over the sample period, divided into 31,950 purchases of company stock and 8,910 sales – meaning there are approximately four times more purchases than sales. The methodology we employ is similar to what is used in the previous chapter, meaning the event study methodology.

In order to undertake an event study based on daily data, we need to identify a daily signal for directors' trades, taking into account multiple and possibly conflicting signals when there are more than one director trades on the same day in the same firm. The standard approach to identifying a daily trading signal is to aggregate the net number of shares traded by each director on a day, and define either a buy or sell signal if the net number of trades is positive or negative. However, this procedure is inappropriate when multiple directors with multiple characteristics are trading on the same day. Our approach is, therefore, similar to our approach in chapter five with small changes. For example, if two directors are trading on the same day in the same company, we have two choices: firstly, to consider this transaction as one transaction (if director's type is the same); or secondly, to consider this transaction as two separate transactions (if director's type is different).

Similar to previous chapter, we decided to use the announcement date as an event date for the same reason discussed in that chapter.

The event period, in our study, ranges from 0 to +10 days after the announcement date. The estimation period for the parameters in the market model starts on day -1 and is 200 days in length.

Previous studies used different industry and sector indices to test for market efficiency assuming that some sectors are efficient while others are not and that the variance of returns for most sectors is largely influenced by their own innovations (Brooks, 2002; Willcocks, 2006; and Petra and Poshakwale, 2008). Also, industry indices mirror the performance of the sector representative firm,

so large firms have high participation to the relative sector index (Pepelas, 2006).

In this chapter, we used ten industry and nineteenth sector indices as a proxy for market return. Sharpe's (1964) simple Market Model expresses the actual rate of return (R) on the security (i) at time (t) as a function of market return (R_m), in the context of past time series, such that:

$$E(R_{i,t}) = \alpha + \sum_{t=t-n}^{t=n} \beta * R_m + e_t \qquad (6.1)$$

Where α is the intercept term, β the systematic risk of security i, and e_t is the error term, with $\sum e_t = 0$.

We used the same equations used before in the previous chapter to calculate the abnormal returns, average abnormal returns, and cumulative average abnormal returns. However, the aim of this chapter is to test two issues. Firstly, we examined whether the informativeness of UK directors' trades varies among different industries. Secondly, we investigate whether the level of information asymmetry in an industry influences the informativeness of directors' trades.

6.4 Results

This section reports the empirical results of the study. First, a summary statistics is presented to highlight the trends and patterns of directors' trades by industries and sectors. Second, to test the informativeness of directors' trades across different industries/sectors we used a Univariate analysis controlling for only one factor that is likely to affect the informativeness, namely transaction type. Third, we examine the same hypothesis whilst controlling for other factors that might have an impact upon the informativeness of directors' trades. Next, we test whether the level of information asymmetry with a sector influences the informativeness of directors' trades whilst controlling for R&D Expenditure, volatility, concentration level, regulation, and Chief Executive Officers pay.

6.4.1 Summary Statistics

Table (6.1) reports summary statistics related to our sample categorised by directors' trades in different industries and sectors. The table shows that the total number of buy trades was approximately three times larger than the total number of sell trades. On the other side, the total value of sell trades was over £13 billion which was roughly two times higher than the total value of buy trades. Thus, directors' buys were higher in number, but of a smaller value. Also, the average value of buy trades is approximately ten times less than the average value of sell trades.

According to industries column, the total number of directors' buy trades in financial industries is higher than the total number of directors' buys trades in other industries. Furthermore, the total value of buy trades in oil and gas and consumer service industries is bigger than the total value of buy trades in other industries. Directors' buy trades in Utilities industries are the lowest in term of total number.

Additionally, the average value of directors' buys are higher than the average value of directors' sells and range between more than ten times less in industries such as basic materials and consumer goods, and two times less in oil and gas industry. For directors' sells, the total number of directors' sell trades in Industrial industries was higher than the total number of directors' sells trades in other industries. Similar to buy trades, the total value of sell trades in Consumer Services industries was the highest among other industries. Although the total number of buy trades overweighs the total number of sell trades, but the total value of sell trades is three times bigger suggesting that directors sell less frequently but more in value.

Turning to the sectors column, the total number of directors' trades in construction and material sectors was higher than the total number of directors' trades in other sectors. Also, oil and gas sectors registered the highest value among all other sectors. Similarly, Directors' buys were higher in number, but of less value except for oil and gas and bank sectors. Similarly, the average value of buy trades is higher than the average value of sell trades for all sectors.

Table 6.1: Summary Statistics Categorised by Directors' Trades in Different Industries and Sectors

Industries	Sectors	BUY			SELL		
		No Of Trades	Value £m	Average Value	No Of Trades	Value £m	Average Value
Basic Materials	Basic Resources	1,268	619	488,104	396	2,773	7,003,073
	Chemicals	400	7	17,695	86	26	303,857
Total		1,668	626	375,296	482	2,799	5,807,777
Consumer Goods	Automobiles and Parts	113	3	28,906	22	3	148,070
	Food and Beverage	832	51	61,197	317	188	593,888
	Personal and Household Goods	1,024	62	60,463	376	343	912,072
Total		1,969	116	58,962	715	534	747,496
Consumer Services	Media	1,948	164	84,388	428	391	913,154
	Retail	1,505	1,353	899,021	568	1,295	2,279,757
	Travel and Leisure	1,674	314	187,366	517	1,374	2,658,201
Total		5,127	1,831	357,142	1,513	3,060	2,022,486
Financials	Banks	792	958	1,209,977	202	403	1,992,649
	Financial Services	5,563	434	77,949	1,308	1,519	1,161,603
	Insurance	1,047	57	54,177	235	333	1,416,663
	Real Estate	1,783	259	145,111	484	444	916,659
Total		9,185	1,707	185,889	2,229	2,698	1,210,619
Health Care	Health Care	1,624	90	55,321	394	326	826,996
Industrials	Construction and Materials	752	66	87,461	207	260	1,256,912
	Industrial Goods and Services	6,342	265	41,782	1,692	1,488	879,332
Total		7,094	331	46,624	1,899	1,748	920,490
Oil and Gas		1,565	2,083	1,331,188	456	1,531	3,356,684
Technology	Technology	2,844	234	82,284	845	734	868,790
Telecommunications	Telecommunications	558	44	78,595	170	152	894,292
Utilities	Utilities	316	40	126,816	207	178	859,575
Total		31,950	7,102	104,776	8,910	13,761	1,076,656

6.4.2 Univariate Analysis

In the same vein with earlier studies (Friederich et al., 2002; Fidrmuc et al., 2006; and Gregory et al., 2009), we conduct a Univariate analysis to test market reactions to directors' trades. Unlike previous studies, we test the hypothesis whether industry (sector) has an impact upon the informativeness of directors' trades.

Table (6.2) and table (6.3) show how the informativeness varies with industry and transaction type. More specifically, table (6.2) examines how the informativeness of buy trades varies with industry and table (6.3) examines how the informativeness of sell trades varies with industry. Based on previous literature which finds, on the whole, only buy trades are informative we have deliberately split our sample into two. We measured the informativeness of directors' trades by using the CAARs associated with different event windows ranging between one and ten days after the announcement date. One clear pattern emerges from table (6.2) which is consistent to previous findings where purchases are positive and significant (informative) across all industries (except for utilities industries). This is also consistent with the view that directors are motivated by market participants as containing good information about firm future prospects.

Another clear pattern emerges from table (6.3) is that, consistent to our priors, sells are negative and insignificant (uninformative) across all industries (up to five days event window). This is also consistent with the view that market participants view the insignificance of sell trades as uninformed trades likely to be motivated by liquidity/diversification, for longer event window (10 days event window), there is some evidence of statistically significantly negative CAARs for directors' trades in basic materials, consumer services, industrials, and telecommunications industries. Thus, there is some evidence to suggest that sell transactions may be informative across certain industries.

Turning to our original hypothesis, table (6.2) shows how the informativeness of buy trades varies with industry. To examine this, we chose ten industries across four event windows. Based on the previous literature (Aboody and Lev, 2000; Choe, 2009; Jo et al., 2011; and Knewtson, 2011), information

asymmetry is expected to vary across different industries due to many factors such as R&D Expenditure, regulation, industry concentration, and CEO pay. This variation enables insiders in certain industries to exploit information and gain higher abnormal returns. Thus, we might expect the informativeness of directors' trades to vary with industry. Since our aim is to examine how the informativeness varies with industry, our focus will be only on informative trades (directors' buys).

One clear pattern emerges from table (6.2) – informativeness across all event windows for directors of technology industries is the highest. This result is consistent with Aboody and Lev (2000) who found that insider gains in technology industries (high R&D) are higher than insider gains in other industries (low or R&D).

To summarise, our results are consistent with the UK studies by King and Roll (1988), Gregory et al. (1994), and Pope et al. (1990) which found positive (significant) abnormal return associated with buy trades, and negative (insignificant) abnormal return associated with sell trades for different event windows. When focusing only on informative trades (buy trades), it appears that market perceives technology industries directors' trades to be more informed than directors of other industries.

Table 6.2: The Results of Univariate Analysis for Buy Trades

(Industry)

Industry		**Event windows**				**No of Trades**
		[0, 1]	[0, 3]	[0, 5]	[0, 10]	
Basic Materials	CAARs	1.81%	1.97%	1.60%	1.61%	1,346
	t-student	4.53	4.92	3.99	4.02	
Consumer Goods	CAARs	1.48%	1.99%	1.78%	1.53%	1,604
	t-student	3.56	4.78	4.27	3.68	
Consumer Services	CAARs	1.96%	2.50%	2.58%	3.07%	4,005
	t-student	4.59	5.85	6.04	7.16	
Financials	CAARs	1.11%	1.47%	1.55%	1.86%	7,444
	t-student	3.11	4.10	4.32	5.19	
Healthcare	CAARs	2.81%	3.41%	3.10%	3.36%	1,255
	t-student	7.59	9.20	8.38	9.06	
Industrials	CAARs	2.21%	2.81%	2.94%	3.08%	5,676
	t-student	5.91	7.51	7.87	8.22	
Oil and Gas	CAARs	2.25%	2.53%	2.42%	1.99%	1,283
	t-student	2.23	2.51	2.39	1.97	
Technology	CAARs	3.61%	4.60%	5.32%	5.34%	2,262
	t-student	4.21	5.35	6.19	6.22	
Telecommunications	CAARs	1.33%	1.99%	1.85%	2.25%	363
	t-student	2.07	3.10	2.88	3.50	
Utilities	CAARs	0.19%	0.22%	0.04%	0.35%	243
	t-student	0.54	0.61	0.12	0.98	

This table reports the cumulative average abnormal returns for directors' buys categorised by industry for different event windows ranging between one day after the announcement date and 10 days after the announcement date.

Table 6.3: The Results of Univariate Analysis for Sell Trades

(Industry)

Industry		**Event windows**				**No of Trades**
		[0, 1]	[0, 3]	[0, 5]	[0, 10]	
Basic Materials	CAARs	-0.41%	-0.62%	-0.62%	-0.92%	398
	t-student	-1.01	-1.53	-1.54	-2.28	
Consumer Goods	CAARs	-0.27%	-0.51%	-0.62%	-0.85%	603
	t-student	-0.51	-0.96	-1.18	-1.60	
Consumer Services	CAARs	-0.22%	-0.21%	-0.06%	-0.33%	1,181
	t-student	-1.85	-1.75	-0.46	-2.71	
Financials	CAARs	-0.35%	-0.62%	-0.91%	-0.60%	1,663
	t-student	-0.45	-0.82	-1.20	-0.79	
Healthcare	CAARs	-0.15%	-0.27%	-0.30%	-0.51%	319
	t-student	-0.51	-0.92	-1.03	-1.75	
Industrials	CAARs	-0.54%	-0.83%	-0.93%	-1.31%	1,536
	t-student	-0.99	-1.52	-1.70	-2.40	
Oil and Gas	CAARs	-0.65%	-0.25%	0.00%	-1.31%	351
	t-student	-0.83	-0.32	0.00	-1.69	
Technology	CAARs	-0.51%	-0.72%	-0.78%	-0.61%	651
	t-student	-1.15	-1.63	-1.78	-1.39	
Telecommunications	CAARs	-0.70%	-0.96%	-1.71%	-1.54%	113
	t-student	-1.06	-1.44	-2.57	-2.32	
Utilities	CAARs	-0.39%	-0.10%	-0.25%	-0.82%	175
	t-student	-0.71	-0.19	-0.45	-1.50	

This table reports the cumulative average abnormal returns for directors' sells categorised by industry for different event windows ranging between one day after the announcement date and 10 days after the announcement date.

