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The influence of board of director networks and corporate governance on firm performance and CEO compensation

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Abstract

This thesis comprises three empirical studies that investigate the effects of director networks and corporate governance mechanisms on firm performance and CEO compensation. The first empirical study (chapter three) describes the extent of board networks among non-financial FTSE 350 firms listed on the London Stock Exchange during 2007-2010. We use the concept of the "centrality" from social network analysis to examine whether board networks are related to firm performance. We find that firms whose directors are more central in a network are associated with better financial performance. Consistent with the "Reputation Hypothesis" (Fama and Jensen, 1983), the number of director connections may proxy for director reputation. Directors are motivated to improve their reputation since they can use their directorships to signal to the market that they are good at decision-making, and at providing advice and monitoring management.

The second empirical study (chapter four) investigates the effects of director networks on CEO compensation among non-financial FTSE 350 firms listed on the London Stock Exchange between 2007 and 2010, while controlling for CEO characteristics, corporate governance characteristics and firm characteristics. We first examine the impact of CEO networks (individual level) and second board networks (firm level) comprising all board members. We examine not only the total remuneration of the CEO but also two important components of the remuneration

package, i.e. basic salary, and long term incentive plans (LTIPs). At the individual level, we find that a well-connected CEO measured by "centrality" receives higher total compensation. Although we find a positive relationship between basic salary and CEO networks, we do not find evidence of a relationship between LTIP compensation and CEO networks. The relationship between board networks and CEO compensation is also examined at the firm level. The results show that board networks have a positive and significant effect on total compensation and LTIP compensation but not on basic salary compensation.

The third empirical study (chapter five) examines the effects of directors' business networks, directors' social networks and corporate governance mechanisms on firm performance. Previous studies have considered only business networks (directorships), while this study explores both business networks and social networks, such as current and past employment, education background, and other types of social activities (membership of golf clubs, membership of charity organizations, universities alumni, etc). We find that well-connected directors seem to use their networks to improve firm performance and in line with the interest of their shareholders. We further split the effects of board networks into business and social networks. We find that social networks play a more important role than business networks in improving firm performance, consistent with social capital theory (Coleman, 1990) which argues that networks of social connections can provide firms with valuable resources and information.

Overall, this thesis provides empirical evidence that director networks and corporate governance mechanisms play an important role in affecting CEO remuneration and firm financial performance. The findings of this thesis suggest that regulators, firms and individuals should not only pay attention to business networks but also to social networks.

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Chapter 1 Introduction

1.1 The role of board of director networks: background

Social networking has drawn much attention from the public, academics and regulators in the 21st century. Social networking can be found in the specific groups, like a small community or a small class. It is also exists in the workplace, universities, high schools and online. When we talk about online social networking, we normally mean a website which operates like an online community. If people can log into a social networking website, they are able to share their interests, news, hobbies and other information. For example, Facebook founded in 2004, is one of the most popular social networking websites. It had more than 900 million active users by the end of May 2012, more than half of them using Facebook on a mobile device (Carlson, 2012; Sengupta, 2012).

Business networking is a type of social networking. The main difference is that individuals are connected for business reasons. For our purposes, director networks, also called director interlocks, are networks constructed when a director working for a company also sits on the board of directors of another company. Director networks can be categorized at two levels, namely the individual level and the company level. At the individual level, two directors are linked if they are sitting on the same board. At the firm level, two companies are connected if they share the same directors. Studies on director interlocks can be traced back to the 1970s and 1980s and

became more and more prominent in the 1990s (Mizruchi, 1996). More recently, studies have investigated the effects of director interlocks on firm performance, M&A activity, CEO compensation and CEO turnover. (Larcker et al, 2012; Cai and Sevilir, 2011; Renneboog and Zhao, 2011; Liu, Y, 2010)

Director networks can potentially affect firm performance positively and negatively. According to the existing literature, the impact can arise from two main sources. First of all, the "Reputation Hypothesis" proposes that the number of directorships may proxy for director reputation (Fama and Jensen, 1983). Most outside directors also hold directorships in other firms. Directors can use their board positions to signal that they have expertise in decision-makings and can provide better advice and monitoring to the board; they understand the importance of the separation of ownership and control (Fama and Jensen, 1983). Thus, a company with more multiple directors may experience an increase in firm value. On the other hand, the "Busyness Hypothesis" (Ferris et al., 2003) states that directors who hold more directorships are more likely to be overcommitted and thus lack time to adequately monitor management, which could increase agency problem and therefore adversely affect firm value.

Director networks can also play an important role in determining CEO compensation. Modern corporations are characterised by the separation of agents (managers) and principals (owners). Agency theory suggests that managers are

likely to pursue their own needs and increase their own wealth rather than maximizing shareholder wealth. As agency costs arise when there is conflict of interest between the agent and the principal, in order to align their interests, compensation packages are designed by companies to maximize value for shareholders. Employment contracts should be designed to attract talented CEOs and motivate them to achieve certain targets. However, according to managerial power theory (Bebchuk et al., 2002), weak corporate governance gives CEOs the chance to effectively determine their own compensation packages, resulting in inefficiently high levels of compensation. It suggests that powerful CEOs (part of which can be measured by the extent of CEO networks) can influence their own compensation. Well-connected CEOs may accumulate more power and establish a stronger negotiating position on the board and also the remuneration committee so that they could extract a more attractive compensation package.

Awareness of corporate governance as an important issue in the UK grew in the late 1980s and early 1990s because of a series of corporate scandals. In 1991, the financial reporting regulators established a committee chaired by Sir Adrian Cadbury, which led to the issue of a series of recommendations in 1992. The Cadbury Report (1992) recommended the separation of the chairman and CEO, a balanced composition of the board of directors, an enhanced role for non-executive directors, transparency of financial reporting and the need for good internal control. The resulting and successive codes follow the "comply or explain" principle. All

public listed companies need to disclosure how they comply with the code. If any companies decide to not apply one or more provisions of the code, they have to explain the reasons for that.

In 1995, the Greenbury Report identifies good practice to determine the level of directors' remuneration due to concerns about directors' pay. In 1996, the Hampel committee was established to review the extent of compliance with the Cadbury Report and the Greenbury Report. As a result, the Hampel Report was published in 1998 and to establish the framework of the Combined Code. In 2002, the Directors' Remuneration Report Regulations were published to give more powers to shareholders regarding directors' remuneration. As a result, shareholders were provided with more information about directors' remuneration and more transparent disclosures. In 2003, the Combined Code reviewed the role and effectiveness of non-executive directors and the audit committee. More recently, the Financial Reporting Council (FRC) published the UK Corporate Governance Code (2010) which takes into account the lessons learnt from the financial crisis (2007-2008).

1.2 Motivations and objectives

Since the Cadbury Report was first published in 1992, it has been updated regularly (e.g. the Greenbury Report 1995, the Hampel Report 1998, the Combined Code 2003, 2006 and 2008, the Directors' Remuneration Report 2003, the UK Corporate Governance Code 2010). It should be noted that some aspects of the corporate

governance code are relevant to director networks.

In Section B.1.1 and B.1.2 of the UK Corporate Governance Code (2010), for all the FTSE 350 companies, at least half of the board should be independent non-executive directors. Directors will not be treated as "independent" if they meet any one of the following conditions:

"1, has been an employee of the company or group within the last five years; 2, has, or has had within the last three years, a material business relationship with the company either directly, or as a partner, shareholder, director or senior employee of a body that has such a relationship with the company; 3, has received or receives additional remuneration from the company apart from a director's fee, participates in the company's share option or a performance-related pay scheme, or is a member of the company's pension scheme; 4, has close family ties with any of the company's advisers, directors or senior employees; 5, holds cross-directorships or has significant links with other directors through involvement in other companies or bodies; 6, represents a significant shareholder; 7, has served on the board for more than nine years from the date of their first election." (Page 12-13)

In Section B.3 of the UK Corporate Governance Code (2010), it is stated that "All directors should be able to allocate sufficient time to the company to discharge their responsibilities effectively." (Page 14) In Section B.3.3, it is stated that "The board should not agree to a full time executive director taking on more than one

non-executive directorship in a FTSE 100 company nor the chairmanship of such a company." (Page 15) As we can see from Section B.1.1, B.1.2, B.3 and B.3.3, there are some concerns about director interlocks. The regulators seem to think that director networks might adversely affect the independence of non-executive directors and the efficiency of executive directors.

In addition, the rapid growth of executive pay has attracted much attention from the public, researchers and regulators over the past decade. From 1980 to 2005, the average pay for executives increased by 422% while the inflation rate only increased by 125% (Institute of Directors, 2006). Previous studies have examined the impact of corporate governance on executive compensation (Conyon, 1997) and the relationship between executive compensation and firm performance (Bebchuk and Fried, 2004), however relatively few studies have been undertaken to examine the effects of director/board networks on executive compensation.

The main objective of this thesis is to fill in three gaps in the literature. First of all, this thesis examines the effects of board networks on firm performance. Unlike the conventional measure of board networks through directors' interlocks, namely the total number of directorships, this study provides a comprehensive and alternative measure based on the concept of the "centrality" of a firm within a network. This concept has been widely used in sociological studies, but relatively few studies in other fields have investigated the effects of board networks on firm performance.

Secondly, this thesis investigates the effects of CEO and board networks on CEO compensation among non-financial FTSE 350 firms listed on the London Stock Exchange, while controlling for other determinants of CEO compensation. It examines not only the total remuneration of the CEO but also two important components of the remuneration package, i.e. basic salary and long term incentive plans (LTIPs).

Thirdly, this thesis examines the effects of director networks (separating them into business networks and social networks) and corporate governance mechanisms on firm performance. This is an original work because of the way in which director networks are measured.

1.3 Data and Research Method

1.3.1 Data

The director networks' data is manually collected from the Boardex database. Corporate governance characteristics are collected from Fame. Accounting information is mainly collected from Datastream. Company's annual reports are also used if there is any information missing in the other databases.

The data covers the period from 2007 to 2010. Most previous studies of director networks use pre-2007 data. This study provides an up-to-date investigation on whether the corporate governance code in use at the time, the Combined Code

(2006) and the Director's Remuneration Report Regulations (2002) have affected firm performance and CEO compensation. As some regulations and recommendations are not applicable to smaller firms, the sample employed in this thesis comprises the FTSE 350 index. The FTSE 350 index is made up of the FTSE 100 index (the 100 largest firms that account for approximately 82% of market capitalization) and the FTSE 250 index (the next 250 largest firms that represent approximately 15% of market capitalization). In total, firms listed on the FTSE 350 index represent about 97% of UK market capitalisation, as reported by Datastream in December 2008.

As the financial year end for UK firms can be different, for example some firms end their financial year on 31 December and other firms on 31 March, we match financial reporting years for each firm when we collect our accounting data. Specifically, if firm's financial year ends between 1 January and 31 June 2009, we treat the year as 2008, while we treat data as belonging to the year 2009 if firm's financial year ends between 1 July 2009 and 31 December 2009.

1.3.2 Research Method

This thesis employs both panel data and cross sectional regression models to test the research hypotheses. For the first two empirical studies (chapter three and chapter four), we use panel data models to investigate the effects of director networks on firm performance and CEO compensation. Random effects models are employed in

the data analysis. For the third empirical study (chapter five), we use the cross sectional model. In order to mitigate the non-normality of distributions, some variables are transformed by taking their natural logarithms.

1.4 Findings and contributions

First of all, chapter three provides empirical evidence on board networks in the context of firm financial performance. According Fich and Shivdasani (2006) the networks of directors is mostly measured by the number of directorships. However, this method might not be comprehensive because it only captures the quantity of directors' obligations not their quality. Hence, the number of directorships does not adequately capture the extent to which directors are really busy and overcommitted. In order to capture different aspects of director networks, we employ five network centrality measures, namely: degree centrality, betweenness centrality, closeness centrality, eigenvector centrality and information centrality. In contrast to simply calculating the number of directorships, centrality measures not only take into account the quantity of directors' obligations but also their quality. Director networks are then aggregated at the firm level to measure board networks. In addition, we use a panel data approach and control for the effects of corporate governance variables and different industries, while previous studies typically employ cross-sectional data and only focus on specific industries (Ferris et al., 2003; Meeusen and Cuyvers, 1985).

We find evidence that board networks increase firm value. This finding implies that the positions of firms within a network are important. According to the social network analysis, the centrality of a node (e.g. firm) depends upon the number of connections with other nodes (e.g. firms). Thus, well-connected firms normally occupy very central position in the network. A firm that occupies central position is able to accumulate significant power and influence and therefore increase its value.

Secondly, chapter four investigates the effects of CEO and board networks on CEO compensation among non-financial FTSE 350 firms listed on the London Stock Exchange, while controlling for other determinants of CEO compensation. Unlike most previous studies, this thesis examines not only the total remuneration of the CEO but also two important components of the remuneration package, i.e. basic salary and long term incentive plans (LTIPs). In addition, in order to capture different aspects of director networks, the same five network centrality measures used in chapter three are employed. These measures are more comprehensive than those used in previous studies (e.g. Renneboog and Zhao, 2011 and Horton et al., 2012).

At the individual level, we find that the more central the position of the CEO, the higher the CEO total compensation. This result supports the managerial power theory (Bebchuk et al., 2002) which suggests that powerful CEOs have the ability to effectively set their own compensation. We also investigate the effect of CEO networks on two components of CEO compensation, i.e. basic salary and LTIPs

compensation. We find a positive relationship between basic salary compensation and CEO networks, but we do not find evidence of a relationship between LTIPs compensation and CEO networks. The findings suggest that as directors have too much managerial power, they are very likely to raise their compensation, especially their basic salary, rather than long term incentive compensation. Since the former does not require additional efforts while the latter does require. At the firm level, we find a positive relationship between board networks and CEO total compensation and LTIPs compensation. However, we find no evidence that CEO basic salary is positively correlated with board networks. The results suggest that if a firm has better access to resources and information through the entire network provided by all directors, it is likely to compensate the CEO less for their own network connections. Therefore, the firm is likely to reward the CEO less on the basis of basic salary but more on the basis of firm performance.

Thirdly, we examine the effects of directors' business and social networks and corporate governance mechanisms on firm performance in chapter five. To the best of our knowledge, this is the first such study that has been carried out for a large sample of UK firms. In terms of the measure of director networks, most previous studies have considered only business networks (e.g. directorships) while this study explores a multitude of business and social networks, including current and past employment, education background, and other types of social activities (membership of golf clubs, membership of charity organizations, universities

alumni, etc). We then aggregate the director networks at the firm level to measure board networks. We find a positive relationship between board networks and firm performance. This suggests that well-connected boards use their networks to improve firm performance and so is in line with the interest of their shareholders. Board networks allow firms access to information and capital which is particularly valuable when the financial situation becomes unstable, as during the financial crisis period.

1.5 Structure of the thesis

This chapter has briefly introduced the background to board of director networks, highlighted the motivations and objectives, discussed sample selection and methodology and presented the major findings and contributions. The remainder of the thesis is organised as follows. Chapter two explains the terminology and methodology used in this thesis. Chapter three examines the relationship between board networks and firm performance. Chapter four examines the relationship between director networks and CEO compensation. Chapter five investigates the effects of directors' business and social networks and corporate governance mechanisms on firm performance. Chapter six presents the conclusions, limitations and suggestions for future research.

Chapter 2 Terminology and Methodology

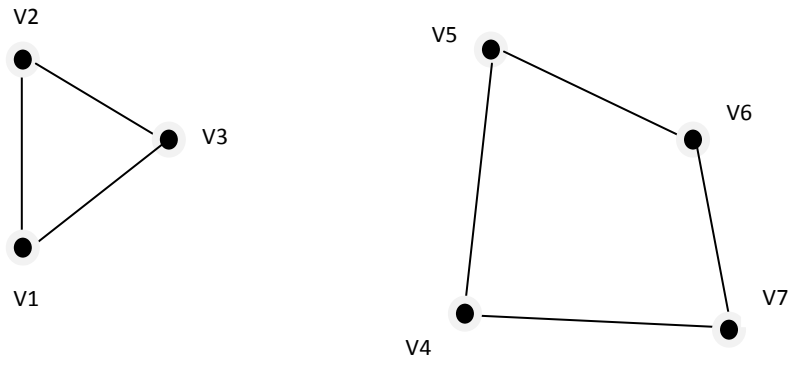
2.1 Basic Terminology

Social network analysis (SNA) is defined as the analysis of a set of socially-relevant nodes connected by one or more relations (Wasserman and Faust, 1994). It is based on an assumption about the importance of relations among interacting nodes. A node could be a person, organization, or workplace, but basically any units that can be connected to other units can be classified as nodes. These could be countries, departments within organizations, web pages, journal articles, etc. In this study we restrict our attention to networks among boards of directors and adopt the following conventions and notations.