Similar to tables (6.2) and (6.3), tables (6.4) and (6.5) show how the informativeness of directors' trades varies with sectors. Specifically, table (6.4) examines how the informativeness of directors' buys varies with sector and table (6.5) examines how the informativeness of directors' sells varies with sector.

The results of tables (6.4) and (6.5) support the previous findings of tables (6.2) and (6.3). Moreover, purchases are positive and significant (informative) across all sectors and sells are negative across all sectors. These results are again consistent with the view that market participants view the significance of buy trades as informative trades likely to be motivated by good information contained in directors' trades.

Since our aim is to examine how the informativeness varies with sector, our focus is only on informative trades (directors' buys). One clear pattern emerges from table (6.4) – informativeness across all event windows for directors of technology sectors is again the highest.

Again, when focusing only on informative trades (buy trades), it appears that the market perceives technology sectors directors' trades to be more informed than directors of other sectors.

Another clear pattern emerges from table (6.5) which is consistent with previous findings and which indicates that sells are negative and insignificant (uninformative) across all sectors (up to five days event window). This is also consistent with the view that market participants view the insignificance of sell trades as uninformed trades likely to be motivated by liquidity/diversification, for longer event window (10 days event window), there is some evidence of statistically significantly negative CAARs for directors' trades in basic resources, automobiles and parts, industrials, goods and services, personal and household goods, and telecommunications sectors. Thus, there is some evidence to suggest that sell transactions may be informative across certain industries.

Table 6.4: The Results of the Univariate Analysis for Directors' Buy (Sectors)

Sector		Event Windows				No of Trades
		[0, 1]	[0, 3]	[0, 5]	[0, 10]	
Automobiles and Parts	CAARs	2.58%	3.10%	2.76%	0.27%	87
	t-student	2.12	2.54	2.27	0.22	
Banks	CAARs	0.17%	0.49%	0.40%	0.81%	611
	t-student	0.69	1.96	1.59	3.23	
Basic Resources	CAARs	1.95%	1.99%	1.59%	1.24%	1,040
	t-student	2.99	3.05	2.43	1.91	
Chemicals	CAARs	1.27%	1.98%	1.77%	2.63%	306
	t-student	2.41	3.76	3.37	5.00	
Construction and Materials	CAARs	2.08%	2.91%	2.85%	3.21%	580
	t-student	5.03	7.01	6.87	7.73	
Financial Services	CAARs	1.05%	1.35%	1.36%	1.56%	4,659
	t-student	4.47	5.75	5.80	6.64	
Health Care	CAARs	0.74%	1.26%	1.37%	1.03%	698
	t-student	1.26	2.15	2.34	1.76	
Food and Beverage	CAARs	2.81%	3.41%	3.10%	3.36%	1,255
	t-student	7.59	9.20	8.38	9.06	
Industrial Goods and Services	CAARs	2.20%	2.80%	2.98%	3.10%	5,096
	t-student	5.66	7.20	7.65	7.96	
Insurance	CAARs	0.99%	1.58%	1.83%	2.57%	725
	t-student	1.53	2.44	2.82	3.96	
Media	CAARs	2.56%	3.33%	3.60%	3.79%	1,558
	t-student	4.80	6.23	6.73	7.09	
Oil and Gas	CAARs	2.25%	2.53%	2.42%	1.99%	1,283
	t-student	2.23	2.51	2.39	1.97	
Personal and Household Goods	CAARs	1.76%	2.14%	1.86%	1.63%	819
	t-student	4.80	5.82	5.05	4.43	
Real Estate	CAARs	1.45%	1.88%	1.96%	2.09%	1,450
	t-student	4.03	5.21	5.44	5.80	
Retail	CAARs	1.82%	1.93%	2.04%	2.76%	1,104
	t-student	5.66	6.00	6.32	8.58	
Technology	CAARs	3.61%	4.60%	5.32%	5.34%	2,262
	t-student	4.21	5.35	6.19	6.22	
Telecommunications	CAARs	1.33%	1.99%	1.85%	2.25%	363
	t-student	2.07	3.10	2.88	3.50	
Travel and Leisure	CAARs	1.33%	1.99%	1.85%	2.25%	1,342
	t-student	2.07	3.10	2.88	3.50	
Utilities	CAARs	0.22%	0.04%	0.35%	243	0.22%
	t-student	0.61	0.12	0.98		0.61

This table reports the cumulative average abnormal returns for directors' buys categorised by sectors for different event windows ranging between one day after the announcement date and 10 days after the announcement date.

Table 6.5: The Results of Univariate Analysis for Sell Trades (Sectors)

Sectors		***Event windows***				***No of Trades***
		[0, 1]	[0, 3]	[0, 5]	[0, 10]	
Automobiles and Parts	CAARs	-3.70%	-5.17%	-4.55%	-3.15%	17
	t-student	-0.85	-1.97	-1.89	-2.53	
Banks	CAARs	-0.05%	-0.46%	-0.37%	-0.42%	172
	t-student	-0.14	-1.21	-0.97	-1.10	
Basic Resources	CAARs	-0.34%	-0.54%	-0.47%	-0.83%	332
	t-student	-1.14	-1.82	-1.57	-2.80	
Chemicals	CAARs	-0.35%	-0.62%	-0.91%	-0.60%	66
	t-student	-0.45	-0.82	-1.20	-0.79	
Construction and Materials	CAARs	-0.58%	-0.47%	-0.56%	-0.78%	163
	t-student	-0.92	-0.65	-0.7	-0.79	
Financial Services	CAARs	-0.09%	0.12%	0.14%	-0.16%	951
	t-student	-0.29	0.38	0.42	-0.49	
Healthcare	CAARs	-0.15%	-0.27%	-0.30%	-0.51%	256
	t-student	-0.51	-0.92	-1.03	-1.75	
Food and Beverage	CAARs	-0.15%	-0.27%	-0.30%	-0.51%	319
	t-student	-0.51	-0.92	-1.03	-1.75	
Industrial Goods and Services	CAARs	-0.53%	-0.71%	-0.86%	-1.20%	1,373
	t-student	-1.11	-1.51	-1.82	-2.54	
Insurance	CAARs	-0.05%	-0.28%	-0.15%	-0.04%	184
	t-student	-0.18	-1.01	-0.53	-0.13	
Media	CAARs	0.00%	-0.28%	-0.80%	-0.98%	338
	t-student	-0.01	-0.52	-1.48	-1.82	
Oil and Gas	CAARs	-0.65%	-0.25%	0.00%	-1.31%	351
	t-student	-0.83	-0.32	0.00	-1.69	
Personal and Household Goods	CAARs	-0.62%	-1.17%	-1.25%	-1.81%	330
	t-student	-0.81	-1.55	-1.66	-2.39	
Real Estate	CAARs	-0.17%	-0.29%	-0.17%	-0.49%	356
	t-student	-0.41	-0.71	-0.41	-1.21	
Retail	CAARs	-0.38%	-0.01%	-0.52%	-1.35%	439
	t-student	-0.8	-0.02	-0.86	-1.81	
Technology	CAARs	-0.51%	-0.72%	-0.78%	-0.61%	651
	t-student	-1.15	-1.63	-1.78	-1.39	
Telecommunications	CAARs	-0.70%	-0.96%	-1.71%	-1.54%	113
	t-student	-1.06	-1.44	-2.57	-2.32	
Travel and Leisure	CAARs	-0.39%	-0.10%	-0.25%	-0.82%	404
	t-student	-0.71	-0.19	-0.45	-1.50	
Utilities	CAARs	-0.51%	-0.72%	-0.78%	-0.61%	175
	t-student	-1.15	-1.63	-1.78	-1.39	

This table reports the cumulative average abnormal returns for directors' sells categorised by sectors for different event windows ranging between one day after the announcement date and 10 days after the announcement date.

6.4.3 Multivariate Analysis

Section (6.4.2) analysed how the informativeness of directors' trades varies with industry/sector controlling for only one factor that is likely to affect the informativeness, namely transaction type. However, the previous literature has highlighted many factors that may have impact upon the information contained in directors' trades. In this section, our aim is to examine the same hypothesis whilst controlling for other factors. The results and conclusions from our Univariate analysis should be viewed tentatively and are mainly included for comparison with other Univariate studies in this area (Seyhun, 1986; Gregory et al., 1994; Friederich et al., 2002; Fidrmuc et al., 2006; and Gregory et al., 2009).

In this section, we examine how the informativeness of directors' trades varies with industry/sector controlling not only for transaction type, but also for firm size measured by market value (see for example, Seyhun, 1988a; Gregory et al., 1994; and Friederich et al., 2002), trade size measured by the value of the trade divided by the market value (Fidrmuc et al., (2006) and Gregory et al., (2009) used value of the trade as a measure of trade size), and holding percentage (see Scott and Xu, 2004 and Gregory et al., 2009).

Studies such as Seyhun (1986), Gregory et al. (1994) and Friederich et al.(2002) examined the impact of firm size upon the informativeness of directors' trades. They argued that the directors of smaller companies are more able to predict their company's future prospects than directors of larger companies. This is perhaps because larger companies tend to include more non-executive directors or because directors' trades of larger companies are more public so that stock market reaction is faster (Gregory et al., 1994). Therefore, insiders of smaller firms are more informed about their trades than insiders of larger firms (Seyhun, 1988a; Gregory et al,. 1997; Huddart and Ke, 2007a; and Gregory et al,. 2009).

Besides, trade size has an impact upon the informativeness of directors' trades. Informed traders prefer to trade larger amount at any given price, whereas uninformed traders do not share this quantity bias. The larger the trade size, the more likely it is that the market maker is trading with an informed trading (Easley and O'Hara, 1987). Informed trades are more concentrated in medium sizes and that price movements are due mainly to informed traders' private

information (Barclay and Warner, 1993). Medium-sized trades as a whole seem more informative than large ones (Friederich et al, 2002). Gregory et al. (2009) used the value of the trade divided by the market value as a measure of trade size (that was in their summary statistics table). Similarly, we used this percentage to control for trade size effects in our multivariate regression.

Scott and Xu (2004) used the traded shares as a percentage of insiders' holdings to separate sells driven by liquidity or diversification needs from sells driven by information advantage. Gregory et al. (2009) found that when directors are buying more shares as a percentage of their holdings, buys produce strong signals.

Formally, our hypothesis is tested within the context of the following model:

$$CAAR = industry + Trade\,Value + Market\,Value + Holding \qquad (6.2)$$

The dependent variable is the cumulative average abnormal return for the windows [0, 1], [0, 3], [0, 5] and [0, 10]. The independent variables are as follows: Trade Value is the natural logarithm of the value of the trade; Market Value is the natural logarithm of the market value of the firm on the event day; Holding is the number of shares transacted as a percentage of total holding; Industry is a dummy variable which represents different industry categories. In this analysis, as with the Univariate, we have ten industry groups. We assumed no constant term to avoid dummy variables trap. Therefore, we have ten dummy variables for the ten industry groups.

Table (6.6) shows the results of the multivariate regression for directors' buys. On the whole, our results for buy trades confirm the pattern found in the Univariate analysis. Namely, ceteris paribus, informativeness is positive across all industries for buy transactions. The following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns for technology industries directors are the highest..