Networks, also known as graphs, can be used to represent a multitude of phenomena. For example, family ties, networks of friendship and information among firms. Wasserman and Faust (1994) defined a graph G = (V, E) which includes a set of vertices (V), and a set of edges (E) which establish connections between two vertices. Two vertices are adjacent if they are connected by an edge, and they are called the ends of this edge. N is denoted as the number of vertices and M as the number of edges. A graph is called simple graph if there are no multiple edges between vertices and no loops, otherwise it is called a multi-graph. It is called complete graph if there is an edge linking each pair of vertices. Note that the number of edges of a simple complete graph is equal to $n(n-1)/2$.

A graph G (Wasserman and Faust, 1994) is bipartite if its vertex set V is partitioned into two subsets V_1 and V_2 such that each edge has one end in V_1 and one end in V_2. It is denoted by G = (V_1, V_2, E). Affiliation networks are instances of bipartite graphs and they are described below. The degree d (v) of a vertex v is the number of edges incident with it. If G is a simple graph, then d (v) is the number of neighbours of v. A vertex with degree equal to 0 or only connected to itself by a loop is isolate. An ego network is the sub graph induced by some given focal node (the ego) and its neighbours. A path of length l from the vertex v_0 to the vertex v_1 in a graph G, or a v_0v_1 path, is a sequence < v_0, e_1, v_1, e_2, ..., e_i, v_i > where v_0, v_1, ..., v_i are vertices of G, e_1, e_2, ..., ei are edges of G, v_i−1 and v_i are the ends of e_i for i = 1, ..., l. If G is a simple graph, this path is completely specified by the sequence of vertices < v_0, v_1, ..., v_i >. A graph is connected if any two of its vertices are connected by a path, and a connected component is a maximal connected sub graph. For example, Figure 2.1 represents a graph consisting of two components. One has node v1, v2 and v3. Another consists of node v4, v5, v6, v7. The geodesic distance d (x, y) between two nodes x and y in a graph is the length of a shortest path; otherwise their distance is defined to be infinite.

Figure 2.1: Graph Consisting of Two Components



If we need to distinguish the role of the ends of the edges of a graph and to orient its edges, this graph is called a directed graph or a digraph (Wasserman and Faust, 1994) and each edge has an initial end and a terminal one, otherwise the graph is undirected. For any vertex v of a digraph, its degree d(v) is the sum of its out degree $d^+(v)$, which is the number of edges whose v is the initial end, and the in degree $d^-(v)$, the number of edges whose v is the terminal end. The underlying graph of a digraph D is the graph obtained from D by ignoring the orientations of its edges. An oriented graph is a digraph whose underlying graph is simple. The adjacency matrix A (D) of a digraph D is the matrix (a_{uv}) whose rows and columns are indexed by the vertices of D and where a_{uv} is the number of edges from u to v. Similarly, one can define the adjacency matrix of an undirected graph G by the (symmetric) adjacency matrix of the digraph obtained by splitting each edge of G in two opposite oriented edges. Moreover, if G is a simple graph, its adjacency matrix is a binary matrix. Usually one represents graphically a graph by drawing a dot for each node and a

line between two such dots if they are connected by an edge. In case of digraphs, the orientation of edges is indicated by an arrow.

2.2 CEO and Board Networks Measures

An important concept used in the study of networks is that of "centrality" (Freeman, 1979) which describes how central a node is relative to other nodes in a network. Nodes occupying a central position will have better access to information and other resources than nodes in less favourable positions. As a result, nodes will have power and influence over other nodes by occupying central positions in the network. In fact some nodes are not only more connected than others but their position in a network allows them to play a role in mediating information from one part of the network to another. Other nodes have to rely on these central nodes to communicate with other nodes. In social network analysis, centrality measures are used to characterize the importance and the role of particular nodes in the larger network by analyzing their position within the network. We use five centrality measures in this study; degree, closeness, betweenness, eigenvector and information centrality. In the following definitions, we consider an undirected graph G = (N, E), with n nodes and e edges, and described by an $n \times n$ adjacency matrix $A = (a_{ij})$. We describe five measures of the centrality of nodes in a network as developed by Freeman (1979), Bonacich (1987) and Stephenson and Zelen (1989).

2.2.1 CEO Network Measures (Individual level)

2.2.1.1 Degree Centrality

Freeman (1979) developed elementary measures of the centrality of nodes based on their "degree". In this study, the degree centrality of a director is the number of direct links that a director have through sitting on the same board. The Degree centrality (C_D) of node n_i is:

$$C_D(n_i) = d_n \qquad 2\text{-}1$$

A director has high degree centrality when she is a board member of several firms. To allow us to compare the connectedness across different networks, we standardize the measure, dividing the number of direct links by the maximum number of links that a director could have. A normalized degree centrality ($C_{D,norm}$) measure in a simple network is defined by

$$C_{D,norm}(n_i) = d_n/(n-1) \qquad 2\text{-}2$$

2.2.1.2 Betweenness Centrality

Betweenness centrality measures how often a given node sits 'between' others. The betweenness centrality C_B of node n_i is given by:

$$C_B(n_i) = \sum(g_{jk}(n_i)/g_{jk}) \qquad 2\text{-}3$$

A normalized betweenness measure is described by:

$$C_{B,norm}(n_i) = 2\sum(g_{jk}(n_i)/g_{jk})/(n-1)(n-2) \qquad 2\text{-}4$$

Where g_{jk} is number of the shortest paths linking j and k. For three nodes, j, k, and i, $g_{jk}(n_i)$ is the number of shortest paths between j and k that contain i. The Betweenness centrality measures the relevance of non-direct links in a network, capturing the importance of a director linking other directors. If a director has high

Betweenness centrality, she is likely able to control information flows and behave as a "broker" of connections (information) in the network.

2.2.1.3 Closeness Centrality

Closeness centrality (Freeman, 1979) measures how close a node is to the other nodes in the network. In this study, the Closeness centrality measures how close a director is to other directors in the network. It is the inverse of the sum of the shortest paths to all other directors. The Closeness centrality (C_C) of node n_i is given by:

$$C_C(n_i)= 1/[\sum d(n_i,n_j)] \quad 2\text{-}5$$

And a normalized closeness ($C_{C,norm}$) centrality measure is given by

$$C_{C,norm}(n_i)= (n-1)/[\sum d(n_i,n_j)] \quad 2\text{-}6$$

Where d (n_i,n_j) is equal to the shortest length between director i and j. The sum of all shortest paths from director i to all other j's is called farness. C_c closeness is equal to the inverse of farness. Those with high closeness are those who can reach many directors in fewer steps. A director with high closeness can reach many other directors in fewer steps.

2.2.1.4 Eigenvector Centrality

Bonacich (1972, 1987) suggests a refined version of Freeman's degree centrality called "Eigenvector" or "Bonacich" centrality. Degree centrality is based on the view that nodes with more connections are more likely to be powerful because they

can influence more nodes. But it does not consider the situation where having the same degree centrality does not necessarily make nodes equally powerful. Bonacich (1972, 1987) argues that a node's centrality should take account of how many connections a node has and also how many connections the node's neighbourhoods have. A node is likely to be more influential if it is connected to more nodes, since that node can quickly obtain more information from the other nodes. But if other nodes are well connected, they are not necessarily dependent on this node. Thus being connected to others makes a node central, but not necessarily powerful.

The more connections the node's neighbourhoods have, the more central the node is. The fewer the connections the node's neighbourhoods have, the more powerful the node is (Bonacich, 1987). The idea behind eigenvector centrality is that not only is the number of links important but the quality of the links is also important. Firms that are connected to many influential firms can access more resources or information compared to firms connected to less influential firms.

The Eigenvector (Bonacich Power) centrality C_E of node n_i is defined as:

$$C_E(n_i) = \sum (\alpha + \beta C_E(j)) \qquad 2\text{-}7$$

Where α is a value used to normalize the measure. The normalization parameter α is automatically selected so that the sum of the squares of the vertex centralities is equal to the size of the network. β is an attenuation factor which reflects the dependence of each vertex's centrality on the centralities of the vertices it is

adjacent to (see Table 2.1) According to Bonacich (1987), a value of 0 gives a centrality measure directly proportional to the degree of each vertex. Positive values give weight to being connected to powerful nodes, negative values give weight to being connected to low powered nodes.

Table 2.1 Beta used for the calculation of Eigenvector centrality by UCINET

Year	Beta
2007	0.04
2008	0.04
2009	0.03
2010	0.05

2.2.1.5 Information Centrality

Stephenson and Zelen (1989) develop a centrality measure called "information centrality" which is based on all the paths between pairs of points. They note that the degree, betweenness and closeness centrality measures developed by Freeman have a common feature, namely, the shortest path. By only considering the shortest path these measures assume that communications only occur along this path. However, it is possible that information is not necessary pass through the shortest path but take a more circuitous route, for example by random communication, or it may be intentionally channelled through intermediaries which are not captured by the shortest path. Stephenson and Zelen (1989) define information centrality for two nodes i and j where there are K_{ij} paths connecting i and j. These paths are denoted by $P_{i,j}$ (1), $P_{i,j}$ (2),…, $P_{i,j}$ ($K_{i,j}$). The number of lines in path $P_{i,j}$(s) is defined as $D_{i,j}$(s)

and the information measure $I_{i,j}(s)$ is the reciprocal of the distance measure, i.e. $I_{i,j}(s)= 1/ D_{i,j}(s)$. The procedure for determining the centrality of any point (i) is to first determine the information measure of point (i) with respect to all of the other points, i.e., $I_{i1,}$ $I_{i2,}$ …, $I_{in.}$ The information centrality of point (i) is defined as the harmonic mean of the information associated with the path from (i) to the other points. Specifically, if I_i refers to the centrality or information of (i), then

$$I_i= n/ \sum 1/I_{ij} \qquad 2\text{-}8$$

Information centrality captures the director's connections to other directors along all paths not just along the shortest paths.

2.2.2 Board Network Measures (Firm level)

To calculate the centrality of board networks (firm level), each firm is considered as a node in the network and two firms are connected if they share at least one director. We first calculate five centrality measures for each board member and then aggregate these at the firm level to measure overall board network centrality. The calculation of five centrality measures is identical to that of the individual level calculation. More specifically, the degree centrality of a firm is the number of other firms it connects to through director interlocks. Firms that have many direct links compared to other firms can take advantage of them to influence other firms or use their links to access resources. However, degree centrality is entirely local and is unrelated to how a firm is positioned in the whole network. The betweenness centrality of a firm measures how often a firm can sit between two other firms

through director interlocks. If a firm sits between many other firms it may act like a "keeper" and control the flow of information through the network. The closeness centrality of a firm measures how close it is to all the other reachable firms. Firms that are more central according to closeness centrality can access resources or information faster than other firms. Unlike degree centrality, this measure is not just a local measure but uses information from the whole network. The eigenvector centrality of a firm measures, not only the number of other firms it connects to, but also the quality of the other firms it connects to. The information centrality of a firm captures it's direct or indirect connections, not only through the shortest paths but also any other possible paths to other firms. Hence, firms that are more central using this measure can enjoy more resources or information compared to the measure of closeness centrality which only considers the shortest paths.

2.2.3 Illustration of Five "Centrality" Calculations at the Firm Level

Consider the simple graph shown in Figure 2.2, which contains 7 firms (nodes) and 7 connections (edges). Table 2.2 illustrates the values of normalized degree centrality, betweenness centrality, closeness centrality, eigenvector centrality and information centrality for the network represented by Figure 2.2.

Figure 2.2: Degree, Betweenness, Closeness, Eigenvector, Information Centrality Measures

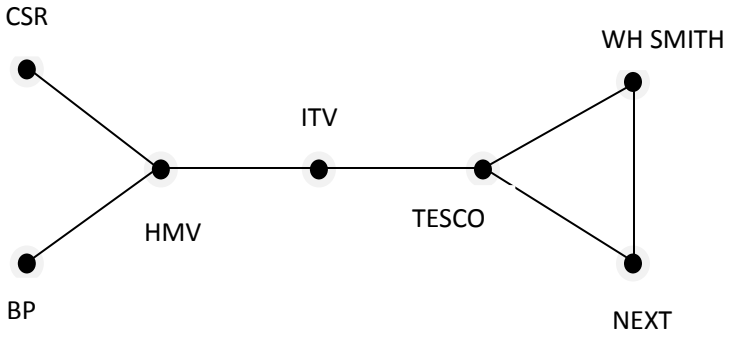


Table 2.2 Centrality Measures

Node	Degree	Betweenness	Closeness	Eigenvector	Information
CSR	0.17	0	0.38	0.17	5.62
BP	0.17	0	0.38	0.17	5.62
HMV	0.50	0.36	0.09	0.39	7.85
ITV	0.33	0.29	0.60	0.53	6.51
TESCO	0.50	0.29	0.09	0.81	7.85
WH SMITH	0.33	0	0.40	0.65	6.51
NEXT	0.33	0	0.40	0.65	6.51

HMV and TESCO are both directly connected to 3 firms and thus have the highest normalized degree measure of 3/ (7−1) = 0.5. However, they do not have the same betweenness measure in this network. The calculation of betweenness centrality involves identifying the shortest paths between all other pairs on the network. The denominator used for standardization is (7-1) (7-2)/2 = 15. In this graph, HMV has the highest betweenness measure of 0.36 ((16/3)/15). It acts as a "broker," joining

two parts of the network together. The connections are fewer but more important, because they give HMV control over information flows from one end of the network to the other. In this graph, without HMV, CSR and BP will be isolated from the rest of the graph. In terms of the closeness centrality measure, WH Smith and Next have the highest value of 0.4. It takes Smith and Next at least four steps to reach BP and CSR, three steps to reach HMV, two steps to reach ITV, and one step to reach everyone else. Therefore, C_C (Smith/Next) = 1/4+4+3+2+1+1 = 0.07 and C_{Cnorm} (Smith/Next) = $(7 - 1) \times 0.07 = 0.4$. Although they have fewer direct connections than HMV does, the pattern of their links allows them to quickly reach everyone else in the graph. Tesco has a higher eigenvector value than HMV although it has the same direct connections as HMV. This is because the firms connected to Tesco are more well-connected than the firms connected to HMV. Eigenvector centrality not only measures direct connections but also the quality of connections. ITV has the highest information centrality since it sits in the most central position of the network and therefore can control the information flowing through the whole network. Table 2.3 presents a brief summary of each of the five centrality measures.

Table 2.3 Summary of Five Centrality Measures

Centrality Measure	Summary
Degree	It captures all of the direct connections to a given firm.
Betweenness	It captures "how many times" a given firm sits between other firms.
Closeness	It captures "how quickly" a given firm can reach other firms.
Eigenvector	It captures not only the direct connections between firms but also the quality of connections.
Information	It captures a firm's connections to other firms along all paths not just the shortest paths.

2.2.4 N-Score

Since the five centrality measures capture slightly different aspects of the importance of nodes in a network, we adopt a comprehensive centrality measure called "N-Score" suggested by Larcker et al. (2012) in order to consider the overall influence of centrality on firm performance. Firstly, we rank all of the firms into quintiles according to market value. Secondly, within each market value quintile, firms are sorted into sub quintiles based on the five centrality measures (Degree, Betweenness, Closeness, Eigenvector and Information). Highest (lowest) values of centrality are given values of five (one). The N-Score is defined as follows:

$$\text{N-Score} = 1/5 \{\text{Quintile (Degree)} + \text{Quintile (Betweenness)} + \text{Quintile (Closeness)} + \text{Quintile (Eigenvector)} + \text{Quintile (Information)}\} \quad 2\text{-}9$$

The N-Score is rounded to the nearest integer, ranging from 1 to 5.

2.3 Panel Data Analysis

A panel data model allows the analysis of both cross sectional and time series data. The most common panel data estimations are fixed effects and random effects models. We follow Verbeek (2009) for most of the discussion below about the fixed effects and the random effects models. Before discussing fixed effects and random effects models and how to choose between them, we should explore the advantages of using panel data models compared with cross sectional and time series models.

2.3.1 Advantages of panel data model

Baltagi (1995) explains a number of benefits of using panel data. First, panel data can control for individual heterogeneity. Every cross section unit in the panel data set, i.e. individuals, firms, states or countries are heterogeneous. Econometric models using purely cross section or time series data are unable to control these individual effects. Some variables are difficult to be observed like cultural factors or business practices across companies can also be controlled in panel data models.

Second, panel data can include variables at different levels of analysis (i.e. students, schools, districts, states) suitable for multilevel or hierarchical modeling. Moreover, including both cross sectional data and time series observations, panel data provide more informative data, less collinearity among variables and more efficiency.

Third, by studying the repeated cross section of observations, panel data are suited

to study the dynamics of change, such as the effects of policy changes, job turnover and labour mobility.

2.3.2 The fixed effects model

The fixed effects model is a static linear regression model which assumes the intercept terms vary over the individual units i, i.e.

$$y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it}, \quad \varepsilon_{it} \sim IID\ (0,\ \sigma_\varepsilon^2) \qquad 2\text{-}10$$

Where y_{it} is the dependent variable, α_i is the intercept term, β is coefficients of the independent variables, and X_{it} represents on independent variable, ε_{it} is the error term, t = 1,…, T; i = 1, …, N. Equation 2-10 assumes that all x_{it} are independent of all $\varepsilon_{it.}$

2.3.3 The random effects model

An alternative to the fixed effects model is the random effects model. In regression analysis, all factors that affect the dependent variable, but not included in the model can be explained by an error term. In this case, this leads to the assumption that the α_i are random factors, independently and identically distributed over individuals. Thus the random effects model can be written as

$$y_{it} = \mu + \beta X_{it} + \alpha_i + \varepsilon_{it},\ \ \varepsilon_{it} \sim IID\ (0,\ \sigma_\varepsilon^2),\ \ \alpha_i \sim IID\ (0,\ \sigma_\alpha^2),$$

2-11

Where y_{it} is the dependent variable, μ is the intercept term, β is coefficients of the independent variables, and X_{it} represents on independent variable, $\alpha_i + \varepsilon_{it}$ is an error term consisting of two components: an individual specific component assumes does not change over time, and a remainder component is assumed to be uncorrelated over time. This means that all correlation of the error terms over time is attributed to the individual effects α_i. t = 1,…, T; i = 1,…, N.

2.3.4 Fixed effects or Random effects?

The choice between fixed effects and random effects depends on the assumption we make about the correlation between the error components ε_{it} and X regressors x_{it}. If the assumption is that ε_{it} and x_{it} are correlated, the fixed effects model should be used. However, if the assumption is ε_{it} and x_{it} are not correlated, then the random effects model may be appropriate. Gujarati (2003) provides some suggestion on how to choose between fixed effects and random effects. First, if the number of cross-sectional units (N) is small and the number of time series data (T) is large, the values of the parameters estimated by the two models are very small. The fixed effects model may be appropriate in terms of computational convenience. Second, if N is large and T is small, the values of the parameters estimated by the two models will be significantly different. In the random effects model, ε_{it} is a random component, while in the fixed effects model ε_{it} is treated as fixed. If we believe that the individual units in our sample are selected randomly from a large sample, we should choose the random effects model. However, if the individual units in the

sample are not randomly selected, the fixed effects model is preferred. Third, if N is large and T is small, and the assumptions of random effects hold, the estimators of the random effects are more efficient than the fixed effects model. Fourth, unlike the random effects model, fixed effects model cannot estimate time-invariant variables such as gender. As our sample includes over 700 observations (N) and only 4 years (T), we prefer to use the random effects estimator in the regression models containing all dummy variables and invariant variables.

In practice, we use the Hausman (1978) test to examine if unobserved effect (ε_{it}) and explained variable (x_{it}) are correlated or not. The null hypothesis of Hausman test is that unobserved effect (ε_{it}) is uncorrelated with explained variable (x_{it}). If the results of the Hausman test show that there is a correlation between ε_{it} and x_{it}, then the null hypothesis is rejected and we should the use fixed effects model. Otherwise, we should choose the random effects model.

Chapter 3 Board networks and firm performance

3.1 Introduction

The board of directors is an important part of any corporate governance structure. An important feature of boards is that they are often connected to each other by a shared director. Most previous studies of boards of directors focus on directors' interlocks, where people sit on several boards thereby creating connections between companies. Fama and Jensen (1983) argue that the number of connections may proxy for director reputation. Directors have the motivations to improve their reputation since they can use their directorships to signal to the market that they are good at making decision, providing good advice and monitoring to the board. Thus, a firm with more multiple directors could lead to an increase in firm value. There are several studies that suggest that board interlocks are positively associated with firm performance. Mizruchi and Stearns (1994) argue that board interlocks are beneficial for firms to monitor each other. For example, if there is an interlock between a financial firm and a non-financial firm, financial firm can better monitor the non-financial firm and therefore reduce the risk of providing capital to the non-financial firm. Schonlau and Singh (2009) find that well-connected boards are related to better acquisition performance, higher ROA and abnormal returns compared with the performance of less-connected boards for a sample of U.S. firms between 1991 and 2005.

However, a number of studies also suggest that directors' interlocks can hurt firm

performance. Since they require the director to monitor several firms, interlocks reduces the time that the director can allocate to each firm. Therefore, such directors might be too busy to monitor each firm adequately. Consistent with this idea, Fich and Shivdasani (2006) find that firms with busy boards are correlated with a lower market to book ratio based on a sample comprising Forbes 500 largest firms from 1989 to 1995, with a busy boards defined as one for which more than half of the directors hold three or more directorships.

Unlike the conventional measure of board networks through directors' interlocks, namely the total number of directorships, this chapter provides a comprehensive and alternative measure based on the concept of the "centrality" of a firm within a network. This concept has been widely used in sociological studies, but relatively few studies in other fields have investigated the effects of board networks on firm performance. This chapter sheds light on the empirical relationship between these two variables.

Using social network analysis, this chapter describes the extent of board networks measured by centrality among non-financial FTSE 350 firms and whether board network centrality is related to firm performance, while controlling for corporate governance characteristics, industry dummies and time dummies. Following Ferris et al. (2003), both Return on Assets (ROA) and Return on Equity (ROE) are used to measure firm performance. Five centrality measures (degree, closeness,

betweenness, eigenvector and information) are employed in this chapter. The centrality of boards of directors is measured using the UCINET software for social network analysis. Centrality is an important concept among sociologists who study social relations. For the purpose of this chapter, a network represents the connections among directors of companies who sit on different boards and therefore communicate with each other.

Overall, this chapter makes several contributions to the existing literature. First, in order to capture different aspects of board networks, we employ five different network centrality measures which represent a more comprehensive approach to that used by Horton et al. (2012). Second, while many studies employ cross-sectional data and only focus on specific industries, we use a panel data approach and include a range of industries. We also include data from the recent financial crisis period. Last but not least, we offer evidence on the types of board network centrality that influences firm performance.

The remainder of this chapter is organized as follows. Section two reviews the literature and develops the hypotheses. Section three describes the sample and research design. Section four presents the results. The final section concludes.

3.2 Literature Review and Hypotheses

There is an area of existing literature focusing on board networks and examining the

effects of board networks on economic outcomes.

Camelia (2006) examines the business connections between fund directors and advisory firms using panel data for U.S. open-end mutual funds for the period 1993-2002. Camelia (2006) finds that social connections of fund directors are playing an important role in contracting decisions. For example, as advisory firms have new mutual funds, it is quite possible that fund board seats are offered to more connected directors. Also, when advisory firms look for a new advisor, they are more likely give the portfolio management contract to an advisor who has had more connections to the fund's directors in the past. Advisors are usually paid a higher payment when they are well-connected to the fund's directors. Moreover, Camelia (2006) argues that although directors' social networks play an important role on decision making, it has a negative effect on the quality of actions taken by these agents measured by fund performance.

Farina (2008) studies the incidence of interlocking directorates among listed banks and non-financial firms in Italy and tests the effects of directors' interlocking on firm performance measured by ROA and ROE. Farina (2008) finds that banks are the most powerful nodes measured by centrality among the network and the relationship between centrality and firm financial performance are positive correlated. The results suggest that banks occupying the central positions in the networks can improve firm performance. Moreover, according to the resource

dependency perspective, as banks can control financial capital in the network, the most of time firms have to dependent on banks, which give banks some power to control other firms.

Musacchio (2008) investigates the board interlocking between banks and other firms in Brazil, Mexico and the United States by using three ways to measure centrality between bank and other firms. The first of these, and the most basic, is "degree" centrality, which calculates the total number of interlocks a firm or bank has. He found that Brazilian banks exhibited less centrality than Mexican and United States' banks. The second measure he used is "betweenness" centrality, which measures how often a node is in the path that links two banks or companies in the network. He found that banks are very central in Mexico and the United States. However, Brazil was found to be different from the Mexican and the United States cases. He did not find a large proportion of banks within the most central companies in the network. In addition, interlocks with banks were not very popular among Brazilian firms. The last measure is "Bonacich" centrality, which takes into account a node's connections depending on the connections it is related to. The results are similar to degree and betweenness centrality. In summary, he finds that connections between banks and other firms are more important in Mexico and the United States than in Brazil.

Santella et al. (2009) investigate director interlocks in the Italian, French, German,

UK and US firms using the methods of social network analysis (SNA) to measure the firms' network position. Specifically, they examine the largest forty firms among these five countries, by capitalization. A total of 2,718 directorships are taken into account. They describe the features of firms connected to each other in each country and compare the country networks in terms of Freeman's degree and betweenness centrality. They find that the number of firms connected to each other through a very small number of well-connected directors in France, Germany, and Italy are higher than other countries. In addition, UK firms are less connected to each other through directors who have no more than two directorships. US firms are also well connected to each other through director interlocks, but their directors tend to only have two directorships at the same time, like the UK.

Conyon and Muldoon (2006) study the social network structure of corporate boards using data from the US, the UK and Germany. They find that the random graph model[1] is suitable to explain board network structure and connections in these countries. In particular, the social network of boards can be described as a "small world" under two certain conditions. First, there is network with high clustering. This is caused by the boards connected to each other when they share same director. Second, the distances between any two boards are relatively short. This suggests that any two boards can be reached in a few steps. They find that the " small world" aspects of corporate boards are no more obvious than would be expected in the

[1] A random graph is constructed by starting with a set of nodes and placing edges between them randomly. Each pair of nodes has an independent probability p.

random graph model.

Schonlau and Singh (2009) apply the method of social network analysis called "centrality" to measure board networks using U.S. data between 1991 and 2005. They argue that more central boards have better access to valuable information through their networks, therefore alleviating information asymmetry when making takeover decisions. They find that boards occupying more central positions in their networks are related to better acquisition performance, stronger improvements in ROA and higher abnormal returns compared to less central boards.

Larcker et al. (2012) map the board networks using "closeness centrality" and "eigenvector centrality" from social network analysis. They argue that board networks can improve firm performance through several ways, such as information accessibility, reducing information asymmetric, shared contacts, good management practices and collusion. They find that firms with the well-connected boards of directors earn superior risk adjusted stock returns and high future growth measured by ROA. Their results are consistent with "Reputation hypothesis" research, which argues that the number of connections may proxy for director reputation. Directors are motivated to improve their reputation since they can use their directorships to signal to the market that they are good at decision-making, and at providing advice and monitoring management.

The existing literature also shows that board networks may adversely affect corporate governance. For example, based on data from the Paris Stock Exchange over the period of 1992-2003, Kramarz and Thesmar (2006) study the social networks between the CEO and directors. They find that former high ranking civil servants account for a large percentage of board composition and CEOs who are former civil servants are less likely to be fired even if they run the company very badly. CEOs who are former bureaucrats tend to hold more directorships and the relationship between directorships and firm performance is negatively correlated, which could suggest that those CEOs are too busy to manage their business. They argue that networks enable better access to subsidies and lower local taxes, so even if CEOs do not run the firms very well, they still remain in power.

Wong and Gygax (2009) investigate the relation between board interlocks and the CEO remuneration packages among interlocked board using a large sample of U.S. firms in 2003. They find that board interlocks are positively correlated with similarity in the design of CEO remuneration packages, especially for the stock-based component. They argue that boards are likely to borrow some idea from their interlocked boards when designing the compensation packages for the CEOs.

Cesare and Geoffrey (2008) construct network connections between directors and CEOs use a sample of S&P 1,500 firms. They use four different measures of CEO power: an entrenchment index, consolidation of the titles CEO, CEO duality and

CEO tenure. They find that powerful CEOs are more likely to appoint new directors are connected with the CEO, which might adversely affect the effectiveness of corporate governance. Besides, they find that firms with more connections between directors and CEOs take more acquisitions which destroying the firm value and have lower market valuations.

Christian and Mirco (2010) examine the relationship between firm performance and the board networks position in the network. Using a sample of 133 German firms between 2003 and 2006, they find that well-connected boards are experiencing lower firm performance and lower accounting performance. Besides, they also find that well-connected boards paying higher compensation to their directors.

From the previous section we have reviewed arguments that suggest that a firm have better connected directors is more likely to obtain different kinds of information and resources, so we expect it to be associated with relatively better performance. However, according to the preceding arguments well-connected firms may also reduce the effectiveness of corporate governance due to high directors' salaries and loss of director's independence. Hence the null hypothesis and alternative hypotheses are as follows:

The null hypothesis is:

H_0: There is no relationship between board network centrality and firm

performance

The alternative hypothesis is:

H_1: Board network centrality is positively associated with firm performance.

H_2: Board network centrality is negatively associated with firm performance.

The alternative hypothesis is two-tailed, i.e. it allows for the possibility of board network centrality to negatively (and positively) affect firm performance.

3.3 Data and methodology

3.3.1 Sample and Data

Based on a comprehensive sample of the non-financial UK FTSE 350 firms covering the four year period 2007-2010, we collect networks and corporate governance data from the BoardEx database on board network, board size, CEO duality, average directorships of inside (outside) directors, executive (non-executive) director's age, executive (non-executive) director's tenure, and audit committee, nomination committee and remuneration committee membership. In addition, we source accounting data from Datastream and FAME, collecting data on accounting performance, leverage, and market value. We measure firm performance using both Return on Assets (ROA) and Return on Equity (ROE), as in Core et al. (1999) and Tian and Lau (2001). Return on assets (ROA) measures the efficiency with which a firm uses its assets to generate earnings. Return on equity (ROE) measures the efficiency of a firm in using shareholders' equity to generate earnings. Financial firms are excluded because they are subject to greater external regulation by bodies

such as the FSA (Financial Services Authority). This is consistent with many previous corporate governance studies (e.g. Fich and Shivdasani, 2006; McKnight and Weir, 2009).

Table 3.1 shows the time and industry distribution of sample firms. The sample is made up of 781 firm-year observations during 2007-2010. Industries are classified by the four-digit code based on the SIC (Standard Industrial Classification) Code collected from Datastream.

Table 3.1

Panel A: Time Distribution of Sample Firms

Year	Number of Firms
2007	178
2008	196
2009	201
2010	206
Total Firm Years	781

Panel B: Industry Classification of Sample Firms

Industry	Number of Firm	Percentage
Mining and Quarrying	52	6%
Manufacturing	274	35%
Wholesale and Retail	126	16%
Transportation and Communication	120	15%
Utilities	41	5%
Construction	77	9%
Other	99	14%
Total	781	100%

3.3.2 Methodology

3.3.2.1 Matrix method for the calculation of board level connections

We have a set of nodes (boards of directors), and a single, non-directional relation (the existence of a shared director) measured on every pairs of nodes. For the purpose of explanation, we construct a symmetric matrix in an Excel file (See Table 3.2). We put the firm's name in the rows and columns. Let X refers to the matrix of social network data. In each cells there is a binary variable, which is equal to one if firm A and firm B share one director, and 0 otherwise. Moreover, we construct a "value matrix" when two firms share more than one director with each cell recording the number of shared directors. Networks derived from these matrices are undirected.