In order to formally test whether the abnormal returns associated with buy transactions are significantly different across industries, we preformed the following test;

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10}$$
$$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq \beta_{10}$$

As can be seen from table (6.5), the null was rejected across all event windows. Specifically, abnormal returns are positive and statistically different across all industries. For example, a *p-value* of 0.0094 for (0, 1) event window confirms the latter.

Table (6.6) also shows the impact of our controlling variables. Consistent with our previous findings, market value is significantly negative i.e. transactions in smaller firms are more informative. Also, trade size has an impact on the informativeness of directors' trades. Therefore, larger trades are more informative than smaller trades. Besides, holding percentage is significantly positive. This suggests the larger the number of shares traded as a percentage of holdings, the higher the abnormal return. Another result also emerges insignificant cumulative average abnormal returns for directors in Utility industries across all event windows.

The test for heteroscedacity reveals high heteroscedacity .i.e. the residuals are not constant or not homogenate. To avoid this, we run robustness check regression, namely, regression diagnostic. Table (1.A) shows the results of diagnostic regression for directors' buys. The coefficients remained the same, but the standard errors were robusted. However, the results, in general, did not change. Hence, buy trades by directors in Technology industry are more informative.

Table 6.6: The Result of the Multivariate Regression for Directors' Buys by Industry

industries	**Event Windows**							
	[0, 1]		[0, 3]		[0, 5]		[0, 10]	
	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics
Basic Materials	1.16%	3.04	1.42%	3.24	1.50%	3.27	0.56%	0.95
Consumer Goods	1.40%	3.77	1.92%	4.53	1.97%	4.42	0.88%	1.53
Consumer Services	1.30%	3.69	1.85%	4.59	1.99%	4.71	1.67%	3.07
Financials	0.81%	2.37	1.24%	3.16	1.41%	3.44	0.83%	1.57
Healthcare	2.17%	5.83	2.68%	6.26	2.63%	5.87	2.05%	3.57
Industrials	1.77%	5.31	2.34%	6.1	2.51%	6.24	1.94%	3.75
Oil and Gas	1.54%	3.91	1.90%	4.21	2.13%	4.5	0.75%	1.23
Technology	2.48%	6.95	3.19%	7.78	3.55%	8.27	3.19%	5.78
Telecommunications	2.23%	4.57	2.40%	4.29	2.32%	3.95	2.51%	3.32
Utilities	0.26%	0.4	1.19%	1.63	1.18%	1.55	0.61%	0.62
Market Value	-0.34%	-9.73	-0.42%	-10.4	-0.43%	-9.81	-0.45%	-8.37
Trade Value	0.33%	9.51	0.33%	8.35	0.37%	8.54	0.42%	7.95
Holding	0.10%	4.11	0.10%	3.56	0.12%	4.01	0.14%	3.78
Heteroscedacity Test	113		166.42		166.43		173.78	
Normality Test	19.749		19.550		19.624		19.694	
Model Specification Test	2.12 (0.0957)		0.66 (0.5750)		4.35 (0.0045)		9.33 (0.00)	
F-statistics	6.75		9.98		26.11		16.05	
	(0.0094)		(0.0016)		(0.00)		(0.0001)	

Table (6.7) shows the results of the multivariate regression for directors' sells. The first thing we notice is that, like the Univariate analysis, sells are negative and insignificant (uninformative) across all industries (up to five days event window). This is also consistent with the view that market participants view the insignificance of sell trades as uninformed trades likely to be motivated by liquidity/diversification. For longer event window (10 days event window), there is some evidence of statistically significantly negative CAARs for directors' trades in almost all industries (except utilities). Thus, there is some evidence to suggest that sell transactions may be informative across certain industries. However, the results of F-statistics show no significantly difference between industries coefficients.

While the majority of previous studies found that sells are uninformative, it is worth noting that Hamil et al. (2002) found that sells are informative and that directors might sell based on the information they possess about their firm future prospects.

Table 6.7: The Result of the Multivariate Regression for Directors' Sells by Industry

industries	**Event Windows**							
	[0, 1]		[0, 3]		[0, 5]		[0, 10]	
	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics
Basic Materials	-0.39%	-0.9	-0.57%	-1.09	-0.92%	-1.58	-1.99%	-2.67
Consumer Goods	-0.41%	-1	-0.56%	-1.13	-0.98%	-1.78	-2.08%	-2.95
Consumer Services	-0.31%	-0.78	-0.38%	-0.78	-0.69%	-1.29	-1.85%	-2.7
Financials	-0.10%	-0.26	-0.12%	-0.25	-0.52%	-1	-1.69%	-2.53
Healthcare	-0.29%	-0.66	-0.45%	-0.85	-0.94%	-1.59	-2.04%	-2.69
Industrials	-0.49%	-1.29	-0.65%	-1.4	-1.13%	-2.19	-2.21%	-3.36
Oil and Gas	-0.70%	-1.57	-0.51%	-0.94	-1.07%	-1.77	-1.34%	-1.74
Technology	-0.49%	-1.21	-0.68%	-1.38	-1.11%	-2.02	-1.91%	-2.72
Telecommunications	-0.52%	-0.95	-0.75%	-1.14	-1.75%	-2.37	-2.69%	-2.85
Utilities	-0.55%	-1.14	-0.43%	-0.74	-0.48%	-0.74	-0.53%	-0.64
Market Value	0.04%	1.25	0.04%	1.02	0.06%	1.4	0.10%	1.89
Trade Value	-0.02%	-0.78	-0.01%	-0.4	0.02%	0.46	0.10%	2.13
Holding	0.01%	0.29	-0.01%	-0.46	-0.01%	-0.37	-0.07%	-1.48
Heteroscedacity Test	34.76 (0.8649)		38.56 (0.7398)		19.33 (0.9997)		52.17 (0.2151)	
Normality Test	16.386		16.479		16.703		15.622	
Model Specification Test	2.51 (0.0571)		1.52 (0.2060)		0.71 (0.5435)		1.60 (0.1878)	
F-statistics	1.1				1		0.88	
	(0.3323)				(0.3662)		(0.3478)	

In order to examine whether the informativeness of directors' trades varies with different sectors, we used the same regression whilst controlling for different sectors instead of industries. In this analysis, as with the Univariate, we have nineteenth sectors.

Similar to tables (6.6) and (6.7), tables (6.8) and (6.9) show the results of the multivariate regression for directors' trades. Specifically, table (6.8) shows the results of the multivariate regression for directors' buys and table (6.9) shows the results of the multivariate regression for directors' sells.

The results of tables (6.8) and (6.9) support the previous findings of tables (6.4) and (6.5). Moreover, purchases are positive and significant (informative) across all sectors and sells are negative across all sectors. These results are again consistent with the view that market participants view the significance of buy trades as informative trades are likely to be motivated by good information contained in directors' trades.

One clear pattern emerges from table (6.8) which indicates that informativeness across all event windows for directors of technology sectors is the highest. Again, when focusing only on informative trades (buy trades), it appears that market perceives technology sectors directors' trades to be more informed than directors of other sectors.

Table (2.A) shows the results of diagnostic regression for directors' buys. The coefficients remained the same, but the standard errors were robusted. However, the results, in general, did not change. Hence, buy trades by directors in Technology industry are more informative.

Table 6.8: The Result of the Multivariate Regression for Directors' Buys (Sectors)

Sectors	Event Windows								No of Trades
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		
	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics	
Banks	0.61%	1.99	0.86%	2.45	0.80%	2.06	0.72%	1.52	791
Basic Resources	1.45%	3.6	1.71%	3.68	1.29%	2.55	0.61%	0.98	1,266
Chemicals	1.19%	2.4	1.75%	3.07	1.42%	2.26	1.78%	2.32	376
Construction and Materials	1.84%	4.17	2.63%	5.2	2.51%	4.53	2.40%	3.54	691
Financial Services	0.68%	1.97	1.09%	2.78	0.94%	2.19	0.70%	1.32	5,405
Food and Beverage	1.24%	2.91	1.75%	3.59	1.58%	2.95	0.80%	1.22	832
Healthcare	2.17%	5.83	2.68%	6.26	2.63%	5.87	2.05%	3.57	1,605
Industrial Goods and Services	2.00%	5.93	2.59%	6.69	2.53%	5.96	2.27%	4.37	6,328
Insurance	1.77%	4.25	2.39%	5	2.39%	4.57	2.31%	3.61	1,045
Media	1.77%	4.71	2.43%	5.64	2.35%	4.98	2.13%	3.7	1,936
Oil and Gas	1.54%	3.91	1.90%	4.21	2.13%	4.5	0.75%	1.23	1.54%
Personal and Household Goods	1.63%	4.01	2.16%	4.62	1.81%	3.54	1.25%	2	1,022
Real Estate	0.85%	2.17	1.28%	2.86	1.09%	2.23	0.72%	1.21	1,726
Retail	1.78%	4.47	2.15%	4.71	2.07%	4.14	2.12%	3.47	1,337
Technology	2.48%	6.95	3.19%	7.78	3.55%	8.27	3.19%	5.78	2.48%
Telecommunications	2.23%	4.57	2.40%	4.29	2.32%	3.95	2.51%	3.32	2.23%
Travel and Leisure	1.05%	2.68	1.61%	3.58	1.43%	2.91	1.39%	2.31	1,651
Market Value	-0.41%	-11.37	-0.50%	-12.03	-0.52%	-11.42	-0.56%	-10.04	
Trade Value	0.32%	9.34	0.33%	8.23	0.37%	8.43	0.42%	7.82	
Holding	0.11%	4.47	0.11%	3.91	0.13%	4.35	0.15%	4.08	
Heteroscedacity Test	128.27		218.40		223		254		
Normality Test	17.777		17.529		17.458		17.149		
Model Specification Test	0.78 (0.5031)		0.79 (0.5015)		3.65 (0.012)		9.66 (0.00)		
F-statistics	6.81 (0.0091)		10.02 (0.0016)		21.91 (0.00)		15.16 (0.0001)		

Table (6.9) shows the results of the multivariate regression for directors' sells. The first thing we notice is that, unlike the Univariate analysis, there is some evidence of statistically significantly negative CAARs for directors' trades in industrial goods and services, and technology sectors. Across all event windows, directors' trades in technology and industrial goods and services have statistically significantly negative abnormal returns. This pattern is again repeated for longer event windows for directors' in retail and personal and household goods sectors. Thus, there is some evidence to suggest that sell transactions may be informative across certain industries.

In conclusion, there appears to be an industry/ sector impact upon the informativeness of directors' trades for buy transactions, where directors in Technology industry/sector were more able to gain high abnormal returns. Also, there is some evidence of statistically significant and negative CAARs for directors in certain industries/sectors such as technology and industrial industries for longer event windows. Thus, there is some evidence to suggest that sell transactions may be informative across certain industries/sectors.

These results, the informativeness of directors' trades in technology and industry/sector, are, somehow, similar to studies such as Aboody and Lev (2000), Gonzales (2006), Ali et al. (2009), McLaughlin and Safieddine (2008), and Knewtson (2011) which found that directors' trades in high R&D, low competition, and low regulated firms are higher than directors' trades in low R&D, high competition, and high regulated firms.