Table 3.2 Examples of matrices for calculating board level connections

Panel A: Binary Matrix

	A	B	C
A	0	1	0
B	1	0	1
C	0	1	0

Panel B: Value Matrix

	A	B	C
A	0	2	0
B	2	0	3
C	0	3	0

In the first network (Panel A), firm A has a tie with firm B, but not with C and itself. Firm B has a tie with A and C, firm C has a tie with firm B. In the second network (Panel B), firm A shares two directors with firm B. Firm B shares two directors with firm A, three directors with firm C. Firm C shares three directors with firm B. Once we construct an annual director network for each year in an Excel file and we are able to calculate the centrality measures by importing the Excel file into the social network analysis software (UCINET).

3.3.2.2 Empirical estimation

This study uses the random effects model to estimate the effects of board network

position on firm performance. Gujarati (2003) suggests that if N (781 for this study) is large and T (4 for this study) is small, the estimators of the random effects are more efficient than the fixed effects model. However, the Hausman test is also employed in this study to confirm that the random effects model is superior to the fixed effects model. It basically tests whether the X variables are correlated with the errors:

The null hypothesis is:

H_0: The X variables are not correlated with the errors (Random Effects).

The alternative hypothesis is:

H_1: The X variables are correlated with the errors (Fixed Effects).

Based on the Hausman test (Table 3.3), the Chi Square value is not significant. Therefore, the null hypothesis is not rejected and random effects model should be chosen.

Table 3.3 The Hausman Test Results

Ho: difference in coefficients is not systematic
Chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
=12.46
Prob>chi2 = 0.7552

Where b represents the coefficients of the fixed effects model, B represents the coefficients of the random effects model, V_b-V_B is the difference between the

variences of b and B, b-B is the difference between the coefficients from fixed effects and random effects model.

We use Return on Assets (ROA) and Return on Equity (ROE) as performance indices. ROA_{it} or ROE_{it}= F(Net_{it}, Gov_{it}, C_{it}). By regressing board network position (board centrality), corporate governance variables, and control variables on firm's financial characteristics, the full model is specified as follows:

$$ROA_{it} \text{ or } ROE_{it} = ß_0 + ß_1 Centrality_{it} + ß_2 Board\_Size_{it} + ß_3 Busy\_Board_{it} + ß_4 Board\_Indep_{it} + ß_5 CEO\_Duality_{it} + ß_6 Remun\_Committe_{it} + ß_7 Nomini\_Committe_{it} + ß_8 Audit\_Committe_{it} + ß_9 Market\_Value_{it} + ß_{10} Leverage_{it} + ß_{11} Industry\_Dummy_{it} + ß_{12} Year\_Dummy_{it} \quad 3\text{-}1$$

Here:

Firm performance is measured by Return on Assets **(**ROA) and Return on Equity (ROE). ROA and ROE are generally used as measures of accounting performance. ROA is calculated by the ratio of net income to total assets. ROE is calculated by the ratio of net income to total equity.

$Centrality_{it}$ refers to variables representing the firm network measures (board centrality). This set of variables includes "Degree centrality", "Eigenvector centrality", "Closeness centrality", "Betweenness centrality" and "Information centrality"

Corporate governance variables include board size, busy board, board independence, CEO duality and the total number of members of the remuneration committee, nomination committee and audit committee. Firm characteristics variables include market value and leverage.

Raheja (2005) argues that optimal board structure should reflect a trade off between the benefits of increased monitoring and the costs of monitoring. Board size can vary from small (five members) to a very large number (fifteen members). Optimal board composition may differ with firm specific characteristics and there is no consensus on whether small or large boards can provide effective monitoring. Larger boards are better than smaller boards because they can have more commercial connections and can very easily obtain scarce resources and information (Hillman and Dalziel, 2003). Larger board also possess more specialized skills and opinions compared to a smaller board (Agrawal and Knoeber, 2001). However, larger boards could suffer from coordination and communication problem and thus reduce the effectiveness of governance. Conyon and Peck (1998) find a negative correlation between board size and firm performance using a sample from the UK, France, Netherlands, Denmark and Italy between 1992 and 1995.

Firms with a high percentage of non-executive directors are regarded as following good corporate governance practice (Lorsch and MacIver, 1989) and they are supposed to have a positive impact on firm performance. However, most prior

empirical studies do not find significant positive relationship between board independence and firm performance. For example, Bhagat and Black (2002) find that there is no relationship between board independence and firm performance as measured by Tobin's Q, ROA, sales to assets ratio and market adjusted stock price returns using a large sample of U.S. firms in 1991. Baysinger and Butler (1985) also find no significant correlation between board independence and firm financial performance measured by Return on Equity (ROE) for a sample of 266 U.S. firms between 1970 and 1980.

The definition of busy boards defined by Fich and Shivdasani (2006) is employed here, namely that more than half of the directors hold three or more directorships. Busy boards should adversely affect firm performance because the directors do not have enough time to monitor each firm effectively. Fich and Shivdasani (2006) find that the Forbes 500 largest firms with busy boards are correlated with lower market to book ratios from 1989 to 1995.

The separation of CEO and chairman is considered to positively influence performance because such an arrangement increases board's independence and leads to the effective monitoring and oversight (Fama and Jensen, 1983). Cadbury (1992) suggest that the role of chairman should be separated from the role of CEO because if one person holding two roles at the same time is considered as concentration of power which might reduce the board independence. Therefore, we

expect that the separation of CEO and chairman will have a positive effect on firm performance.

A greater number of directors on remuneration, nomination and audit committees is regarded as being consistent with good corporate governance practice (Lorsch and MacIver, 1989; Levy, 1993; the UK Corporate Governance Code, 2010) so the size of these committees should be positively associated with firm performance. Table 3.4 lists all of the control variables and their definitions.

Table 3.4 Control Variable Definitions

Variable Name (Abbreviation)	Definition
Board size (BS)	The total number of directors on the board
Board Independence (BI)	Number of non-executive directors divided by the total number of directors
Duality	A dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise
Busy Board (BB)	A dummy variable taking the value of one if more than half of the directors hold three directorships and zero otherwise
Audit Committee (AC)	The total number of members of the board Audit committee
Nomination Committee (NC)	The total number of members of the board Nomination committee
Remuneration Committee (RC)	The total number of members of the board Remuneration committee
Market Value (MV)	Market capitalization of the firm
Leverage	Total debt divided by total equity

3.4 Empirical results

3.4.1 Descriptive Statistics

Table 3.5 presents the summary statistics for all of the variables used in the empirical analysis. The average board degree centrality is 0.28 with a median of 0.35. The average board Eigenvector centrality is 1.35 with a median of 1.60. The average board Betweenness centrality is 0.15 with a median of 0.21. The average board Closeness centrality is 0.45 with a median of 0.48. The average board Information centrality is 5.26 with a median of 6.52. The average board size in the sample is 9.00 (mean=8.98) and ranges from 5.00 to 19.00. The percentage of non-executive directors, measured by the BI variable, is about 64% in our sample. In terms of CEO duality, about 95% of firms separated the role of CEO and Chairman, which was strongly recommended by the UK Corporate Governance Code (2010). The average value of the Busyboard variable is 0.46, which indicates that in 46% of firms more than half of the directors hold more than three directorships. The average audit committee size is 3.55, which is smaller than the nomination committee size (4.69) and the remuneration committee size (3.83). The average market value is £5.2 million and leverage is 0.17 (i.e. a 17% debt to equity ratio).

Table 3.6 depicts the Pearson correlation matrix for the key variables employed in the study. The correlation coefficient is used to test the strength of the relationship between the independent variables and thus detect the possible presence of

multicollinearity. Variables that are highly correlated with each other increase the standard errors of their partial regression coefficients, leading to low t-statistics. This makes it more difficult to reject the null hypothesis if multicollinearity is present. The worse-case scenario of high multicollinearity will make some variables statistically insignificant whereas they might be significant in reality. We find that degree centrality has a strong positive correlation with eigenvector centrality (0.55) as we expected. Board size is positively and significantly correlated with degree (0.41), eigenvector (0.32), betweenness (0.38), closeness (0.41) and information (0.55) centrality. Firm size measured by market value is found to be positively and significantly correlated with board size (0.48), which indicates that larger firms tend to have bigger boards, as one would expect. As we do not observe high correlation coefficients in the Pearson correlation matrix, multicollinearity does not appear to be a significant problem in our model. However, in order to double check that multicollinearity is not a significant problem, the Variance Inflation Factor (VIF) test is employed to test the level of multicollinearity (see Table 3.7). If a VIF is more than 10 or a tolerance (1/VIF) is less than 0.10 then multicollinearity may be a problem (O'Brien, 2007). Table 3.7 shows that none of the independent variables had VIF values greater than 10 (or tolerance values less than 0.10) with a mean VIF value of 2.40 and an overall tolerance value of 0.41, which confirms that multicollinearity is not a significant problem in our regression model.

Table 3.8 presents the top 10 most central FTSE 350 non-financial firms in 2007 based on the five different centrality measures. It can be seen that some firms feature prominently in all five centrality rankings. RIO TINTO, for example, a multinational metals and mining company. However, firms like Bunzl only can be found in degree and eigenvector centrality, which suggests that firms that dominate in one or two centrality measures do not necessarily have high values for other centrality measures.

Table 3.5 Descriptive Statistics

This table presents the summary statistics for all the variables used in this study. Degree, Eigenvector, Betweenness, Closeness and Information centrality are calculated by UCINET 6 (Social Network Analysis Software). Board size is the number of directors on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of total debt to the book value of equity. MV is the market capitalization.

Variable	Mean	Median	Min	Max	Std. Dev
Degree	0.28	0.35	0.00	3.85	0.85
Eigenvector	1.35	1.60	0.00	48.61	2.26
Betweenness	0.15	0.21	0.00	7.84	0.39
Closeness	0.45	0.48	0.00	0.85	0.25
Information	5.26	6.52	0.00	9.60	0.78
Board Size	8.98	9.00	5.00	19.00	2.36
BI	0.64	0.67	0.24	0.93	0.12
Duality	0.95	1.00	0.00	1.00	0.22
BusyBoard	0.46	0.00	0.00	1.00	0.50
Audit	3.55	3.00	2.00	8.00	0.90
Nomination	4.69	5.00	0.00	10.00	1.60
Remuneration	3.83	4.00	2.00	8.00	1.00
Leverage	0.17	0.18	0.00	0.48	0.11
MV (million)	5,160	1,224	108	114,583	12,652

Table 3.6 Pearson Correlation Matrix

This table presents the Pearson correlation coefficients for all the variables used in this study. Degree, Eigenvector, Betweenness, Closeness and Information are five different centrality measures. Board size is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split and zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Variables 10 to 12 represent the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of total debt to total equity. MV is the market capitalization. The asterisks ***, ** and * show statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
(1)Degree	1													
(2)Eigenvector	0.5535***	1												
(3)Betweenness	0.4862***	0.3238***	1											
(4)Closeness	0.3339***	0.1866***	0.0323**	1										
(5)Information	0.3726***	0.3957***	0.3227**	0.6079**	1									
(6)Board Size	0.4103***	0.3233***	0.3804**	0.4129**	0.5505**	1								
(7)BI	0.1483**	0.1682**	0.1016**	0.0157	0.1315**	0.0873*	1							
(8)Duality	-0.0036	-0.0085	-0.026	-0.0263	-0.0295	-0.0658*	0.1673*	1						
(9)BusyBoard	0.1047**	0.1457**	0.1274**	0.0069	0.1116**	0.1636*	0.3000*	-0.0533	1					
(10)Audit	0.2505**	0.2138**	0.2240**	0.0625**	0.3561**	0.4317*	0.2638*	0.0441	0.1087*	1				
(11)Nomination	0.2908**	0.2234**	0.2818**	0.0764**	0.3361**	0.3128*	0.0916*	0.0950*	-0.0349	0.4624*	1			
(12)Remunaration	0.2806**	0.2325**	0.2533**	0.0819**	0.3167**	0.3071*	0.2449*	0.1039*	0.0592*	0.7031*	0.4748*	1		
(13)Leverage	0.1279**	0.0926**	0.1364**	0.0067	0.1531**	0.1406*	0.0535	-0.0206	0.0421	0.1492*	0.0738*	0.1475*	1	
(14)MV	0.2634**	0.2709**	0.1791**	0.0755**	0.3543**	0.4845*	0.2633*	0.0402	0.2544*	0.2819*	0.0518	0.1677*	0.0500	1

Table 3.7 Variance Inflation Factor (VIF) Test Results

Variable	**VIF**	**1/VIF**
Information	6.20	0.16
Degree	5.40	0.19
Eigenvector	2.93	0.34
Betweenness	2.71	0.37
Closeness	2.45	0.41
Audit	2.24	0.44
Remuneration	2.19	0.46
Board Size	1.84	0.54
MV	1.53	0.65
Nomination	1.51	0.66
BI	1.25	0.80
Busyboard	1.19	0.84
Duality	1.06	0.95
Leverage	1.05	0.96
Mean	**2.40**	**0.41**

Table 3.8 Top 10 Central Firms

Panel A: Firms with the highest Degree centrality

Company Name	C_D
TAYLOR WIMPEY	3.85
ITV	3.76
THOMAS COOK GROUP	3.25
RIO TINTO	3.04
BERKELEY GROUP HDG	2.91
BAE SYSTEMS	2.83
BRITISH AMERICAN TOBACCO	2.81
RIYAL DUTCH SHELL	2.54
TESCO	2.52
ROLLS ROYCE	2.51

Panel B: Firms with the highest Eigenvector centrality

Company Name	C_{Bo}
BERKELEY GROUP HDG	48.61
ROYAL DUTCH SHELL	46.17
BUNZL	44.66
SMITH(DS)	41.90
NEXT	37.81
RANK GRP	36.27
BELLWAY	34.56
RIO TINTO	32.10
BRITISH AMERICAN TOBACCO	28.69
TESCO	26.28

Panel C: Firms with the highest Betweenness centrality

Company Name	C_B
NATIONAL GRID	7.84
BRITISH AMERICAN TOBACCO	7.36
MARKS AND SPENCER	7.25
ROYAL DUTCH SHELL	7.20
RIO TINTO	7.19
SAINSBURY	7.18
ITV	6.17
BP	6.13
BAE SYSTEMS	6.11
EURASIAN NATURAL RESOURCES	6.10

Panel D: Firms with the highest Closeness centrality

Company Name	C_C
BRITISH AMERICAN TOBACCO	0.85
THOMAS COOK GROUP	0.77
BP	0.75
BAE SYSTEMS	0.73
TESCO	0.71
RIO TINTO	0.69
JOHNSON MATTHEY	0.66
SAINSBURY	0.63
BT GRP	0.63
MARKS AND SPENCER	0.62

Panel E: Firms with the highest Information centrality

Company Name	C_C
BHP BILLITON PLC	9.60
BAE SYSTEMS	9.45
BP	8.42
VODAFONE GROUP PLC	8.15
RIO TINTO	8.09
ROYAL DUTCH SHELL	8.06
BT GRP	7.98
SAINSBURY	7.86
MARKS AND SPENCER	7.48
JOHNSON MATTHEY	7.42

Figure 3.1 shows the degree centrality of firms by industry between 2007 and 2010. The industry with the highest centrality is manufacturing, with an average degree centrality of 0.45 whereas 'other' industries has the lowest centrality of 0.07. Apart from 'manufacturing', the highest centrality industries are 'wholesale and retail', 'construction' and 'mining and quarrying' with degree centrality measures ranging from about 0.32 to 0.40. Figure 3.2 shows the eigenvector centrality of firms by industry between 2007 and 2010. As we can see, 'manufacturing', 'wholesale and retail', and 'mining and quarrying' have the highest centrality measures, which are similar to degree centrality. Figure 3.3 shows the betweenness centrality of firms by industry between 2007 and 2010. In contrast to the degree and eigenvector centrality, 'wholesale and retail' has the highest centrality of 0.28, while 'manufacturing' has the lowest centrality of 0.06. Figure 3.4 shows the closeness centrality of firms by industry between 2007 and 2010. The industries with the highest centrality are 'manufacturing', 'wholesale and retail', 'mining and quarrying' and 'transportation and communication'. Figure 3.5 shows the information centrality of firms by industry between 2007 and 2010. 'wholesale and retail', 'manufacturing' and

'mining and quarrying' have the highest centrality. In summary, it is evident that 'wholesale and retail' and 'manufacturing' have the highest centrality across all five centrality measures.

Figure 3.1: Degree centrality classified by industry for the non-financial FTSE 350 firms between 2007 and 2010

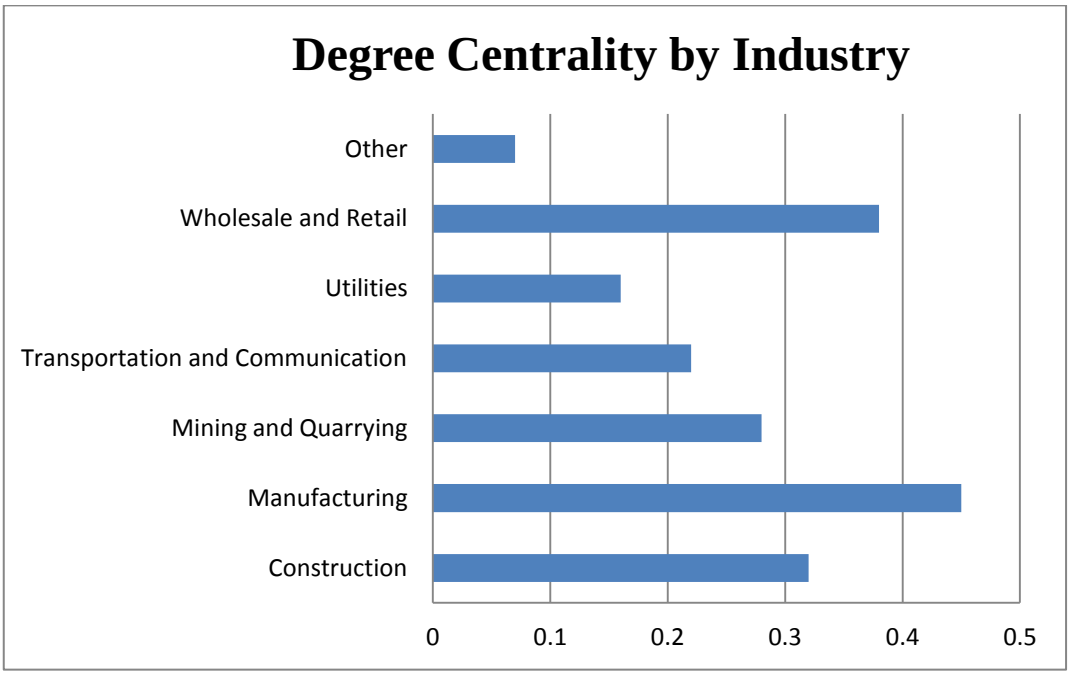


Figure 3.2: Eigenvector centrality classified by industry for the non-financial FTSE 350 firms between 2007 and 2010

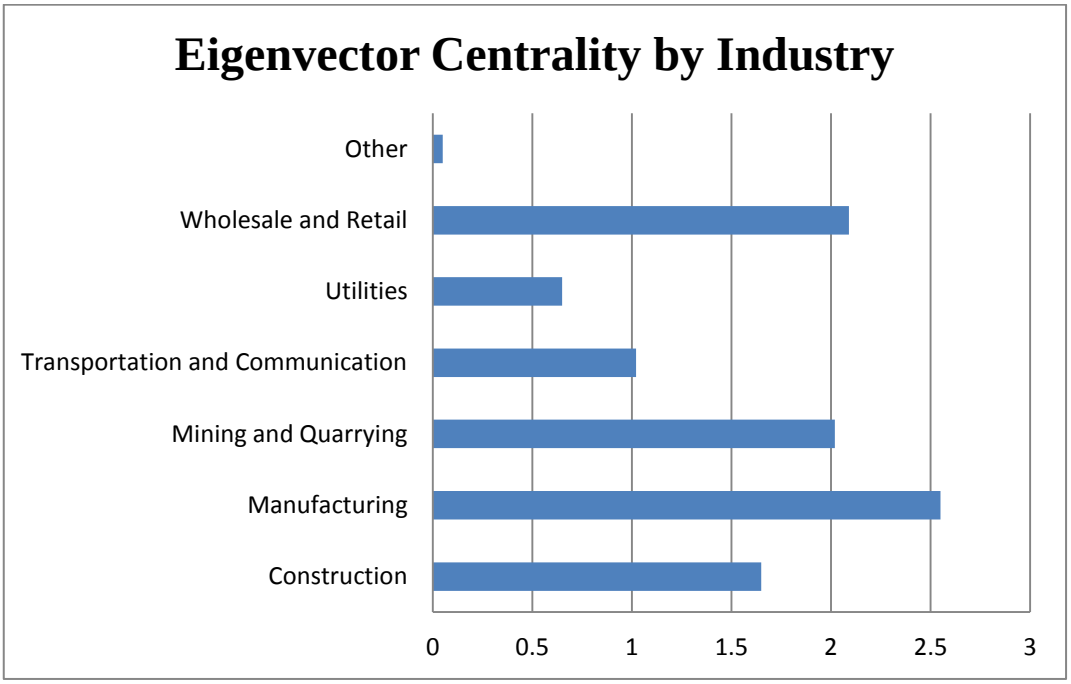


Figure 3.3: Betweenness centrality classified by industry for the non-financial FTSE 350 firms between 2007 and 2010

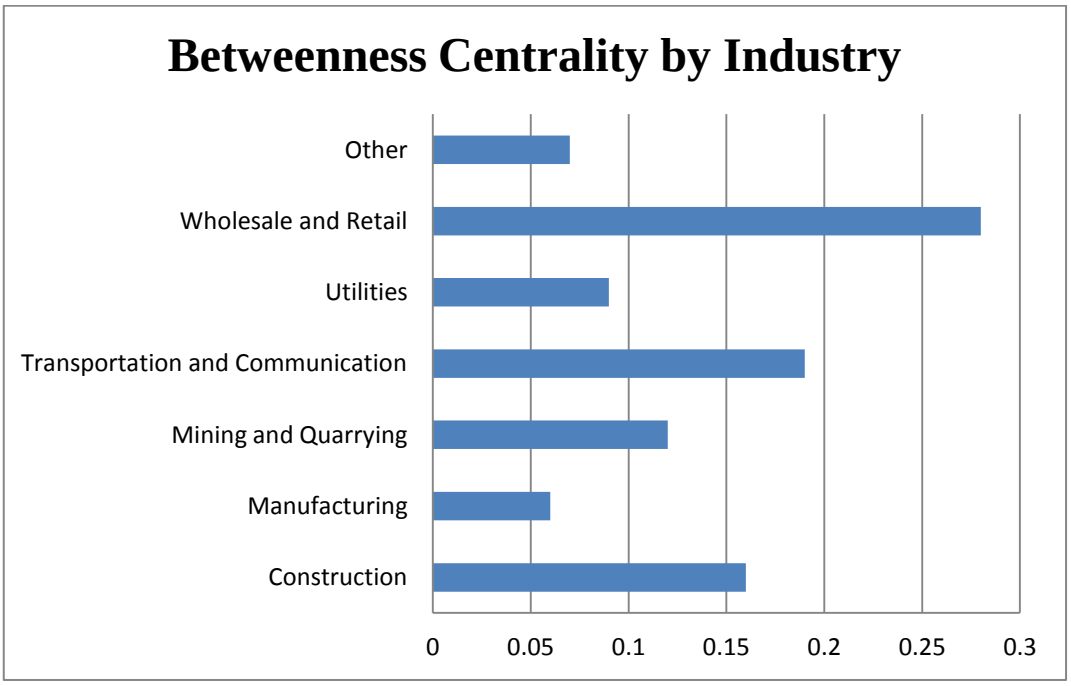


Figure 3.4: Closeness centrality classified industry for the non-financial FTSE 350 firms between 2007 and 2010

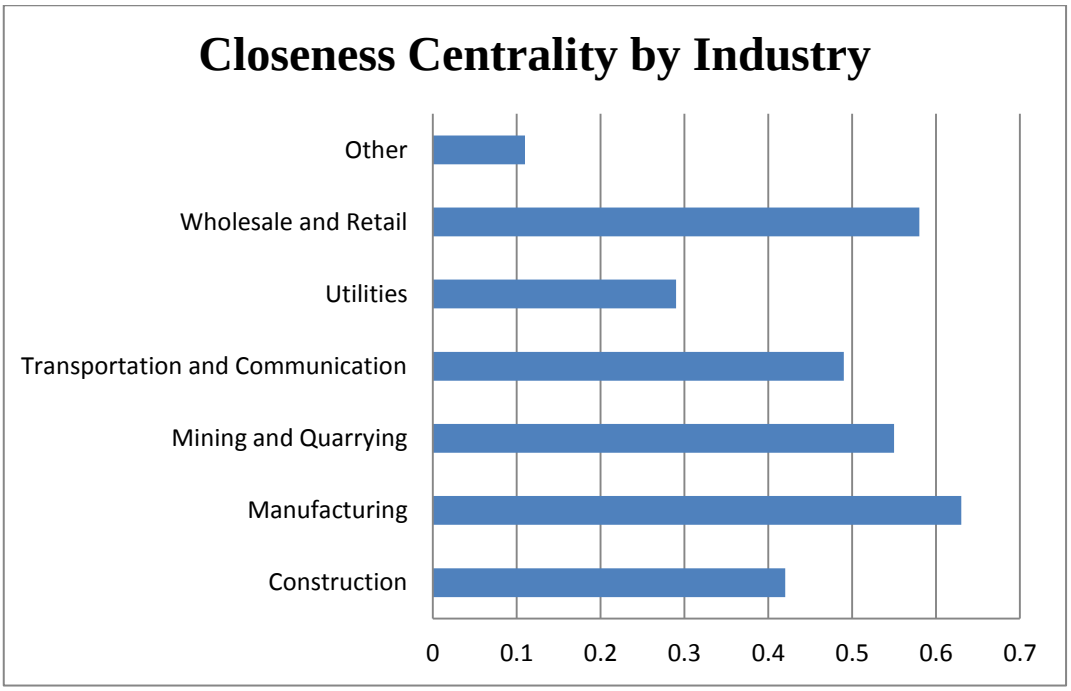
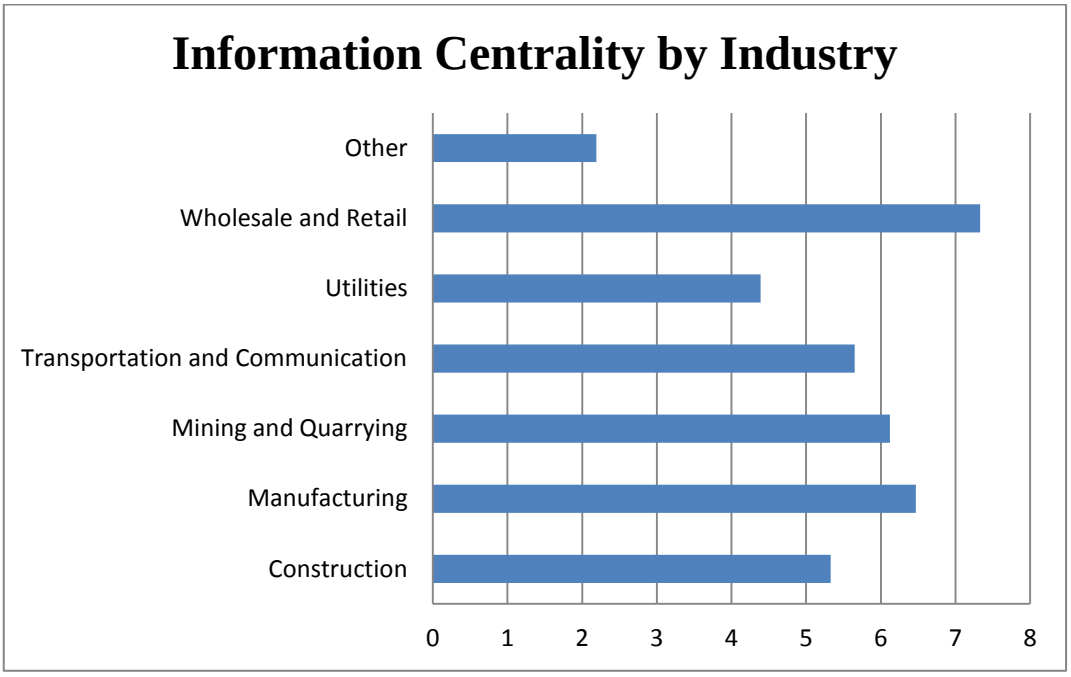


Figure 3.5: Information centrality classified by industry for the non-financial FTSE 350 firms between 2007 and 2010



Figures 3.6 – 3.9 present the networks linking all sample firms listed on the London Stock Exchange for each year between 2007 and 2010. In 2007, there were only four firms isolated from the whole network, but this number increased to twelve in 2008 and to thirty in 2009. In 2010, we found that firms isolated from the whole network decreased to seven. In 2009, four firms (No 10, 65, 84, and 212) were isolated from the main network and became two small branches. It can be seen that the firm (No 108) connected with two firms (No 146 and 175) in 2007. However, it was isolated from the whole network in 2008 and 2009. In 2010, it connected with two firms (No 32 and 224) again. In addition, we observe that the directors' network in 2007 is denser than networks in 2008 and 2009. The likely reasons behind this phenomenon are that directors lacked the time to devote to board duties, which grew heavier during the global financial crisis (Wong, 2012). Second, the probability of directors' resignation (e.g. CEO, CFO, etc) was much higher during financial crisis

period. According to a 2008 Wall Street Journal analysis, nearly 50 non-executive directors who were full time CEOs or CFOs elsewhere resigned their posts that year in troubled financial services, retail and home construction sectors (Wong, 2012). Besides, the number of FTSE 100 finance directors who remained in their jobs during the financial crisis period (2008-2009) decreased by 16 percent from 94 to 79 compared with the year 2008 (Groom, 2009).