Table 6.9: The Result of the Multivariate Regression for Directors' Sells (Sectors)

Sectors	Event Windows								
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		
	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics	Coefficients	T-statistics	
Banks	-0.34%	-0.65	-0.78%	-1.22	-1.02%	-1.43	-1.54%	-1.68	202
Basic Resources	-0.47%	-1.05	-0.80%	-1.49	-1.13%	-1.86	-2.25%	-2.89	395
Chemicals	-0.37%	-0.6	-0.49%	-0.67	-1.01%	-1.21	-1.40%	-1.32	
Construction and Materials	-0.22%	-0.46	-0.50%	-0.86	-0.74%	-1.12	-1.17%	-1.4	199
Financial Services	-0.21%	-0.54	-0.32%	-0.68	-0.70%	-1.32	-1.88%	-2.78	1,292
Food and Beverage	-0.35%	-0.78	-0.53%	-0.98	-1.01%	-1.66	-1.77%	-2.26	317
Healthcare	-0.35%	-0.8	-0.62%	-1.17	-1.11%	-1.88	-2.16%	-2.83	394
Industrial Goods and Services	-0.60%	-1.55	-0.86%	-1.85	-1.37%	-2.64	-2.47%	-3.72	1,690
Insurance	0.10%	0.21	0.03%	0.05	-0.56%	-0.86	-1.36%	-1.61	235
Media	-0.23%	-0.53	-0.28%	-0.53	-0.30%	-0.51	-1.07%	-1.41	426
Oil and Gas	-0.77%	-1.72	-0.69%	-1.28	-1.25%	-2.07	-1.46%	-1.88	401
Personal and Household Goods	-0.68%	-1.57	-1.15%	-2.19	-1.51%	-2.55	-2.64%	-3.51	375
Real Estate	-0.11%	-0.25	-0.20%	-0.38	-0.63%	-1.08	-1.91%	-2.57	480
Retail	-0.55%	-1.28	-0.77%	-1.49	-1.50%	-2.58	-2.71%	-3.64	529
Technology	-0.55%	-1.36	-0.84%	-1.71	-1.27%	-2.31	-2.02%	-2.88	825
Telecommunications	-0.59%	-1.07	-0.93%	-1.42	-1.94%	-2.62	-2.80%	-2.97	167
Travel and Leisure	-0.31%	-0.73	-0.55%	-1.06	-0.68%	-1.16	-1.92%	-2.57	517
Utilities	-0.62%	-1.29	-0.63%	-1.08	-0.68%	-1.05	-0.63%	-0.76	198
Market Value	0.05%	1.45	0.06%	1.56	0.08%	1.84	0.11%	1.94	
Trade Value	-0.02%	-0.68	-0.01%	-0.21	0.02%	0.63	0.10%	2.32	
Holding	0.01%	0.29	-0.01%	-0.47	-0.01%	-0.38	-0.06%	-1.44	
Heteroscedacity Test	63.36 (0.9262)		87.17 (0.2997)		0.2172		72.55 (0.737)		
Normality Test	15.193		16.760		15.934		15.591		
Model Specification Test	1.90 (0.1270)		1.46 (0.2244)		0.67 (0.5705)		1.75 (0.1550)		
F-statistics	0.78 (0.4584)		0.64 (0.4225)		0.11 (0.7434)		1.74 (0.1876)		

6.4.4 Information Asymmetry and the Informativeness of Directors' Trades

Section (6.4.3) examined how the informativeness of directors' trades varies with industries/sectors. The results showed that the informativeness across all event windows for directors of technology industries/sectors is the highest. This section presents the results of the hypothesis whether the level of information asymmetry in a sector has an impact on the informativeness of directors' trades using the different measures of information asymmetry discussed earlier in the literature section.

6.4.4.1 The Informativeness of Directors' Trades and R&D Expenditure

One reason why information asymmetry may vary across industries is Research & Development Expenditure.

In technology and science based sectors, R&D Expenditure is an important source of information asymmetry between insiders and outsider investors which enables insiders to profit from insider trading (Aboody and Lev, 2000). Hence, directors' trades in high R&D industries/sectors may contain more information than directors' trades in low or no R&D industries/sectors (Barth et al., 2001 and Aboody and Lev, 2000)

One explanation given by Barth et al. (2001) is that investment in intangible assets such as R&D is risky and uncertain making sectors with high R&D Expenditures exhibit more information asymmetry. Thus, in high R&D industries, outside investors should regard directors' trades (insiders) as being more informative than low R&D industries. Further, in high R&D industries, where potential information asymmetry is high, any private information which the directors may have is more valuable to them than in low R&D industries.

Based on these previous points, this section examines whether the informativeness of directors' trades varies with sectors based on R&D expenditure. Specifically, based on our priors, we may expect directors' trades

in highly R&D sectors to be more informed than directors' trades in lowly R&D sectors.

There are many ways to calculate Research and Development Expenditure for each sector. One way is, across all firms within a sector, to divide Research and Development value for each firm over the total sales for that firm on the chosen date. In other words, the equation is:

$$Reserch\ and\ Developement\ Expenditure_{Sector} = \frac{1}{N}\sum_{1}^{N}\frac{R\&D}{Sales} \tag{6.3}$$

Where N refers to the number of firms.

Another way to calculate Research and Development Expenditure is to add weights to the previous equation such as market value. Therefore the equation becomes as follows;

$$Reserch\ and\ Developement\ Expenditure_{Sector} = \frac{1}{N}\sum_{1}^{N} W_j\ \frac{R\&D}{Sales} \tag{6.4}$$

W_j is a value-weighted variable which captures the effect of firm size measured by market capitalisation. Additionally, there is another way of calculation through this equation;

$$Reserch\ and\ Developement\ Expenditure_{Sector} = \frac{\sum R\&D}{\sum Sales} \tag{6.5}$$

For example, suppose the total sells for company A and company B are 20 and 30 respectively and the Research and Development Expenditures are 4 and 8.both of these companies are working in Financial sector. To calculate the Research and Development Expenditure for the specified sector, we divide the Research and Development Expenditures for each company by total sells (i.e. 4/ 20 for company A and 8/30 for company B). Then, we sum the outputs

(4/20=0.2 for company A + 0.26 for company B = 0.46) and divide the results over the number of companies (0.46/2=0.23). Another way to calculate Research and Development Expenditures is by summing the Research and Development Expenditures values for the firms operating in the same sector (4+8=12) as well as the total sells (20+30=50) and then divide the results (12/50=0.24). Both methods indicates that Financial sector spends 24% on Research and Development projects. Assuming the market values for companies A and B are 5 and 2 respectively, we can also calculate the Research and Development Expenditures by multiplying the market values by Research and Development Expenditures for each company (5*4=20 and 2*8=16) and summing the outputs (46). Then, we divide the output over the sum of sells (50) and then by the number of companies (2).

All three measures of R&D Expenditure were calculated, and the results presented in table (6.10) are qualitatively similar. Therefore, the results focus only on the second measure. Table (6.10) shows the distribution of Research and Development Expenditure per sector based on this measure of R&D. We split our sample into three groups:

- High R&D expenditure sectors include healthcare and technology;
- Medium R&D expenditure sectors include automobiles and parts; industrial goods and services; chemicals; personal and household goods; telecommunications; oil and gas; travel and leisure; media; utilities;
- Low or No R&D expenditure sectors include food and beverage; banks; retailers; real estates; insurance; financial services; basic resource; construction and materials.

This table shows that sectors such as healthcare and technology invest more in Research and Development where they invest approximately 15% and 14% respectively (High Research and Development), whereas sectors, such as banks, insurance, and retail invest less in Research and Development.

Table 6.10:The Average R&D Expenditure for Each Sector

Sector	Average Research and Development Expenditure
Healthcare	15.17%
Technology	14.32%
Chemicals	6.31%
Automobiles and Parts	5.21%
Media	4.09%
Utilities	4.02%
Industrial Goods and Services	3.05%
Travel and Leisure	2.70%
Oil and Gas	2.35%
Telecommunications	2.33%
Personal and Household Goods	1.21%
Construction and Materials	0.95%
Food and Beverage	0.93%
Retail	0.86%
Basic Resources	0.34%
Financial Services	0.22%
Banks	0%
Insurance	0%

Formally, our hypothesis istested within the context of the following model;

$$CAAR_{\mathrm{i}} = Sector \times Transaction\,Type + Trade\,Value + Market\,Value + Holding \qquad (6.6)$$

Similar to multivariate analysis, we attempted to control for other factors that affect the informativeness by including market value, trade value, and holding. We also consider that transaction type is a dummy which takes the value of 1 if the transaction is "Buy" or 0 if the transaction is "Sell", and sector is a dummy variable for the three R&D categories (High R&D, Medium R&D, and Low R&D). In our analysis, sector and transaction type are interacted in order to identify whether the informativeness of directors' trades varies across different sector groups. Thus, we used three sector dummies interacted with buy trades and another three dummies interacted with sell trades assuming no constant term to avoid dummy variables trap. Table (6.11) shows the results of the

multivariate regression for directors' trades. Again, purchases are significantly positive across all sector groups. One clear pattern emerges from table (6.11) - informativeness across all event windows for high R&D sector group (for directors' buy trades) is the highest.

In order to formally test whether the abnormal returns associated with buy transactions are significantly different across sector groups, we preformed the following test;

$$H_0: \beta_{High\ RandD} = \beta_{Medium\ RandD} = \beta_{Low\ RandD}$$
$$H_1: \beta_{High\ RandD} \neq \beta_{Medium\ RandD} \neq \beta_{Low\ RandD}$$

As can be seen from table (6.11), the null was rejected across all event windows. Specifically, although abnormal returns are positive and statistically significant for all buys in respective of sector R&D Expenditure, they are also statistically different from each other. For example, a *p-value* of 0.00 for (0, 1) event window confirms the latter. Therefore, the informativeness of directors' trades in high R&D sectors is significantly different from those in low R&D sectors. This is also the case of sell trades as can be seen from the last row of table (6.11).

Again, when focusing only on informative trades (buy trades); it appears that the market perceives directors' trades in high R&D sectors to be more informative than directors' trades in other sectors.

Turning to directors' sells, there is some evidence of statistically significantly negative CAARs for directors' trades in high R&D sectors. For example, across all event windows directors' trades in high R&D sectors have statistically significantly negative abnormal returns. Thus, there is some evidence to suggest that sell transactions may be informative across certain industries.

Studies by Barth et al., (2001) and Aboody and Lev (2000) found that insider gains in high R&D firms are higher than insider gains in low or no R&D firms. The first study used a sample of financial analysts whereas the second sample used a sample of former directors. Our results added to the previous studies by identifying that the informativeness of directors' trades is highest for directors in high R&D sectors.

Table 6.11: The Result of the Multivariate Regression by Sectors Categorised by R&D Expenditure Level

Industry	Event Windows								N
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		
	coefficients	T-statistics	**coefficients**	T-statistics	**coefficients**	T-statistics	**coefficients**	T-statistics	
High R&D sectors (Buy)	2.40%	7.13	3.14%	8.05	3.06%	7.16	2.63%	5.02	**3,451**
Medium High R&D sectors (Buy)	1.62%	4.99	2.20%	5.87	2.01%	4.88	1.54%	3.05	6,214
Low R&D sectors (Buy)	1.04%	3.15	1.52%	4	1.27%	3.04	1.07%	2.1	12,375
High R&D sectors (Sell)	-1.18%	-2.69	-1.06%	-2.07	-1.45%	-2.59	-1.93%	-2.83	9,51
Medium High sectors R&D (Sell)	-0.67%	-1.7	-0.38%	-0.83	-0.72%	-1.44	-1.21%	-1.98	1,767
Low R&D sectors (Sell)	-0.30%	-0.77	0.00%	-0.01	-0.29%	-0.58	-1.02%	-1.65	3,321
Market Value	-0.31%	-11.25	-0.37%	-11.72	-0.38%	-11	-0.39%	-9.16	
Trade Value	0.22%	8.31	0.22%	7.37	0.26%	7.81	0.32%	7.79	
Holding	0.07%	3.36	0.06%	2.67	0.08%	3.08	0.08%	2.7	
Heteroscedacity Test	32.93 (0.6605)		23.76 (0.9548)		30.06 (0.7837)		27.42 (0.8746)		
Normality Test	14.942		16.388		18.299		16.432		
Model Specification Test	0.85 (0.4675)		0.51 (0.6732)		1.47 (0.2193)		7.04 (0.0001)		
$\boldsymbol{\beta_{High\ RandD\ Buy} = -\beta_{High\ RandD\ Sell}}$	2.73		5.94		2.97		0.37		
	(0.0986)		(0.0148)		(0.0850)		(0.5454)		
F-statistics (Buy)	38.27		57.90		58.97		27.91		
F-statistics (Sell)	(0.00)		(0.00)		(0.00)		(0.00)		
	5.59		5.788		5.84		2.40		
	(0.0037)		(0.0031)		(0.0029)		(0.0908)		

6.4.4.2 The Informativeness of Directors' Trades and Volatility

Another reason why information asymmetry may vary across industries is industry volatility. Investment in high volatile industries might be more risky and uncertain making sectors with high volatile exhibit more information asymmetry. Thus, in high volatile outside investors should regard directors' trades (insiders) as being more informative than low volatile. Further, in high volatile industries, where potential information asymmetry is high, any private information directors may have is more valuable to them than in low volatile industries.

Based on the previous points, this section examines whether industry volatility as a measure of information asymmetry influences the informativeness of directors' trades. Specifically, based on previous findings, we may expect directors' trades in highly volatile sectors to be more informed than directors' trades in lowly volatile sectors.

We measured industry volatility in three ways. One way to measure industry volatility is by estimating Beta term from the covariance of industry index monthly returns. Another way of calculating industry volatility is by collecting yearly (or quarterly) beta values for each firm in an industry from DataStream and average them over the period of study. Moshirian and Wu (2009) calculated Bank sector volatility by constructing bank sector portfolios and value-weighted[50] excess returns for each portfolio. Then, they ran the following regression to obtain the beta;

$$R_{it} = \beta_i R_{mt} + \varepsilon_{it} \qquad (6.\ 7)$$

Where R_{it} is the quarterly value-weighted bank excess return, R_{mt} is the quarterly market excess return, β_i is the beta of the banking industry, and ε_{it} is

[50] Weights are based on market capitalisation.

the error term. Finally, they used weekly data to construct bank sector volatility as follows;

$$VOL_{it} = VAR(R_{it}) = \beta^2{}_i var(R_{mt}) + \sigma^2{}_{it} \quad (6.8)$$

The results of the three measures of industry volatility are qualitatively similar. Therefore we only reported the results of the first measure.

Table (6.12) shows the average volatility per sector based on the first measure of industry volatility. Beta, as a measure of volatility, represents the tendency of stock's returns to response to market swings. Less than one Beta means that the stock return is less volatile than market, whereas more than one Beta means that the stock return is more volatile than the market. Thus, we split our sample based on industry volatility into two categories. High volatility sectors such as oil and gas, basic materials, banks, insurance, technology, media, automobiles and parts, industrials, chemicals, and telecommunications, and low volatility sectors for the remaining industries.

Table (6.12) shows that sectors such as technology and automobiles and parts experience high volatility, whereas sectors such as utilities and real estate experience low volatility.

Table 6.12: Average Volatility for Each Sector over the Sample Period

Sector	Average Volatility
Automobiles and Parts	1.70
Technology	1.58
Basic Resources	1.37
Media	1.16
Banks	1.13
Telecommunications	1.08
Industrial Goods and Services	1.03
Chemicals	1.02
Oil and Gas	1.01
Insurance	1.01
Construction and Materials	0.98
Retail	0.94
Healthcare	0.92
Financial Services	0.92
Real Estate	0.84
Personal and Household Goods	0.80
Travel and Leisure	0.71
Food and Beverage	0.60
Utilities	0.51

Similar to multivariate analysis, we use the same regression where the dependent variable is the CAARs for different event windows, whereas the independent variables are: market value, trade value, holding which are defined before, and sector which is a dummy variable for the two sectors volatility categories. In our analysis, we have two sector dummy variables one for high volatility sectors and the other for low volatility sectors.

Table (6.13) shows the results of the multivariate regression for directors' trades. Similar to previous findings, purchases are significant and positive across all sectors groups, whereas sells are insignificant and negative across all sectors groups.

One clear pattern emerges from table (6.13) – the informativeness of directors' buy trades across all event windows for high volatility sectors is the highest.

In order to formally test whether the abnormal returns associated with buy transactions are significantly different across sectors groups, we preformed the following test;

$$H_0: \beta_{High\ Volatility} = \beta_{Low\ Volatility}$$
$$H_1: \beta_{High\ Volatility} \neq \beta_{Low\ Volatility}$$

As can be seen from table (6.13), the null was rejected across all event windows. Specifically, although abnormal returns are positive and statistically significant across all sectors, they are also statistically different from each other. For example, a *p-value* of 0.00 for (0, 1) event window confirms the latter. Thus, the informativeness of directors' trades in high volatility sectors is significantly different from those in low volatility sectors. This is not the case for sell trades as can be seen from the last row of table (6.13). Again, when focusing only on informative trades (buy trades), it appears that market perceives directors' trades in high volatile sectors to be more informative than directors' trades in other sectors.

Studies by Campbell et al. (2001), and Crouzille et al. (2004) found that there is an increase in volatility level in some industries which might be due to private information revealed through trading. However, our results showed that insider gains are highest for directors in high volatile sectors.

Table (3.A) shows the results of diagnostic regression for directors' trades. The coefficients remained the same, but the standard errors were robusted. However, the results, in general, did not change. Hence, insider gains are highest for directors in high volatile sectors.

Table 6.13: The Result of the Multivariate Regression by Sectors Categorised by Volatility Level

Industry	Event Windows								**N**
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		
	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	
High Volatility sectors (Buy)	1.98%	6.13	2.63%	7.01	2.51%	6.1	2.04%	4.06	12,977
Low Volatility sectors (Buy)	1.18%	3.63	1.72%	4.55	1.44%	3.48	1.15%	2.28	11,823
High Volatility sectors (Sell)	-0.57%	-1.46	-0.28%	-0.61	-0.63%	-1.26	-1.17%	-1.91	3551
Low Volatility sectors (Sell)	-0.27%	-0.71	0.04%	0.09	-0.24%	-0.49	-0.97%	-1.6	3365
Market Value	-0.33%	-12.21	-0.40%	-12.7	-0.41%	-11.97	-0.42%	-9.82	
Value	0.21%	8.2	0.22%	7.24	0.26%	7.7	0.31%	7.75	
Holding	0.07%	3.66	0.07%	2.99	0.09%	3.39	0.09%	2.88	
Heteroscedacity Test	20.85 (0.0760)		17.98 (0.1582)		24.42 (0.0275)		38.99 (0.0002)		
Normality Test	22.750		22.836		22.677		22.795		
Model Specification Test	0.83 (0.4762)		0.26 (0.8531)		0.77 (0.5089)		3.84 (0/009)		
$\beta_{Lpw\ Volatility} = \beta_{High\ Volatility}$	3.45 (0.0318)		5.40 (0.0045)		3.33 (0.0358)		1.38 (0.2515)		
F-statistics (Buy)	85.39 (0.00)		82.13 (0.00)		94.15 (0.00)		43.28 (0.00)		
F-statistics (Sell)	2.85 (0.0912)		2.46 (0.1170)		2.99 (0.0838)		0.51 (0.4750)		

6.4.4.3 The Informativeness of Directors' Trades and Competition Level

Information asymmetry is likely to vary across firms in differently competitive environments. In highly competitive environments, market competition forces firms to operate effectively and competitively, and reduce the information asymmetry between corporate insiders and outside investors (Chu and Song, 2011). Hence, directors' trades are more profitable in lightly competitive environments.

Based on these priors, this section examines whether industry concentration as a measure of information asymmetry influences the informativeness of directors' trades. Specifically, based on our previous findings, we may expect directors' trades in lowly competitive sectors to be more informed than directors' trades in highly competitive sectors. Similar to previous studies (Gregg, Jewell and Tonks, 2005), we measured industry concentration using the Herfindahl index, which is defined as

$$\text{Herfindahl}_j = \sum_{i=1}^{I} S_{ij} \qquad (6.9)$$

Where S_{ij} is the market share of firm i in industry j. We performed the above calculations each year for each industry, and then averaged the values over the past nine years. This ensures that potential data errors do not have undue influence on our Herfindahl measure (Hou and Robinson, 2006).

The study uses total sales to calculate market share as this is the most common Herfindahl measure. Small values of the Herfindahl Index (0–1800) imply that the market is shared by many competing firms, while large values (1800–10,000) indicate that market share is concentrated in the hands of a few large firms.

For example, suppose the total sells for company A and company B are 2 and 8 respectively. To calculate the Herfindahl value, we divide the total sells for each company by the sum of total sells (i.e. 2/ 2+8 for company A and 8/2+8 for company B). Then, we squared the outputs (2/10=0.2^=0.4 for company A

and 1.6 for company B) and sum the results and multiply them by 1000 (0.4+1.6=2*1000=2000). Hence, the industry, in which these firms operate, is considered highly concentrated (Herfindahl value is between 1800-10000).

Turning to our hypotheses, in this section we examine whether sectors, measured by their concentration level, have an impact upon the informativeness of directors' trades. To examine this, we chose two sectors groups (high and low concentrated sectors) over four event windows.

Based on Herfindahl measure, we split the sample into two categories. High concentrated sectors such as automobiles and parts, chemicals, basic resources, healthcare, insurance, oil and gas, telecommunication, and utilities. Low concentrated sectors such as banks, construction and materials, financial services, food and beverage, industrial goods and services, media, personal and household goods, real estate, retails, technology, and travel and leisure.

Similar to the multivariate analysis, we used the same regression where sector is a dummy variable for the two sectors concentration categories (High concentrated sectors and low concentrated sectors). Table (6.14) shows the results of the multivariate regression for directors' trades. Again, purchases are significantly positive across all sectors groups.
One clear pattern emerges from table (6.14) – the informativeness of directors' buy transactions across all event windows for high concentration sectors group is the highest.

In order to formally test whether the abnormal returns associated with buy transactions are significantly different across sectors groups, we preformed the following test;

$$H_0: \beta_{\text{High concentration}} = \beta_{\text{Low concentration}}$$
$$H_1: \beta_{\text{High concentration 1}} \neq \beta_{\text{Low concentration}}$$

As can be seen from table (6.14), the null was rejected across all event windows. Specifically, although abnormal returns are positive and statistically significant for all buys in respective of industry concentration, they are also statistically different from each other. For example, a *p-value* of 0.00 for (0, 1) event window confirms the latter. Thus, the informativeness of directors' trades

in high concentrated sectors is significantly different from those in low concentrated sectors. On the other hand, this is not the case of sell trades as can be seen from the results of the F-test (Sell) of table (6.14).

Once again, when focusing only on informative trades (buy trades), it appears that market perceives directors' trades in low concentrated industries to be more informative than directors' trades in other sector groups.

Similar to multivariate analysis results, market value, trade value and holding have an impact on the informativeness of directors' trades. Turning to directors' sells, there is some evidence of statistically significantly negative CAARs for directors' trades in high concentrated industries. Thus, there is some evidence to suggest that sell transactions may be informative across low concentrated sectors.

Table (4.A) shows the results of diagnostic regression for directors' trades. The coefficients remained the same, but the standard errors were robusted. However, the results, in general, did not change. Hence, informativeness of directors' trades is lowest for directors in less concentrated sectors.

Thomas (2002) and Ataullah et al. (2012) reported that insiders in high concentrated firms may have more information than insiders in low concentrated firms, and, therefore, have more opportunity to earn higher abnormal returns. We added to the previous literature by finding that the informativeness of directors' trades is lowest for directors in less concentrated sectors.