Figure 3.6 The network of 190 firms listed on London Stock Exchange (2007)

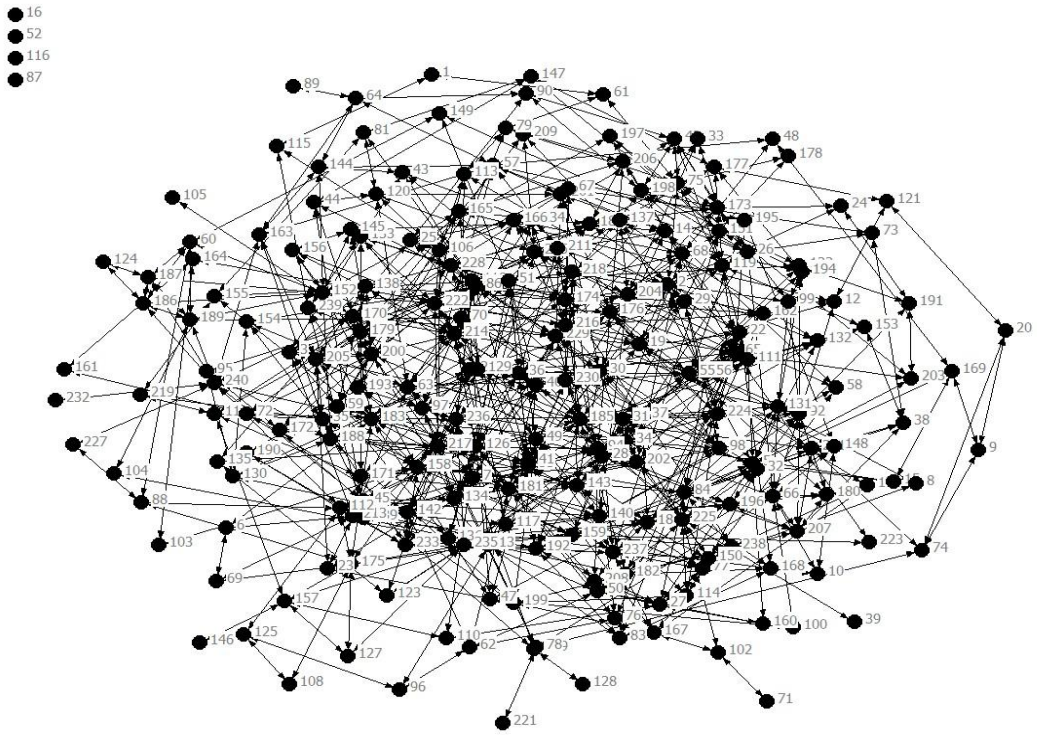


Figure 3.7 The network of 194 firms listed on London Stock Exchange (2008)

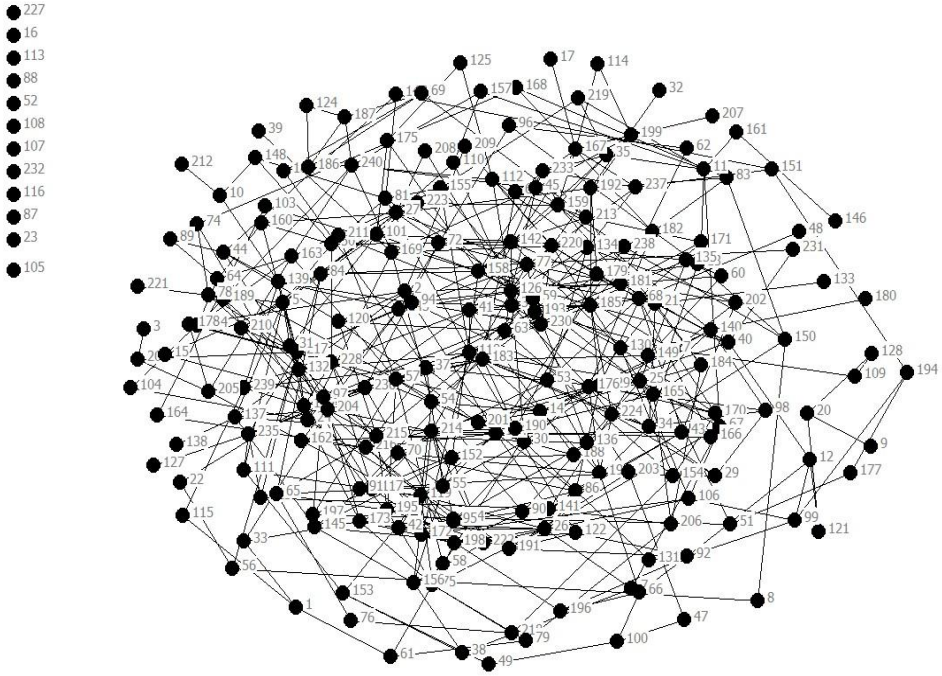


Figure 3.8 The network of 196 firms listed on London Stock Exchange (2009)

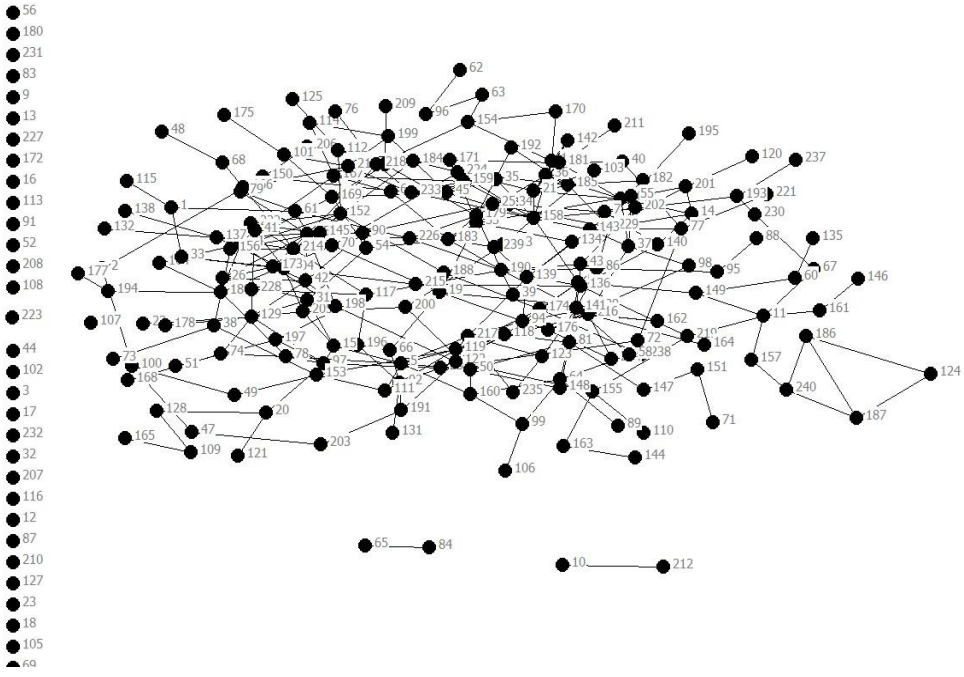
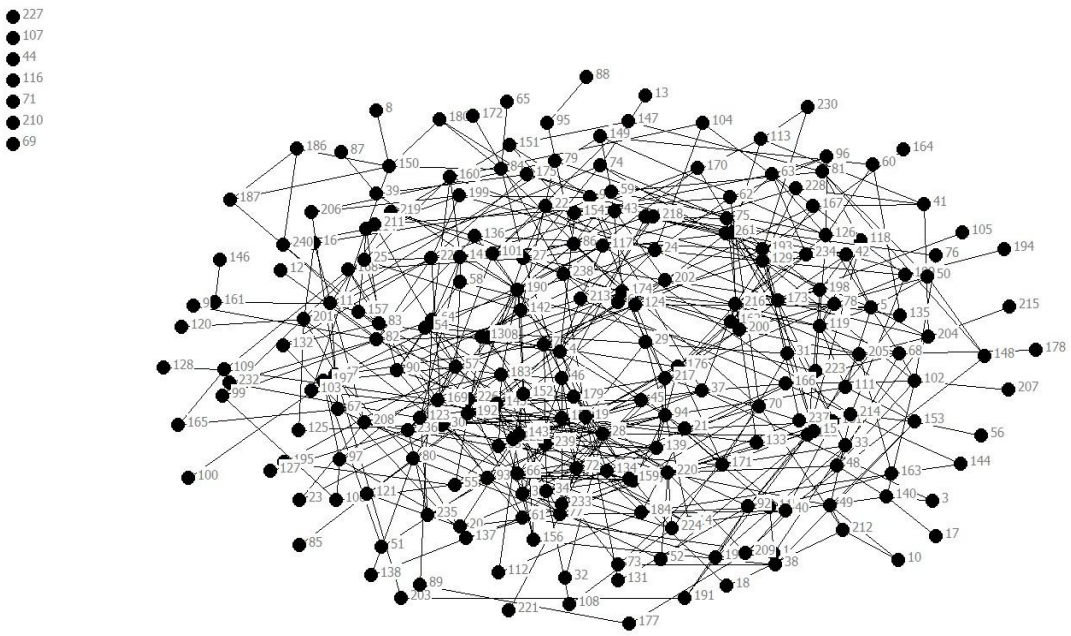


Figure 3.9 The network of 201 firms listed on London Stock Exchange (2010)



3.4.2 Board networks and firm performance

There are two different opinions existing in the literature. On the one hand, director networks reflect the reputation of directors (Fama and Jenson, 1983). Firms with well-connected directors have more opportunities to access different information and resources and therefore improve firm performance. On the other hand, well-connected directors are sometimes overcommitted and lack the time to scrutinize their businesses effectively. Thus, firms with well-connected directors have lower performance. In order to test these two competing hypotheses, multivariate analysis is applied. Director interlocks or networks are mostly measured by the number of directorships in the existing literature. However, this method only captures the quantity of directors' obligations, not their quality. It cannot be explained by the extent whether directors are really busy and overcommitted. For example, a director who holds five directorships in small firms is not necessarily busier than a director who holds, say, three directorships in larger firms. Therefore, we suggest that a more accurate measure of networks can be

obtained from the concept of centrality employed in social network analysis. Board network centrality is therefore applied to measure the position of firms in entire networks of firms.

We find that all board centrality measures have positive and significant effects on firm performance when we regress them in same model (see Table 3.9). Specifically, Table 3.9 column (1) shows that there is a positive and significant relationship between degree centrality and firm performance (ROA) at the 5% level. Also, firm performance is found to be positively and significantly associated with Eigenvector, betweenness, closeness and information centrality at 5%, 10%, 5%, and 5% significance levels respectively. The results do not support the null hypothesis but they do support alternative hypothesis 1 (H_1) that board network centrality is positively associated with firm performance. We also find that board size is negatively and significantly associated with firm performance at the 5% level, which suggests that large boards tend to perform poorly. Board independence is found to be positively and significantly associated with firm performance. The results support the argument that the majority of the board should be composed of non-executive directors. We also observe that busy board is negatively and significantly associated with firm performance. This result suggests that busy directors are unable to effectively contribute to all of the businesses where they occupy board positions. When we measure firm performance by ROE, we find similar results (see Table 3.9 column (2)). Leverage has a significant negative effect on firm performance. This is consistent with the argument of McConnell and Servaes (1995) that firms may have to forego expenditure on projects with positive net present values (underinvest) if they have excessive debt.

Table 3.9 Board Networks Position and Firm Performance

This table presents the regression results of the impact of board networks position on firm performance. The dependent variables are ROA and ROE. Degree, Eigenvector, Betweenness, Closeness and Information Centrality are calculated by UCINET 6 (Social Network Analysis Software). BoardSize is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	Dependent Variable	
Independent Variable:	**(1)Return on Assets**	**(2)Return on Equity**
Degree	5.422**	3.985**
	(2.563)	(2.341)
Eigenvector	7.319**	6.439**
	(2.331)	(2.296)
Betweenness	6.322*	4.498*
	(1.843)	(1.673)
Closeness	10.342**	5.285**
	(2.674)	(2.164)
Information	8.432**	6.849**
	(2.436)	(2.135)
BoardSize	-1.943**	-0.424*
	(-2.574)	(-1.612)
BI	2.235**	1.427**
	(2.892)	(2.577)
Duality	0.235	1.928
	(0.453)	(0.984)
BusyBoard	-4.345***	-5.484***
	(-3.258)	(-3.128)
Audit	1.423	2.857
	(0.467)	(0.768)
Nomination	4.343	3.847
	(0.879)	(0.984)
Remuneration	3.335	3.26
	(0.562)	(0.662)
Leverage	-12.327**	-10.482**
	(-2.128)	(-2.478)
MV	4.354	2.484
	(0.135)	(0.148)
Intercept	-12.453	-10.485
Industry and Time Dummies	Yes	Yes
Adj R^2	0.32	0.26
F	3.65	3.15

Table 3.10 Board Networks Position and Firm Performance Measured by ROA

This table presents the regression results of the impact of Board Networks Position on firm performance. The dependent variable is **ROA**. Centrality measures are calculated by UCINET 6. Board size (BS) is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Degree	5.561**				
	(2.762)				
Eigenvector		7.467***			
		(2.465)			
Betweenness			4.473*		
			(1.787)		
Closeness				10.746**	
				(2.946)	
Information					9.842**
					(2.318)
BoardSize	-1.656**	-1.899***	-2.646**	-0.667***	-2.858***
	(-2.523)	(-2.888)	(-2.583)	(-2.876)	(-2.985)
BI	2.685**	2.859**	2.768**	2.847**	3.212**
	(2.474)	(2.371)	(2.985)	(2.475)	(2.146)
Duality	0.483	0.657	0.489	0.589	0.674
	(0.484)	(0.378)	(0.125)	(0.487)	(0.849)
BusyBoard	-2.623***	-3.454***	-4.878***	-3.767***	-4.378***
	(-3.654)	(-2.879)	(-2.988)	(-2.634)	(-3.411)
Audit	0.984	-0.782	-0.767	-0.456	-0.837
	(1.263)	(-1.656)	(-1.223)	(-1.774)	(-1.327)
Nomination	1.556	-2.998	-0.456	-0.578	-0.396
	(1.885)	(-1.874)	(-0.993)	(-0.996)	(-0.132)
Remuneration	0.674	2.858	0.873	0.532	0.463
	(0.775)	(0.825)	(1.489)	(1.673)	(1.410)
Leverage	-8.387***	-8.587***	-9.998***	-8.582***	-9.314***
	(-2.788)	(-2.865)	(-4.984)	(-4.665)	(-4.414)
MV	3.784	2.847	0.083	0.088	0.183
	(0.786)	(0.776)	(0.856)	(0.985)	(0.849)
Intercept	-0.015**	-0.016**	-0.016**	-0.017**	-0.042**
	(2.53)	(2.73)	(2.14)	(2.56)	(2.35)
Industry and Time Dummies	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.32	0.33	0.35	0.35	0.35
F	3.32	3.44	3.87	3.99	3.96

Table 3.11 Board Networks Position and Firm Performance Measured by ROE

This table presents the regression results of the impact of Board Networks Position on firm performance. The dependent variable is **ROE**. Centrality measures are calculated by UCINET 6. Board size (BS) is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Degree	8.536**				
	(2.793)				
Eigenvector		7.423**			
		(2.444)			
Betweenness			6.677*		
			(1.868)		
Closeness				10.532**	
				(2.856)	
Information					9.283**
					(2.567)
BS	-1.569**	-2.839**	-1.332**	-2.485**	-1.349**
	(-2.776)	(-2.538)	(-2.609)	(-2.491)	(-2.586)
BI	2.556**	2.829**	1.428**	2.829**	3.491**
	(2.244)	(2.271)	(2.565)	(2.429)	(2.244)
Duality	0.652	0.657	0.399	0.279	0.639
	(0.419)	(0.398)	(0.305)	(0.297)	(0.139)
BusyBoard	-2.649***	-3.454***	-3.948***	-3.729***	-4.491***
	(-3.374)	(-2.289)	(-2.688)	(-2.294)	(-3.441)
Audit	0.734	-0.372	-0.967	-0.106	-0.832
	(1.153)	(-1.496)	(-1.323)	(-1.294)	(-1.324)
Nomination	1.486	-2.878	-0.436	-0.498	-0.331
	(1.495)	(-1.694)	(-0.203)	(-0.940)	(-0.429)
Remuneration	0.895	2.856	0.849	0.291	0.449
	(0.645)	(0.885)	(1.221)	(1.367)	(1.429)
Leverage	-8.389***	-7.492***	-9.478***	-8.584***	-9.193***
	(-2.198)	(-2.584)	(-4.284)	(-4.281)	(-4.384)
MV	3.482	2.692	0.294	0.482	0.393
	(0.402)	(0.759)	(0.583)	(0.932)	(0.812)
Intercept	-0.073**	-0.079**	-0.071**	-0.593**	-0.492**
	(-2.654)	(-2.266)	(-2.562)	(-2.431)	(-2.631)
Industry and Time Dummies	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.28	0.25	0.22	0.23	0.28
F	2.77	2.88	3.56	2.88	2.93

Table 3.12
Board Networks Position measured by N-SCORE and Firm Performance

This table presents the regression results of the impact of N-SCORE on firm performance. The dependent variable is ROA and ROE. N-SCORE is calculated by taking the average quintile rank in each of the four centrality measures. BS is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. MV is the market capitalization. Leverage is the ratio of Total Debt to Total Equity. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	Dependent Variable	
Independent Variable	**(1)Return On Assets**	**(2)Return On Equity**
N-Score	1.492**	2.425**
	(2.201)	(2.693)
BS	-0.398**	-1.941**
	(-2.314)	(-2.591)
BI	1.223***	1.589**
	(3.484)	(2.983
Duality	0.489	0.743
	(0.082)	(0.099)
BusyBoard	-0.492**	-2.648**
	(-2.491)	(-2.533)
Audit	-0.594	-9.291
	(-0.491)	(-0.748)
Nomination	1.840	2.311
	(1.819)	(0.493)
Remuneration	1.349	5.493
	(1.259)	(1.145)
Leverage	-11.314**	-15.429**
	(-3.319)	(-2.593)
MV	0.597	3.524
	(0.402)	(0.524)
Intercept	0.593**	0.420**
	(2.456)	(2.325)
Industry and Time Dummies	Yes	Yes
Adj R^2	0.25	0.32
F	2.65	2.97

We then test the effects of five centrality measures on firm performance separately (see Table 3.10). Table 3.10 column (1) shows that there is a positive and significant relationship, at the 5% level, between degree centrality and firm performance after controlling for corporate governance characteristics, firm characteristics and other control variables. Column (2) of Table 3.10 shows a positive influence of eigenvector centrality on firm performance, significant at the 1% level. This implies that not only the number of ties is important, but the quality of ties is also important.

Third, we examine the effect of Betweenness centrality on firm performance (Table 3.10, Column (3)) and find that it has a positive and significant effect on firm performance after controlling for industry and other control variables, although the significance is only at the 10% level. Betweenness is based on communication. If a firm lies on the shortest path between two other firms, information between these firms will likely pass by on its way through the network. Therefore, this firm can control information flows to an extent, giving it power over other firms. Fourth, we test the effect of closeness centrality on firm performance. We find that the relationship between them is positive and significant at the 5% level (see Table 3.10, Column (4)). Finally, we test the effect of information centrality on firm performance and find that it has a strong positive association with firm performance, also significant at the 5% level. This suggests that information or resources may not only flow through the shortest path but could travel via other circuitous routes. Based on the above results, alternative hypothesis 1 (H_1), which argues that firms with well-connected directors are associated with better firm performance, is supported.

In order to test the robustness of these results, we examine the relationship between board network centrality and firm performance using ROE instead of ROA as the dependent variable. The results, reported in Table 3.11, are consistent with prior results. However, although the magnitudes of the regression coefficients are larger in Table 3.11, the adjusted R^2 values are slightly lower. It is worth noting that in both Tables 3.10 and 3.11 the partial regression coefficient with the greatest magnitude is that for closeness centrality. Firm performance as measured by ROA and ROE will improve by 10.75% and 10.53% respectively as the closeness centrality measure increases by 1%. The results suggest that the shortness of the paths linking firms to other firms has the greatest economic impact on firm performance.

Table 3.12 contains the results from regressing the aggregate N-Score value of network centrality on firm performance. The regression results demonstrate that the N-Score values are significantly related to firm performance at the 5% level, when controlling for the other variables. We also find that board independence is positively and significantly associated with firm performance, while board size, busy board and leverage are negatively and significantly related to firm performance, consistent with our previous findings.

3.4.3 Endogeneity

It may be argued that endogeneity is a potential issue that needs to be accounted for in our regressions. In addition to noting that the problem of reverse causality, Hermalin and Weisbach (2003) argue that the issue of endogeneity can also be

divided into two categories: equilibrium and out-of-equilibrium explanations. For example, some empirical studies show that there is a negative relation between board size and firm performance. Based on the out-of-equilibrium explanation, large boards may be difficult to manage and thus reduce the effectiveness of boards and firm value. However, the equilibrium explanation suggests that other factors which haven't been controlled for in the explanatory model could affect board size and firm performance simultaneously, so that it's hard to say which one affects which. In this study, firstly, we must recognize that good companies will be inclined to hire well-connected directors. Thus, there could be a reverse causality from firm performance to board networks. Secondly, some specific firm characteristics (such as previous firm performance) could affect firm value and board networks simultaneously.

In order to examine the potential endogeneity issue, firstly, we use one year lagged values of the centrality measures in the following regression model (3-2). The idea is that although firm performance can affect board networks and vice versa, it is unlikely that firm performance can influence the past values of board networks. Secondly, we also include lagged values of firm performance to control for the effect of past performance on current board composition (Wooldridge, 2003) (see model 3-2). This approach is also consistent with previous studies (e.g. Bohren and Strom, 2005 and Horton et al, 2012).

$$ROA_{it} \text{ or } ROE_{it} = ß_0 + ß_1 Centrality_{it-1} + ß_2 Performance_{it-1} + ß_3 Board\_Size_{it} + ß_4 Busy\_Board_{it} + ß_5 Board\_Indep_{it} + ß_6 CEO\_Duality_{it} + ß_7 Remun\_Committe_{it} + ß_8 Nomini\_Committe_{it} + ß_9 Audit\_Committe_{it} + ß_{10} Market\_Value_{it} + ß_{11} Leverage_{it} + ß_{12} Industry\_Dummy_{it} + ß_{13} Year\_Dummy_{it} \quad 3\text{-}2$$

It can be seen from Tables 3.13 - 3.14 that the results of the one year lagged values of the centrality measures are still consistent with our previous findings, which suggests that boards with well-connected directors positively affect firm performance. Since the lagged value of the centrality measures still remain statistically significant, we conclude that the centrality measures do not suffer from the endogeneity issue in our regressions.

Table 3.13 Lagged Board Networks Position and Lagged Firm Performance

This table presents the regression results of the impact of Board Networks Position (one year lagged) on firm performance. The dependent variable is **ROA**. Performance (Lagged) is one year lagged values of firm performance. Board size is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Degree	3.105**				
	(2.490)				
Eigenvector		3.578**			
		(2.563)			
Betweenness			2.197*		
			(1.791)		
Closeness				5.225**	
				(2.841)	
Information					4.585**
					(2.291)
Performance (Lagged)	0.773***	0.854***	0.738***	0.847***	0.651**
	(4.599)	(5.582)	(5.221)	(6.565)	(2.584)
BoardSize	-2.950**	-1.482**	-2.592**	-1.895***	-2.645***
	(-2.662)	(-2.557)	(-2.655)	(-2.825)	(-2.889)
BI	2.583**	2.494*	2.291**	2.497**	2.764**
	(2.558)	(1.858)	(2.657)	(2.587)	(2.574)
Duality	0.488	0.756	0.291	0.696	0.578
	(0.284)	(0.292)	(0.468)	(0.484)	(0.982)
BusyBoard	-3.173***	-2.633***	-4.592***	-3.294***	-2.482***
	(-3.879)	(-2.692)	(-2.592)	(-2.592)	(-3.875)
Audit	0.375	-0.949	-0.768	-0.858	-0.583
	(1.032)	(-1.225)	(-1.592)	(-1.239)	(-1.258)
Nomination	1.343	-1.296	-0.569	-0.347	-0.591
	(0.784)	(-0.499)	(-0.685)	(-0.558)	(-0.567)
Remuneration	0.955	1.258	0.792	0.592	0.479*
	(0.274)	(0.375)	(1.359)	(1.491)	(1.949)
Leverage	-3.480***	-5.482***	-4.458***	-7.458***	-6.258***
	(-2.866)	(-2.683)	(-4.849)	(-3.284)	(-4.654)
MV	1.094	2.592	0.548	0.285	0.594
	(0.756)	(0.768)	(0.338)	(0.496)	(0.527)
Intercept	-0.033**	-0.028**	-0.049**	-0.033**	-0.058**
	(2.694)	(2.492)	(2.867)	(2.578)	(2.322)
Industry and Time Dummies	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.30	0.33	0.34	0.31	0.29
F	3.12	3.45	3.79	3.58	3.11

Table 3.14 Lagged Board Networks Position and Lagged Firm Performance

This table presents the regression results of the impact of Board Networks Position (one year lagged) on firm performance. The dependent variable is **ROE**. Performance (Lagged) is one year lagged values of firm performance. Board size is the number of directors sitting on the board. BI stands for the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals one if more than half of directors holding three or more directorships, otherwise it is zero. Audit, Nomination and Remuneration are the number of board members serving on Audit, Nomination and Remuneration Committees. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Degree	4.383**				
	(2.647)				
Eigenvector		3.112**			
		(2.482)			
Betweenness			3.484*		
			(1.512)		
Closeness				3.491**	
				(2.667)	
Information					3.349*
					(2.228)
Performance (Lagged)	0.492***	2.383***	1.447***	1.449***	1.585***
	(5.291)	(5.689)	(4.382)	(5.402)	(7.212)
BoardSize	-1.456*	-1.492**	-1.542*	-2.298**	-1.558**
	(-2.373)	(-2.647)	(-2.213)	(-2.484)	(-2.772)
BI	1.592**	2.335**	1.495**	2.859**	3.586**
	(2.594)	(2.502)	(2.942)	(2.301)	(2.876)
Duality	0.291	0.852	0.664	0.658	0.524
	(0.583)	(0.596)	(0.621)	(0.487)	(0.598)
BusyBoard	-3.592***	-3.527***	-2.956***	-3.494***	-3.756***
	(-3.887)	(-2.878)	(-3.282)	(-2.699)	(-3.494)
Audit	0.492	-0.479	-1.530	-0.350	-0.265
	(1.259)	(-1.286)	(-1.789)	(-1.627)	(-1.529)
Nomination	1.792	-2.694	-0.695	-0.258	-0.688
	(1.576)	(-1.675)	(-0.232)	(-0.492)	(-0.647)
Remuneration	0.529	2.485	0.453	0.998	0.583
	(0.958)	(0.829)	(1.659)	(1.332)	(1.002)
Leverage	-3.543**	-5.658***	-5.502***	-4.599***	-6.555***
	(-2.846)	(-2.529)	(-4.948)	(-3.887)	(-4.563)
MV	2.591	2.668	0.575	0.520	0.998
	(0.268)	(0.760)	(0.821)	(0.936)	(0.576)
Intercept	-0.055**	-0.066**	-0.068**	-0.397**	-0.682**
	(-2.962)	(-2.439)	(-2.758)	(-2.482)	(-2.629)
Industry and Time Dummies	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.31	0.29	0.29	0.25	0.28
F	2.33	2.96	3.98	2.46	2.76

3.5 Conclusion

In this chapter we have investigated the relationship between board networks and firm performance. Specifically, we examine whether firm performance is affected by firms with more connected directors.

Based on a sample of the non-financial UK FTSE 350 firms between 2007 and 2010, we find that firms with more connected directors presents better firm performance while controlling for corporate governance characteristics, firm characteristics and other variables. The results provide support for the "Reputation Hypothesis" (Fama and Jensen, 1983), the number of connections may proxy for director reputation. Directors are motivated to improve their reputation since they can use their directorships to signal to the market that they are good at decision-making, and at providing advice and monitoring management. Therefore, a board with well-connected directors could lead to an increase in firm value.

The results for the busy board as control variable indicate that directors with multiple directorships hurt the firm performance as expected. This evidence may be valuable to the regulator as it supports the idea of restricting of the number of directorships each director can hold.

Chapter 4 Director Networks and CEO Compensation

4.1 Introduction

The growth in executive pay over past decades has attracted considerable public attention and generated ongoing debate about the effectiveness of the board of directors and the high compensation that directors receive. Many investors have questioned whether executives are worth their substantial pay packages and, particularly since the start of the financial crisis, this concern has been widely shared around the world.

The main duties of the board of directors are to monitor and govern the organization, to set the salaries and compensation of company management and to protect the interests of shareholders (McNamara, 2008). Some authors argue that corporate governance weaknesses hamper the board effectiveness. For instance, Jensen and Murphy (1990) argue that boards of directors are not able to effectively monitor management and directors' performance because of information asymmetry problems that exist between management and the board. Yermack (1996) finds that board size is negatively correlated to firm performance. This implies that large boards are difficult to monitor which could affect the effectiveness of board and thus decreasing firm performance. Furthermore, Core et al. (1999) find that firms with gray, interlocked and busy directors are linked with high CEO compensation and low firm performance.

This chapter investigates the effects of director networks on CEO compensation among non-financial FTSE 350 firms listed on the London Stock Exchange, while

controlling for other determinants of CEO compensation. Unlike most previous studies, it examines not only the total remuneration of the CEO but also two important components of the remuneration package, i.e. basic salary and long term incentive plans (LTIPs). We also investigate two levels of director networks, i.e. CEO networks (individual level) and board networks (firm level). Using Social Network Analysis, this chapter describes the extent of director networks among non-financial FTSE 350 firms and whether director networks centrality is related to CEO compensation.

This chapter makes several contributions to the literature. First, in order to capture different aspects of director networks, it employs five different network centrality measures (degree, betweenness, closeness, eigenvector and information) which are more comprehensive than the measures used in previous U.K. studies (Renneboog and Zhao, 2011; Horton et al., 2012). Second, while many studies employ cross-sectional data and only focus on specific industries, this chapter uses a panel data approach and also includes data from the financial crisis period. This chapter documents whether CEO compensation decreased as expected during this period. Third, the effects of director networks centrality on two important components of CEO compensation, i.e. basic salary and long term incentive plans (LTIPs), rather than just CEO total compensation, are examined. Fourth, director networks are studied at both the individual level (CEO) and the firm level (board), while most previous studies only examine them at the individual level.

The remainder of this chapter is structured as follows. Section two briefly reviews the relevant literature and develops the hypotheses. Section three describes the

methodology. A description of the data is presented in Section four. The empirical results of the study are presented in Section five. Finally, Section six provides the summary and conclusions.

4.2 Literature Review and Hypotheses

4.2.1 Theoretical background: Agency theory

There is a phenomenon known as "the separation of ownership and control" existing in the modern corporations. The firms' shareholders/owners, also called the principals, provide capital for the company and own its residual claims, but they do not involve in the day-to-day management of the company. On the other hand, the firms' managers/executives, called the agents, are contracted by the shareholders to deal with the firm's day-to-day decision making and control (Fama and Jensen, 1983). In return, they are paid rent for their labour and time. It has been argued that this separation of roles is an efficient form of economic organization (Fama, 1980). However, agency problems could arise because sometimes the objectives of the principals (shareholders) and the agents (managers) are not perfectly aligned, which might lead to difficulty for the principals in monitoring the actions of the agents. Agency theory suggests that managers are likely to pursue their own interests and increase their own wealth rather than maximising shareholders' wealth. In order to maintain the linkage between managers' actions and the interests of shareholders, the design of the managers' compensation contract is crucial. Optimal contracting theory argues that remuneration packages should be designed by the board of directors to maximize shareholders' value. The board of directors should make sure that the contracts are enough to attract talented CEOs and provide motivations for them to exert effort and exploit opportunities when it appears.

4.2.2 Director networks and CEO compensation

4.2.2.1 Introduction

The validity of optimal contracting theory has been questioned by the rapid increase in executive compensation. Under the optimal contracting approach, the board tries to maximize shareholders interests and the compensation plan is designed to reduce agency costs and align the interests between directors and shareholders. However, according to managerial power theory (Bebchuk et al., 2002), CEOs having power over the board of directors will be in a stronger negotiation position for their compensation package. This could result in inefficiently high levels of compensation and CEO pay being less sensitive to firm performance. It suggests that powerful CEOs (one measure of which is the extent of their networks) can influence their own compensation. Well-connected CEOs may accumulate more power and establish a stronger negotiation position on the board and the remuneration committee so that they are able to extract a more attractive compensation package. Hermalin and Weisbach (2003) also argue that CEOs who prove to be very successful will have sufficient bargaining power to request higher compensation. Kuhnen and Zwiebel (2009) provide support for managerial power theory in their investigation of 1,724 U.S. firms and 2,383 CEOs during 1992-2005, finding that CEOs are able to manipulate their pay including both observable (salary) and unobservable (perks, pensions and pet projects) components, subject to the constraint that too much rent extraction will get them replaced.

Networks not only increase the power of directors, but they could also provide companies with additional skills, knowledge and information, which may improve firm performance. According to resource dependency theory directors serve to link

their organizations with the external environment and gain access to key resources such as information and capital, which can reduce uncertainty (Pfeffer and Salancik, 1978). Directors who sit on multiple boards can gain access to broader corporate networks and thereby improve financial performance (Waddock and Graves, 1997).

Schoorman et al. (1981) suggest that director networks bring four benefits to firms. First, firms can gain access to information regarding pricing, advertising and research and development. Second, firms can reduce the sources of uncertainty regarding its inputs and outputs. Third, firms can benefit from the experience and skills that directors bring to their board if the directors also serve on outside boards. Fourth, directors serving on outside boards act as a signal of managerial quality. Firms with prestigious directors on their board convey information to other firms regarding their value. Chuluun et al. (2010) suggest that information transmission in better connected firms could lower information asymmetries, lowering the perceived risk of their bonds. More specifically, they study a sample of 5,402 bond-year observations in U.S. S&P 1,500 firms from 1994-2006. They find that well-connected firms benefit from lower borrowing costs. Engelberg et al. (2009) argue that firms can benefit from CEO networks by accessing information. A CEO who connected to lots of people can be regarded as a resource of information and influence, which give the firm chance to make better decisions. Therefore, the information value created through the CEO's networks should be reflected in their compensation.