Table 6.14: The Result of the Multivariate Regression by Sectors Categorised by Concentration Level

Industry	Event Windows								**N**
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		
	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	
Low Concentrated Industries (Buy)	1.06%	3.26	1.59%	4.24	1.32%	3.2	1.04%	2.05	8793
High Concentrated Industries (Buy)	1.87%	5.82	2.53%	6.77	2.36%	5.77	1.88%	3.75	8013
Low Concentrated Industries (Sell)	-0.36%	-0.93	-0.03%	-0.06	-0.32%	-0.65	-1.05%	-1.74	2100
High Concentrated Industries (Sell)	-0.97%	-2.47	-0.71%	-1.58	-1.13%	-2.28	-1.62%	-2.66	2327
Trade Value	0.23%	8.83	0.23%	7.77	0.27%	8.28	0.33%	8.25	
Market Value	-0.31%	-11.27	-0.37%	-11.87	-0.38%	-11.08	-0.39%	-9.15	
Holding	0.00%	-0.2	0.00%	0.51	0.00%	0.45	0.00%	-0.78	
Heteroscedacity Test	25.66 (0.0189)		24.10 (0.0302)		39.69 (0.0002)		46.86 (0.000)		
Normality Test	24.024		24.863		25.205		24.497		
Model Specification Test	0.86 (0.4608)		0.44 (0.7258)		1.26 (0.2877)		4.86 (0.0022)		
F-statistics (Buy)	11.36		15.94		9.86		12.81		
	(0.0008)		(0.0001)		(0.00)		(0.0003)		
F-statistics (Sell)	1.65		2.73		3.39		1.79		
	(0.1991)		(0.0984)		(0.0655)		(0.1815)		
$\boldsymbol{\beta}_{Lpw\ Concentrated\ Buy}$	1.68		4.99		1.90		0.06		
$= -\boldsymbol{\beta}_{Low\ Concentrated\ Sell}$	(0.1954)		(0.0255)		(0.1680)		(0.8116)		
$\boldsymbol{\beta}_{Lpw\ Concentrated} = \boldsymbol{\beta}_{High\ Concentrated}$	3.82		5.14		2.92		0.50		
	(0.0220)		(0.0059)		(0.0538)		(0.6057)		

6.4.4.4 The Informativeness of Directors' Trades and Regulation Level

Information asymmetry also varies across firms in differently regulated environments. In highly regulated environments, greater information released to the public reduces the information asymmetry between corporate insiders and outside investors (Knewtson, 2011). Hence, directors' trades are more profitable in lightly regulated environments.

Based on that, this section examines whether the informativeness of directors' trades varies with sectors based on regulation level. Specifically, based on previous findings, we may expect directors' trades in lowly regulated sectors to be more informed than directors' trades in highly regulated sectors.

Similar to Knewtson (2011), we adopted the same division to highly and lightly regulated sectors. High regulated sectors are defined as financials, consumer goods, utilities, and healthcare sectors, whereas other sectors are defined as low regulated industries.

Similar to the multivariate analysis, we use the same regression where sector is a dummy variable that takes the value of 1 for financials, consumer goods, healthcare, and utilities sectors (highly regulated) and the value of 0 otherwise (lowly regulated).

Table (6.15) shows the results of the multivariate regression for directors' trades. Comparable to our previous results, purchases are significantly positive and sells are insignificant and negative nearly always across all sector groups. One clear pattern emerges from table (6.15) – informativeness across all event windows is the highest for low regulated sectors group.

In order to formally test whether the abnormal returns associated with buy transactions are significantly different across sectors groups, we preformed the following test;

$$H_0: \beta_{High\ Regulated} = \beta_{Low\ Regulated}$$
$$H_1: \beta_{High\ Regulated} \neq \beta_{Low\ Regulated}$$

As can be seen from table (6.15), the null was rejected across all event windows. Specifically, although abnormal returns are positive and statistically significant for all buys in respective of sector regulation, they are also statistically different from each other. For example, a *p-value* of 0.000 for (0, 1) event window confirms the latter. Therefore, the informativeness of directors' trades in high regulated sectors is significantly different from those in low regulated sectors. Turning to directors' sells, there is some evidence of statistically significantly negative CAARs for directors' trades in low regulated sectors only for ten days event window. When testing whether the abnormal returns associated with sell transactions are significantly different across sectors groups, the null was rejected across all event windows (except for one day event window). Therefore, the informativeness of directors' sells in high regulated sectors is significantly different from those in low regulated sectors

The results are consistent with Knewtson (2011) and Amir et al. (1999) who found that directors' trades in lightly regulated industries are more profitable because less information is flowing to the markets.

Table 6.15: The Result of the Multivariate Regression by Sectors Categorised by Regulation Level

Industry	Event Windows								N
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		
	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	
High Regulated Sectors (Buy)	1.28%	3.92	1.83%	4.85	1.61%	3.89	1.42%	2.8	11036
Low Regulated Sectors (Buy)	1.88%	5.82	2.50%	6.69	2.34%	5.71	1.83%	3.64	13764
High Regulated Sectors (Sell)	-0.19%	-0.5	0.17%	0.37	-0.08%	-0.15	-0.74%	-1.22	2876
Low Regulated Sectors (Sell)	-0.69%	-1.78	-0.45%	-0.99	-0.82%	-1.65	-1.35%	-2.23	4040
Market Value	-0.33%	-11.97	-0.40%	-12.47	-0.41%	-11.76	-0.42%	-9.77	
Value	0.21%	8.2	0.22%	7.25	0.26%	7.7	0.31%	7.71	
Holding	0.07%	3.46	0.07%	2.8	0.08%	3.22	0.09%	2.84	
Heteroscedacity Test	23.14 (0.3356)		25.90 (0.2101)		35.67 (0.0238)		23.00 (0.3440)		
Normality Test	14.998		15.215		15.078		14.389		
Model Specification Test	0.48 (0.6945)		0.36 (0.7814)		2.23 (0.0823)		0.66 (0.5795)		
F-statistics (Buy)	45.21		46.30		54.07		34.98		
	(0.00)		(0.00)		(0.00)		(0.00)		
F-statistics (Sell)	8.00		9.02		10.96		4.90		
	(0.2297)		(0.0027)		(0.0009)		(0.0268)		
$\boldsymbol{\beta_{Lpw\ Regulated} = \beta_{High\ Regulated}}$	1.47		3.20		1.50		0.36		
	(0.0220)		(0.0407)		(0.2242)		(0.7012)		

N presents the number of trades.

6.4.4.5 The Informativeness of Directors' Trades and CEO Compensation

Information asymmetry also varies across firms in differently CEO pay sectors. In highly CEO pay sectors, CEOs are forced to reveal more information to outsiders which in turn reduces the information asymmetry between corporate insiders and outside investors (Jo et al., 2011; and Jung and Subramanian, 2013). Hence, directors' trades are more profitable in lightly CEO pay sectors. Based on these previous points, this section examines whether the level of CEO pay has an impact on the informativeness of directors' trades. Specifically, based on our priors, we may expect directors' trades in lowly CEO pay sectors to be more informed than directors' trades in highly CEO pay sectors.

To measure CEO pay, Gregg et al. (2005) suggested two measures of directors' compensation which can be collected from DataStream: the first measure is the total remuneration of the whole board and the other is the pay of the highest paid director. Total board pay includes the total of directors fees, emoluments for management services and pensions or pension fund contributions paid to, or on behalf of directors (Gregg et al,. 2005). Similarly, we used total remuneration to differentiate industries with higher and lower CEO pays.

Turning to our hypotheses, in this section we examine whether sectors measured by their CEO pay level have an impact upon the informativeness of directors' trades. To examine this, we chose two categories: high CEO compensation sectors such as oil and gas, chemicals, insurance, healthcare, media, constructions and materials, food and beverage, retails, and telecommunications; and low CEO compensation sectors for the remaining industries. The basis of this division can be seen in table (6.16). Directors in media, basic resources, and bank sectors earn higher remunerations, whereas directors in travel and leisure, real estate, and technology sectors earn lower remunerations. This division, to a large extent, is similar to Gregg et al. (2005) division which classified UK industries according to total remuneration. High remunerations are in industries such as resources and financials, while low remunerations are in industries such as information technology and utility.

Table 6.16 : The Average Remuneration for Each Sector over the Sample Period

Sector	Total remuneration (£)
Media	3.137
Basic Resources	2.976
Banks	2.862
Oil and Gas	2.845
Telecommunications	2.453
Chemicals	2.391
Food and Beverage	2.322
Insurance	2.274
Retail	2.179
Construction and Materials	2.155
Industrial Goods and Services	2.002
Financial Services	1.991
Automobiles and Parts	1.934
Healthcare	1.905
Utilities	1.886
Personal and Household Goods	1.832
Travel and Leisure	1.811
Real Estate	1.783
Technology	1.633

Again, we use the same regression where sector is a dummy variable representing the two CEO pays categories (High CEO pay sectors and Low CEO pay sectors). Table (6.17) shows the results of the multivariate regression for directors' trades. Similar to Univariate and multivariate analysis, purchases are significant and positive and sells are insignificant and negative across all sectors groups. One clear pattern emerges from table (6.17) – the informativeness of directors' buy trades across all event windows for low CEO pay sectors group is the highest.

In order to formally test whether the abnormal returns associated with buy transactions are significantly different across sectors groups, we preformed the following test;

$$H_0: \beta_{High\ \text{CEO pay}} = \beta_{Low\ \text{CEO pay}}$$
$$H_1: \beta_{High\ \text{CEO pay}} \neq \beta_{Low\ \text{CEO pay}}$$

As can be seen from table (6.17), the null was rejected across all event windows. Specifically, although abnormal returns are positive and statistically significant across all industries, they are also statistically different from each other. For example, a *p-value* of 0.042 for (0, 1) event window confirms the latter. Thus, the informativeness of directors' trades in high CEO pay sectors is significant and higher from those in low CEO pay sectors

Turning to directors' sells, there is no evidence of statistically significantly negative CAARs for directors' trades in low and high CEO pay sectors.

Table (5.A) shows the results of diagnostic regression for directors' trades. The coefficients remained the same, but the standard errors were robusted. However, the results, in general, did not change. Hence, the informativeness of directors' trades in high CEO pay sectors is significant and higher from those in low CEO pay sectors.

Roulstone (2003) and Zhang et al. (2005) documented an increased (decreased) level of insider trading associated with decreased (increased) pay-performance sensitivity. We expanded the scope of these studies by examining the informativeness of directors' trades in different CEO Pay environments. Our results suggested that the informativeness of directors' trades is highest for low CEO compensation sectors.

Table 6.17: The Result of the Multivariate Regression for Directors' Trades by Sector Categorised by CEO Pay

Industry	Event Windows								
	[0, 1]		[0, 3]		[0, 5]		[0, 10]		**N**
	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	coefficients	T-statistics	
High CEO compensation sectors (Buy)	1.32%	4.11	1.89%	5.07	1.66%	4.07	1.32%	2.64	10279
Low CEO compensation sectors (Buy)	2.09%	6.35	2.78%	7.31	2.61%	6.26	2.06%	4.03	1452
High CEO compensation sectors (Sell)	-0.48%	-1.26	-0.14%	-0.32	-0.46%	-0.95	-1.11%	-1.86	2731
Low CEO compensation sectors (Sell)	-0.74%	-1.79	-0.53%	-1.11	-0.93%	-1.78	-1.52%	-2.39	4185
Market Value	-0.31%	-11.64	-0.38%	-12.22	-0.39%	-11.45	-0.40%	-9.42	
Trade Value	0.22%	8.67	0.23%	7.62	0.27%	8.13	0.33%	8.15	
Holding	0.00%	-0.18	0.00%	0.53	0.00%	0.47	0.00%	-0.77	
Heteroscedacity Test	32.74 (0.0019)		28.57 (0.007)		34.16 (0.0011)		42.77 (0.00)		
Normality Test	23.345		23.320		23.413		23.519		
Model Specification Test	1.21 (0.3042)		0.42 (0.7382)		1.15 (0.3283)		5.34 (0.0011)		
F-statistics (Buy)	71.08		60.89		65.66		36.83		
	(0.000)		(0.000)		(0.000)		(0.000)		
F-statistics (Sell)	1.65		2.73		3.39		1.79		
	(0.1991)		(0.0984)		(0.0655)		(0.1815)		
$\boldsymbol{\beta_{Lpw\ CEO\ Pay} = \beta_{High\ CEO\ Pay}}$	3.82		5.14		2.92		0.50		
	(0.0220)		(0.0059)		(0.0538)		(0.6057)		

6.5 Conclusions

The previous empirical literature in the general area of information contents of directors' trades has found that the informativeness of directors' trades depends on firm, trade, and director characteristics. To the best of our knowledge, an empirical investigation of the effect of industry classification on the informativeness of directors' trades has yet to be examined.

There are many reasons why the informativeness of directors' trades may vary across industries. These are related to information asymmetry differences across industries. Many measures of information asymmetry such as Research and Development Expenditure (Aboody and Lev, 2000), industry regulation (Knewtson, 2011), industry concentration (Gugler, 2001; Blair, 1995; Chu and song, 2011), and directors pay (Jung, 2013) have been shown to vary across industries. This variation may enable directors in certain industries to exploit information, trade on the basis of this information and this should manifest itself in higher abnormal returns (Aboody and Lev, 2000).

Using a dataset of 2,830 UK companies over the period January 2002 to December 2010 resulting in 34,090 events, we carried out a series of Univariate and multivariate tests to determine the impact of industry/sector on the informativeness of directors' trades and to investigate whether information asymmetry level impacts this informativeness. Our results indicated the following: the informativeness is significant and positive across all industries/sectors for buy transactions. The following pattern is also noticed: across all windows, abnormal returns for directors of technology industries are the highest. Turning to the sell transactions, the first thing we noticed is that there is some evidence of statistically significantly negative CAARs for directors of certain industries.

Consistent to our priors, market value is significantly negative i.e. transactions in smaller firms are more informative. Also, the size of the trade has an impact (large trade values are more informative than small trade values). Besides, holding percentage is significantly positive. This suggests the larger the

number of shares traded as a percentage of holdings, the higher the abnormal return. The results again show that the level of information asymmetry has an impact on the informativeness of directors' trades. More specifically, insider gains in high R&D, high volatility, and low regulated, highly concentrated, and low CEO compensation industries/sectors are higher than insider gains in low R&D, low volatility, highly regulation, lightly concentrated, and high CEO compensation industries. Thus, directors' trades in high R&D, high volatility, lightly regulated, highly concentrated and low CEO compensation industries/sectors might be more informative than directors' trades in low R&D, low volatility, highly regulation, lightly concentrated, and high CEO compensation industries.

Previous literature suggests that information asymmetry varies across industries based on R&D expenditure level, volatility level, competition level, regulation level, and CEO pay level. These studies brought many reasons to this variation which explained in details in chapter six. Our results add to the previous literature by identifying that the level of information asymmetry, as measured by R&D expenditure level, volatility level, competition level, regulation level, and CEO pay level, has an impact on the informativeness of directors' trades. Moreover, insider gains are highest for high R&D, high volatility, low regulated, highly concentrated, and low CEO compensation industries/sectors.

Chapter 7: Conclusion

The key objective of this research was to examine various issues relating to insiders' trades, particularly, the general patterns and characteristics of directors' trades, the seasonality patterns of aggregate directors' trades, the impact that director's age has on trade informativeness, and the effect of industry classification on the information content of directors' trades. To the best of our knowledge, no empirical examination of the last two issues has yet to be examined.

chapter two reviewed the relevant literature of insider trading activities and analyzed the increasing body of the literature considering the information content of insider trading, the timing behavior of insiders' activities, and other issues in order to provide readers, researchers, and newcomers with an insight into how these concepts have been researched, been developed, and been linked over time. Previous studies showed that insider trading activities might reduce agency costs and increase firm value. Trades by insiders are used as signals to contradict or confirm the information released to public. Thus, outsiders view these signals and act accordingly. Also, the previous empirical literature in the general area of information contents of directors' trades found that the informativeness of directors' trades depends on firm, trade, and director characteristics. More specifically, buy trades are more informative than sell trades (Seyhun, 1988b; King and Roll, 1988; Fidrmuc et al., 2006; Gregory et al., 2009), medium-size trades are more informative than other-size trades (Barclay and Warner, 1993; Chakravarty, 2001; Abad and Pascual, 2010), insiders in small firms (with high price to earnings ratio) are more informative than insiders in large firms (with low price to earnings ratio) [Williams, 1986; Rozeff and Zaman, 1988; Pope et al., 1990; Ajlouni and Toms, 2008], trades by executive directors are more informative than trades by other types of directors (Seyhun, 1988b; Jenter, 2005; Knewtson, 2011), female

executive directors are more informative than male executive directors (Gregory et al., 2012) and trades conducted by CEOs are more informative than trades conducted by CFOs (Ozkan and Trzeciakiewicz, 2012). Besides, the previous empirical literature in the timing behavior of insider trading found that directors who trade prior to the disclosure of price sensitive news inform the market of mispricing, and as such the market will react correspondingly. In examine different hypothesis regarding insider trading activities, previous studies employed different methodological approaches. For example, event study methodology based on Market Model or Capital Asset Pricing Model was used to calculate the cumulative average abnormal returns in order to examine the informativeness of directors' trades (Fidrmuc et al., 2006; Ajlouni and Toms, 2008). Finally, other insider trading studies examined; whether high returns in January and April can be explained by insider trading activities (Seyhun, 1992b; Hillier and Marshall, 2002a); whether insiders use private information when they exercise options (Carpenter and Rimerez, 2001; Kyriacou and Mase, 2003); whether insiders trade on the basis of contrarian beliefs or superior information (Jiang and Zaman, 2010); the relationship between insider trading and stock price crashes (Marin and Olivier, 2008); or whether the changes in R&D productivity can be explained by insider trading patterns within the firm (Rong, 2013).

Chapter Three described the dataset used in this thesis to analyze the information content of director trading and to familiarize the reader with some important characteristics of insider trading activities. Focusing only on ordinary buy and sale transactions of directors between the period 1991 and 2010, the following patterns were observed:

1) Directors buy more frequently than they sell but the average value of individual sell trades are approximately seven times larger, which suggests that directors sell less frequently but in larger monetary amounts (a similar argument was made for volume). Also, the total value of shares sold peaked in 2007. This is perhaps due to the financial crisis which occurred during that year. Interestingly, the value of shares sold was

similar in 2006, perhaps indicating that directors, collectively, were anticipating the crisis.

2) The majority of buys and sales transactions occurred for directors between the age 45 and 65. Buys and sales under the age of 40 and over the age of 70 are less frequent compared to buys and sales of other age groups. Directors engage in buy transactions most frequently between the age 55 and 59 but sell more often between 50 and 54. The average value of directors' buy transactions (and sell transactions) is highest above the age of 65. This may be driven by a greater requirement for liquidity after 65 (sales) and an increased desire for the income from investments (i.e. Dividends) at retirement age (hence greater value buys).
3) When categorising transactions by volume of trades, it is found that small transactions (less than 10,000 shares) tend to be purchases while large transactions tend to be sells.
4) The majority of the trades were by former directors[51] (for both transaction types) followed by executive and non- executive directors. This pattern is repeated for buy transactions but not for sales. For buy transactions, the average amount per trade of executive and PDMR directors dominate those of former and non-executive directors (about three times larger). For sell transactions, the average money spent per trade by executive directors is approximately six times than that of PDMRs.
5) Directors trade in most in Financial industries and least in Utilities industries. Also, directors trade in most in Industrial Goods and Services sectors and least in Utilities sectors.

As well as these general findings, a few unexplained patterns have identified:

I. There are five times as many non-executive buys as there are sales, whereas for PDMRs, they are slightly equal.

[51] Fidrmuc, et al. (2006) suggested that former directors still possess superior information and can trade more freely on that information. On the other hand, when former directors sell shares, the market may not react because of the belief that they sell for diversification needs and not because of negative insider information

II. The total value of shares sold reached its maximum in 2007.

We suggest these unexplained patterns as an avenue for further research in this area.

One aim of Chapter Four was to test for seasonal patterns in aggregate insider trading transactions. Specifically, do insiders prefer to trade on any particular day of the week or month of the year? A second aim of Chapter Four, given that such seasonal patterns exist, was to attempt to relate these patterns to explanations drawn from the literature on calendar anomalies in returns (and volumes). Our results find the following: There is a day of the week anomaly in aggregate insider activities (as measured by number and value of insider transactions). Specifically, relative to other days, insiders tend to trade more on Fridays and less on Tuesdays. Also, the distribution of the average value of directors' trades (buys and sells) across the week days forms a U shape i.e. high trading value on the beginning of the week (Monday) and the end of the week (Friday). The aggregate value of director transactions, which is higher on Friday and lower on Tuesday, is consistent with the previous studies such as Agrawal and Tandon (1994) and Balaban (1995, 1996) which reported positive returns on Friday and negative returns on Tuesdays. Previous studies on trading volume anomalies have found that informed investors tend to trade more on Mondays because private information is available all days of the week including weekends, whereas other studies indicates Tuesday effect in trading volume in other markets rather than US and reasoned that as a reflection of trades by informed investors on Monday. On the other side, studies by lakonishok and Maberly (1990), Abraham and Ikenberry (1994) and Chan et al., (2004) suggest that individual investors sell more (buy less) on Monday because they have more time to think about their decisions during the weekends. Our results find Friday and Tuesday effects in average number of directors' trades which reflects the desire for insiders to trade more on Friday and less on Tuesday. One possible explanation, based on the previous studies, is that insiders act like institutional investors who trade less on Tuesday as a reflection of insiders' trades on Monday in US. Also, bearing in mind that the aim of the previous studies in trading volume anomalies is to explain the

calendar anomalies in stock returns, our results were consistent with studies on stock returns anomalies that show high returns on Friday and lower returns on Tuesdays. Therefore, these results might explain the seasonal pattern in stock returns. Also, the U shape pattern (in average value of directors' trades) observed when running OLS (excluding trades over £15 million) and TOBIT model can be attributed to price changes from larger(smaller) trades which are higher (lower) at the beginning and end of the day. This is attributed to smaller trades will move prices during periods of low volume because informed traders do not want to reveal their information to the market. When volume is low, informed traders are able to increase their trade sizes because high volume hides their information (Blau et al., 2012).

Also, there is a month of the year anomaly in aggregate insider activities (as measured by the number of insider transactions). Insiders tend to trade most frequently in March and least in August. The results of OLS Regression Model indicate that there is no monthly anomaly in aggregate insider selling activities as measured by the aggregate value of insider transactions. The results of TOBIT Regression Model show that the average value of directors' selling activities in March is higher and significantly different relative to other months of the year. The results of OLS regression are also confirmed by the results of *K-W* statistic test which supported the non existence of monthly anomaly in aggregate director trading (measured by the value of director transactions). Unlike the previous findings, there seems to be a day of the week effect in director aggregate value of buy trades which might happen normally when OLS regression model assumptions are not met completely.

Also, In UK, April is the month of taxation. According to the tax-loss hypothesis, investors sell more in the month before the taxation and buy more after taxation. Therefore, our results, which showed that the average number of directors' trades in March is higher than the average number of trades in other months of the year, might due to directors selling more to avoid taxes. Another explanation why April and March aggregate number of sell trades are higher than those of other month is related to capital gains taxation. Accordingly, it is also possible, for investors, to delay capital gains realization so that they can delay tax payment on capital gains. By doing so, investors might postpone tax

payment by one year. Thus, investors will sell winners (shares) in April. Hence, more sell pressure will occur in April.
Although the purpose of chapter Four is purely to identify whether such anomalies exist (day of the week and month of the year), we do not attempt to explain why they do. We suggest these unexplained patterns as an avenue for further research in this area.

Both chapters three and four used a dataset of more than 5,000 UK companies, over the period January 1991 to December 2010, resulting in 91,970 transactions of which 69,967 were buy trades and 22,003 were sales. The total monetary value of all trades over this period was £28.9 billion.

Chapter Five examined whether directors age has an impact on the informativeness of their trades. The literature which has examined the effect of directors on the informativeness of their trades, to the best of our knowledge the impact of director age has yet to be examined. Using a dataset of 2,300 UK companies over the period January 2002 to December 2010 resulting in 25,096 events, we carry out a series of Univariate and multivariate tests to determine the impact of age. Our results find the following:

1) Although abnormal returns are positive and statistically significant across all age groups, they are also statistically different from each other. However, as measured by the size of the buy coefficients, we find that younger directors' buy transactions produce significantly higher abnormal returns than older directors.The following pattern is also noticed; across all windows, as witnessed by the size of the coefficient, abnormal returns are highest for the younger age group (under 40). Thereafter, they decline until the 60 to 65 age group and then begin to level off.
2) For sell transactions, there is some evidence of statistically negative CAARs for younger directors. For example, across all event windows the 40 to 44 age group has statistically negative abnormal returns. This pattern is

again repeated for longer event window for the 45 to 49 age group. Thus, there is some evidence to suggest that sell transactions may be informative across certain age groups.

3) When controlling for director type, the same pattern found in Univariate and multivariate analysis for buy trades is also identified for Executives' and Formers' buy transactions. Hence, younger executives (formers) are more informed about their buy trades than executives (formers) of other age groups. Unlike the previous pattern, older non-executives (over 70) seem to be more informed about their buy trades than younger non-executives. Regardless the type of director, sells produces insignificantly negative CAARs.

These results were in line with the previous literature of age impact on cognitive and physical abilities. For example, Baltes and Lindenberger (1997), and Fair (2007) showed a linear percent decline in Man (Woman) cognitive and physical abilities between the age of 35 and about age 70 (in our study between ages 40 and 65). After the age of 70, the role of experience, education, wealth, and income may lower the effects of cognitive abilities leading investors to make better financial decisions (King and Leape, 1987; Goetzmann and Kumar 2008; and Korniotis and Kumar, 2011). This might explain the pattern found in Univariate and multivariate analyses for buy trades when examining the informativeness of directors' trades. Our results are also consistent with Kyriacou and Mase (2003), who suggested that the signals generated from executive stock option exercises by younger executives are consistently more informative than those generated from the corresponding exercises by older executives. The results for non-executive directors' trades are also consistent with studies by Lusardi and Mitchell (2007), Van Rooij, et al. (2007), and Korniotis and Kumar (2011) which found that investors with more experience and more financial knowledge are better decision makers. Therefore, this might indicate that the market reacts more strongly to buy

transactions of the over-70 non-executives presumably because they believe experience and expertise are likely to be increased with age.

Although we have identified age of director as an important determinant of the informativeness of directors' trades we remain agnostic as to why the pattern identified exists. We suggest these unexplained patterns as an avenue for further research in this area.

Many measures of information asymmetry such as Research and Development expenditure (Aboody and Lev, 2000), industry regulation (Knewtson, 2011), industry concentration (Gugler, 2001; Blair, 1995; Chu and song, 2011), and directors pay (Jung, 2013) have been shown to vary across industries. This variation may enable directors in certain industries to exploit information, trade on the basis of this information and this should manifest itself in higher abnormal returns. Therefore, chapter six further explored whether the informativeness of UK directors' trades varies among different industries and whether the level of information asymmetry in an industry influences the informativeness of directors' trades. The following results were observed:

1) The informativeness is significant and positive across all industries/sectors for buy transactions. Also, across all windows, abnormal returns are highest for directors of technology industries.
2) Turning to the sell transactions, there is some evidence of statistically significantly negative CAARs for directors of certain industries.
3) The level of information asymmetry has an impact on the informativeness of directors' trades. Specifically, insider gains are highest for high R&D, high volatility, low regulated, highly concentrated, and low CEO compensation industries/sectors.

Previous literature suggests that information asymmetry varies across industries based on R&D expenditure level, volatility level, competition level, regulation level, and CEO pay level. These studies brought many reasons to this variation which explained in details in chapter six. Our results add to the previous literature by identifying that the level of information asymmetry, as

measured by R&D expenditure level, volatility level, competition level, regulation level, and CEO pay level, has an impact on the informativeness of directors' trades. Moreover, insider gains are highest for high R&D, high volatility, low regulated, highly concentrated, and low CEO compensation industries/sectors.

Appendix A

Table 1.A: The Result of Diagnostic Regression for Directors' Buys (Industries)

Industry	[0, 1]			[0, 3]			[0, 5]			[0, 10]		
	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T
Basic Materials	1.16%	0.005133	2.26	1.42%	0.0071	2	1.50%	0.007426	2.02	0.56%	0.002617	2.14
Consumer Goods	1.40%	0.006542	2.14	1.92%	0.007805	2.46	1.97%	0.006633	2.97	0.88%	0.001413	6.23
Consumer Services	1.30%	0.005285	2.46	1.85%	0.007806	2.37	1.99%	0.006219	3.2	1.67%	0.005	3.34
Financials	0.81%	0.003418	2.37	1.24%	0.00496	2.5	1.41%	0.005261	2.68	0.83%	0.002345	3.54
Healthcare	2.17%	0.01014	2.14	2.68%	0.012127	2.21	2.63%	0.011955	2.2	2.05%	0.006699	3.06
Industrials	1.77%	0.008762	2.02	2.34%	0.010174	2.3	2.51%	0.009401	2.67	1.94%	0.006713	2.89
Oil and Gas	1.54%	0.00744	2.07	1.90%	0.00751	2.53	2.13%	0.006265	3.4	0.75%	0.002492	3.01
Technology	2.48%	0.012525	1.98	3.19%	0.013632	2.34	3.55%	0.0142	2.5	3.19%	0.010528	3.03
Telecommunications	2.23%	0.010619	2.1	2.40%	0.009836	2.44	2.32%	0.007682	3.02	2.51%	0.007515	3.34
Utilities	0.26%	-0.00813	-0.32	1.19%	0.079333	0.15	1.18%	-0.10727	-0.11	0.61%	-0.02033	-0.3

Table 2.A: The Result of Diagnostic Regression for Directors' Buys (Sectors)

Industry	[0, 1]			[0, 3]			[0, 5]			[0, 10]		
	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T
Banks	**0.61%**	0.008971	0.68	**0.86%**	0.005181	1.66	**0.80%**	0.013115	0.61	**0.72%**	0.005106	1.41
Basic Resources	1.45%	0.007214	2.01	1.71%	0.009716	1.76	1.29%	0.007167	1.8	0.61%	0.003297	1.85
Chemicals	1.19%	0.002576	4.62	1.75%	0.004258	4.11	1.42%	0.004451	3.19	1.78%	0.005669	3.14
Construction and Materials	1.84%	0.00844	2.18	2.63%	0.011435	2.3	2.51%	0.012613	1.99	2.40%	0.009717	2.47
Financial Services	0.68%	0.003178	2.14	1.09%	0.004486	2.43	0.94%	0.003443	2.73	0.70%	0.001763	3.97
Food and Beverage	1.24%	0.003701	3.35	1.75%	0.005368	3.26	1.58%	0.004788	3.3	0.80%	0.002768	2.89
Healthcare	2.17%	0.01014	2.14	2.68%	0.012018	2.23	2.63%	0.011955	2.2	2.05%	0.006699	3.06
Industrial Goods and Services	2.00%	0.01	2	2.59%	0.011164	2.32	2.53%	0.009134	2.77	2.27%	0.007747	2.93
Insurance	1.77%	0.003057	5.79	2.39%	0.006373	3.75	2.39%	0.005371	4.45	2.31%	0.004695	4.92
Media	1.77%	0.008082	2.19	2.43%	0.011739	2.07	2.35%	0.008484	2.77	2.13%	0.007634	2.79
Oil and Gas	1.54%	0.00744	2.07	1.90%	0.00728	2.61	2.13%	0.006283	3.39	0.75%	0.002492	3.01
Personal and Household Goods	1.63%	0.008109	2.01	2.16%	0.008438	2.56	1.81%	0.005231	3.46	1.25%	0.001911	6.54
Real Estate	0.85%	0.003602	2.36	1.28%	0.005378	2.38	1.09%	0.004977	2.19	0.72%	0.002846	2.53
Retail	1.78%	0.006593	2.7	2.15%	0.007544	2.85	2.07%	0.005405	3.83	2.12%	0.004117	5.15
Technology	2.48%	0.012525	1.98	3.19%	0.013517	2.36	3.55%	0.014087	2.52	3.19%	0.010459	3.05
Telecommunications	2.23%	0.010619	2.1	2.40%	0.009639	2.49	2.32%	0.007682	3.02	2.51%	0.007515	3.34
Travel and Leisure	1.05%	0.003261	3.22	1.61%	0.005279	3.05	1.43%	0.003961	3.61	1.39%	0.004112	3.38

Table 3.A: The Result of Diagnostic Regression by Sectors Categorised by Volatility Level

Industry	[0, 1]			[0, 3]			[0, 5]			[0, 10]		
	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T
High Volatility sectors (Buy)	0.0198	0.006972	2.84	0.0263	0.007013	3.75	0.0251	0.0047	5.34	0.0204	0.007183	2.84
Low Volatility sectors (Buy)	0.0118	0.004126	2.86	0.0172	0.004831	3.56	0.0144	0.002571	5.6	0.0115	0.003305	3.48
High Volatility sectors (Sell)	-0.0057	0.001014	-5.62	-0.0028	0.000517	-5.42	-0.0063	0.001173	-5.37	-0.0117	0.002955	-3.96
Low Volatility sectors (Sell)	-0.0027	0.001031	-2.62	0.0004	-0.00011	-3.79	-0.0024	0.000825	-2.91	-0.0097	0.004554	-2.13

Table 4.A: The Result of Diagnostic Regression by Sectors Categorised by Concentration Level

Industry	[0, 1]			[0, 3]			[0, 5]			[0, 10]		
	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T	coefficients	Robust Std Error	T
Low Concentrated Industries (Buy)	**1.06%**	0.005354	1.98	**1.59%**	0.007227	2.2	**1.32%**	0.005176	2.55	**1.04%**	0.003467	3
High Concentrated Industries (Buy)	1.87%	0.009034	2.07	2.53%	0.011145	2.27	2.36%	0.009958	2.37	1.88%	0.006912	2.72
Low Concentrated Industries (Sell)	-0.36%	0.000662	-5.44	-0.03%	5.87E-05	-5.11	-0.32%	0.000552	-5.8	-1.05%	0.001262	-8.32
High Concentrated Industries (Sell)	-0.97%	0.00344	-2.82	-0.71%	0.002483	-2.86	-1.13%	0.004593	-2.46	-1.62%	0.012366	-1.31

Table 5.A: The Result of Diagnostic Regression by Sectors Categorised by CEO Pays Level

Industry	[0, 1]			[0, 3]			[0, 5]			[0, 10]		
	coefficients	**Robust Std Error**	**T**	**coefficients**	**Robust Std Error**	**T**	**coefficients**	**Robust Std Error**	**T**	**coefficients**	**Robust Std Error**	**T**
High CEO compensation sectors (Buy)	**1.32%**	**0.006439**	**2.05**	**1.89%**	**0.007875**	**2.4**	**1.66%**	**0.006288**	**2.64**	**1.32%**	**0.00394**	**3.35**
Low CEO compensation sectors (Buy)	**2.09%**	**0.009248**	**2.26**	**2.78%**	**0.01144**	**2.43**	**2.61%**	**0.009031**	**2.89**	**2.06%**	**0.007055**	**2.92**
High CEO compensation sectors (Sell)	**-0.48%**	**0.001345**	**-3.57**	**-0.14%**	**0.000292**	**-4.8**	**-0.46%**	**0.001045**	**-4.4**	**-1.11%**	**0.003437**	**-3.23**
Low CEO compensation sectors (Sell)	**-0.74%**	**0.001326**	**-5.58**	**-0.53%**	**0.002137**	**-2.48**	**-0.93%**	**0.004745**	**-1.96**	**-1.52%**	**0.005188**	**-2.93**

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