4.2.2.2 Empirical studies of the relationship between director networks and CEO compensation

Recently several studies have investigated the relationship between CEO compensation and networks. Overall, these studies can be separated into two categories: individual level studies and firm level studies.

4.2.2.2.1 CEO networks (Individual level)

First, at the director level, Hallock (1997) finds that CEOs who are interlocked with other CEOs through their board of directors earn significantly higher salaries than non-interlocked CEOs, in his investigation of the boards of directors of the top 500 U.S. firms and CEO compensation in 1992. Kramarz and Thesmar (2006) using data on the executive and non-executive directors of firms listed on the Paris Stock Exchange from 1992 to 2003 find that CEOs' social networks affect board composition and that CEOs with active networks are less likely to be replaced even when they underperform. Kramarz and Thesmar (2006) note that usually a director is defined as independent if he/she was previously not an employee, customer or supplier. However, he/she could be well connected with the CEO through social networks, which can affect board independence, leading the authors to draw a distinction between 'formal' independence and 'real' independence. Therefore, Kramarz and Thesmar (2006) suggest that instead of raising the minimum fraction of independent directors, transparency in the director recruitment process may be more important.

Brown et al. (2009) extend the conventional measure of CEO networks through directorships to include all the networks generated by a CEO's past and current employment, education and other types of social activities (e.g. golf clubs, charity organizations, etc). They find that CEO social networks are positively correlated to

the level of CEO compensation and negatively correlated to pay-performance sensitivity, using U.S. data for the 2005 fiscal year. Crespi-Cladera and Pascual-Fuster (2011) find a positive relationship between CEO network centrality and CEO compensation using a data set of Spanish listed firms from 2004-2008. In particular, they show that directors' compensation is higher for firms with dispersed ownership compared to firms with concentrated ownership. They suggest that when firms are controlled by top management due to dispersed ownership, directors can set their own compensation. However, when shareholders control the firm because of concentrated ownership they tend to reward directors' networking activity if it is profitable for them.

Renneboog and Zhao (2011) study the relation between CEO compensation and networks of directors using data for all UK listed firms from 1996 to 2007. In contrast to previous studies, they classify networks into two types: direct networks (measured by degree centrality) and indirect networks (measured by closeness centrality). Director networks mainly enable CEOs to achieve managerial power over boards, as degree centrality measures the connectedness of a director in a network based on adjacent connections. Indirect networks enable CEOs to collect information that can be beneficial to the firm, as closeness centrality measures a director's position in a network based on distances between the director and other directors. They find that both direct and indirect networks are positively associated with CEO compensation. They also test the pay-for-performance sensitivity (which is measured by performance and the interaction term between networks and performance) of CEO compensation. They find that as the number of direct connections increases, the change in total compensation becomes less sensitive to

stock price performance. Another UK study by Horton et al. (2012) analyses a sample of 4,278 listed UK firms that comprises 31,495 directors over the period 2000-2007 and they find a positive relationship between CEOs networks (measured by closeness centrality and brokerage position, a measure that quantifies the degree to which a director serves as an effective broker in a network) and total compensation. They also find that there is a strong positive relation between executive compensation and future firm performance after controlling for past performance and other governance characteristics. Their results do not support the opinion that directors use their connections to extract rents but rather that they are paid for the resources or the connections they bring to the firm.

According to managerial power theory, executive directors have power to manipulate their own pay, and they use that power to extract rents. In this study, CEO power is measured by five network centrality measures. The first hypothesis is:

H1: The greater the network centrality of a CEO the greater the level of total compensation.

We also investigate the effect of director networks on two components of CEO compensation. If directors have too much managerial power, they are very likely to raise their compensation, especially their basic salary, rather than long term incentive-based compensation. Salary is a kind of fixed income which does not require any additional effort from the CEO, as opposed to incentive-based compensation (LTIPs) which is normally linked to firm performance. Hence,

hypotheses 2 and 3 are as follows:

H2: The greater the network centrality of a CEO the greater the level of basic salary component of CEO compensation.

H3: The greater the network centrality of a CEO the lower the level of incentive-based CEO compensation.

4.2.2.2.2 Board networks (Firm level)

Secondly, at the firm level, using a sample of 460 Fortune 1,000 firms, Geletkanycz et al. (2001) find that firms reward CEO social capital (CEO director networks) in accordance with the firm's needs and requirements. Geletkanycz et al. (2001) argue that external networks provide many types of strategic benefits to firms. First, external networks help firms to secure critical resources and reduce the level of uncertainty surrounding external resource dependencies. Second, external networks enable directors to gain greater access to strategic information and opportunities. Finally, external networks confer legitimacy and prestige. Directors serving on outside boards convey a signal of managerial quality, so the firm's attractiveness among employees, customers, and suppliers is increased. In summary, external networks are strategically valuable to firms, and so they should be reflected in executive compensation.

Barnea and Guedj (2009) collected data for the entire network of directors in the S&P 1,500 index between 1996 and 2004. They find strong evidence that in firms whose directors are more central in the network, measured by degree and closeness

centrality, CEO pay is higher. Hwang and Kim (2009) study a sample of the Fortune 100 firms between 1996 and 2005. In contrast to conventional measures of board independence, they classify a director as independent only if he or she is both conventionally and socially independent, with the latter defined as directors and the CEO sharing at least two of the following ties: military service, alma mater, regional origin, academic discipline, industry of primary employment, or third-party connection through another director. They find that CEO compensation is higher in companies where directors are more socially connected to CEOs.

According to resource dependence theory (Pfeffer and Salancik, 1978) director's networks can bring useful information and resources to the firm, hence the firm should reward directors with higher compensation. Therefore, we formulate the next hypothesis as follows:

H4: Firms with greater network centrality award a higher level of total compensation to their CEOs.

If a firm has better access to resources and information through the entire network provided by all directors, it is likely to compensate the CEO less for their own network connections. The firm is also likely to reward the CEO less on the basis of basic salary compensation and more on the basis of firm performance. Therefore, we formulate the hypotheses 5 and 6 as follows:

H5: Firms with greater network centrality award a lower level of basic salary to their CEOs.

H6: Firms with greater network centrality award a higher level of incentive-based compensation to their CEOs.

4.2.3 Other variables related to CEO compensation

CEO compensation is not only affected by director networks but also by other CEO characteristics, corporate governance characteristics, firm characteristics and performance characteristics.

CEO characteristics include tenure, age, education and gender. According to managerial power theory, CEOs with longer tenure have greater influence over their own compensation. We use CEO's age to represent their experience. We also include a CEO's education as another factor that could affect CEO compensation. If CEOs have more professional qualifications or degrees, they should receive higher compensation in recognition of these achievements. In terms of gender, Kulich et al. (2011) find that only 3% of executive directors among the listed UK firms are women and they receive lower compensation than men. Bertrand and Hallock (2001) also find a similar situation in U.S. firms over the period of 1992 to 1997, when women only accounted for 2.5% of top executive directors and earned 45% less than men. They suggest that this gender compensation gap can be explained by ability differences and discrimination.

Corporate governance variables include board size, board independence, busy board, CEO duality and the total number of members of the Remuneration committee, Nomination committee and Audit committee. Larger firms usually pay their CEO higher compensation and board size is positively correlated with firm size. We expect that the relationship between board size and compensation should be positive. Boards with : (a) a high proportion of non-executive directors; (b) the separation of CEO and Chairman; (c) the presence of remuneration, nomination and audit

committees are regarded as having good corporate governance (Lorsch and MacIver, 1989; Levy, 1993), so they should be negatively related to CEO compensation. In other words, we should expect firms which are well governed not to award excessive compensation to their CEOs. Chhaochharia and Grinstein (2009) examine the impact of new rules introduced in response to the corporate scandals in the United States in 2001 and 2002 that enhanced board independence and they find that board independence had a significant effect on CEO compensation. Specifically, they find that CEO compensation decreases if firms comply with the new regulations that listed companies much have a majority of independent directors sitting on the board.

There are a number of definitions of a "busy board". The definition of Fich and Shivdasani (2006) is employed here, namely that more than half of the directors hold three or more directorships. Busy boards should in theory be less compensated because the directors do not have enough time to monitor each firm effectively.

Firm characteristics include firm size (measured by market value), risk (measured by leverage) and firm performance (measured by the market to book ratio). According to Murphy (1998), firm size has a significantly positive effect on executive compensation. This is reasonable as larger firms are more difficult to manage, so the rewards should be higher compared to smaller firms. CEOs may ask for high compensation as risky, or even financially distressed, firms are usually difficult to manage, so we expect risk to be positively correlated with executive compensation.

There are two views in the literature about the relationship between firm performance and CEO compensation. According to the agency theory (Fama and Jensen, 1983), the objective of executive compensation is to align the interests of managers and shareholders, so as to make sure that managers maximize shareholders' wealth. Hence, there is a positive relationship between firm performance and CEO compensation. On the other hand, according to managerial power theory (Bebchuk et al., 2002), executive directors can accumulate power and establish a stronger negotiation position on the board in order to extract a more attractive compensation package. Bebchuk and Fried (2004) find that executive compensation is not related to firm performance. Table 4.1 lists all the control variables and their definition.

Table 4.1 Control Variable Definitions

Variable Name (Abbreviation)	Definition
Audit Committee (AC)	The total number of members of the board audit committee
Nomination Committee (NC)	The total number of members of the board Nomination committee
Remuneration Committee (RC)	The total number of members of the board remuneration committee
Board size (BS)	The total number of directors on the board
Board Independence (BI)	Number of non-executive directors divided by the total number of directors
Duality	A dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise
Tenure	The total number of years the CEO has held the position of CEO at firm
Age	The age of the CEO
Education	The number of qualifications held by the CEO. This is a count of all qualifications of degree level including all professional qualifications
Gender	A dummy variable taking the value of one if CEO is male, zero otherwise
Busy Board (BB)	A dummy variable taking the value of one if more than half of the directors hold three directorships and zero otherwise
Market Value (MV)	Market value of the firm
Market to book value (MTBV)	Market value divided by book value
Leverage	Total debt divided by total equity

4.3 Methodology

To test hypotheses 1, 2 and 3 we employ multivariate analysis that controls for CEO characteristics, corporate governance mechanisms and firm specific characteristics. We use random effect models rather than fixed effect models to investigate if the director network is associated with higher total CEO compensation, higher basic salary and lower incentive-based compensation due to the following reasons. First, the fixed effects model assumes that each individual has an unobservable individual effect, while the random effects model takes account of individual effects such as

random deviations from a mean individual effect (Wooldridge 2003). The random effects model requires a large cross-section of data compared to the sample period's length. Wooldridge (2003) argues that the estimator of the random effects model is consistent and asymptotic normal when the cross sectional units (N) get larger with a same time dimension (T). In this study, the number (N) is 781 with a T of only 4 years. Second, the fixed effects model does not consider time constant variables. In our study, some variables such as the industry dummy, the time dummy and gender are important. Lastly, the random effects model is a weighted average of between and within estimators, while the fixed effects model only takes account of within group estimators. Therefore, the random effects model also considers the differences between individual averages. In addition, we use the Hausman test to choose between the fixed effects model and the random effects model. The results (see Table 4.2) show that the regressors are not correlated with the errors. Thus, the random effects model should be chosen.

Table 4.2 The Hausman Test Results

Ho: difference in coefficients is not systematic
Chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
=10.27
Prob>chi2 = 0.7158

Where b represents the coefficients of the fixed effects model, B represents the coefficients of the random effects model, V_b-V_B is the difference between the variences of b and B, b-B is the difference between the coefficients from fixed effects and random effects model.

The regression model is written as follows:

(1) The effect of director networks on the level of the CEO compensation (director level)

$$CEO\ compensation_{it} = ß_0 + ß_1 CEO\ Networks_{it} + ß_2 CEO\ Characteristics_{it} + ß_3 Corporate\ Governance\ Measures_{it} + ß_4 Firm\ Characteristics_{it} + ß_5 Industry\ Dummies_{it} + ß_6 Year\ Dummies_{it} \quad 4\text{-}1$$

Here the dependent variable CEO compensation $_{it}$ refers to compensation received by the CEO of firm i at time t. To test hypotheses 1, 2 and 3 we define compensation in three different ways: (1) CEO total compensation which includes salary, bonus, pension, other and LTIPs; (2) CEO basic salary; (3) CEO long term incentive-based compensation, which includes share plans, share matching plans, options plans and cash plans.

The explanatory variable CEO Networks $_{it}$ refers to variables representing CEO networks centrality. This set of variables includes "Degree centrality", "Betweenness centrality", "Closeness centrality", "Eigenvector centrality" and "Information centrality".

The control variables used are as follows: CEO characteristics include tenure, age, education and gender. Corporate governance measures include dummy variables such as CEO duality, the total number of members of remuneration, Nomination committee and Audit committee. Firm characteristics include market value, leverage and the market to book ratio.

To test hypotheses 4, 5 and 6, we employ the following regression model to investigate if board networks are associated with lower total CEO compensation, lower salary and higher incentive-based compensation. The regression model is written as follows:

(2) The effect of board networks on the level of CEO compensation (firm level)

$$CEO\ compensation_{it} = ß_0 + ß_1 Board\ Networks_{it} + ß_2 CEO\ Characteristics_{it} + ß_3 Corporate\ Governance\ Measures_{it} + ß_4 Firm\ Characteristics_{it} + ß_5 Industry\ Dummies_{it} + ß_6 Year\ Dummies_{it} \quad 4\text{-}2$$

As for regression model 1, CEO compensation $_{it}$ refers to compensation received by the CEO of firm i at time t. We define compensation in three different ways: (1) CEO total compensation which includes salary, bonus, pension, other and LTIPs; (2) CEO basic salary; (3) CEO long term incentive-based compensation, which includes share plans, share matching plans, options plans and cash plans. The key explanatory variable used in this model is board networks instead of CEO networks. Similar to regression model 1, model 2 also includes CEO characteristics, corporate governance and firm characteristics as control variables.

4.4 Sample and Data

We undertake a detailed empirical analysis of CEO and board networks by examining a sample of non-financial UK FTSE 350 firms covering the four year period 2007-2010. CEO compensation data and board characteristics are collected from Boardex. We also hand collect a number of data items from firms' annual reports in cases where some data is missing from Boardex. CEO compensation data contains the British Pound values of base salaries, cash bonuses, D.C. pensions,

other and long term incentive plans (LTIPs). Base salaries are a key component and represent the fixed component in the compensation package. Cash bonuses are related to accounting performance and usually paid based on short-term (one year) performance. D.C. pensions are employer's contribution towards the director's pension scheme. Other includes annual direct payments such as relocation, fringe benefits, etc. Long-term incentive plans are similar to bonuses which are related to accounting performance, but are based on long-term (typically five year) cumulative performance rather than short-term (one year) performance. BoardEx assumes that the maximum award will be achieved when calculating the value of LTIPs which includes cash, equity, equity matched, or option plans. Option is a contract which gives the managers the right to buy a share of stock at an exercise price. Option can usually be exercised four years after they are granted. Opting pricing model (Black and Scholes, 1973) is used to calculate the price of options. Other firm characteristics and accounting information are collected from the Datastream and Fame databases. Table 4.3 shows the time and industry distribution of the sample firms.

Table 4.3 Time and Industry Distribution of Sample Firms

The sample is made up of 781 firm-year observations during 2007-2010. Industries are classified by the four-digit code based on the SIC (Standard Industrial Classification) Code collected from Datastream.

Panel A: Time Distribution of Sample Firms

Year	Number of Firms
2007	178
2008	196
2009	201
2010	206
Total Firm Years	781

Panel B Industry Classification

Industry	Number of Firms	Percentage
Mining and Quarrying	52	6%
Manufacturing	274	35%
Wholesale and Retail	126	16%
Transportation and Communication	120	15%
Utilities	41	5%
Construction	77	9%
Other	99	14%
Total	781	100%

Figure 4.1 shows the level and components of total CEO compensation from 2007-2010. In 2007, the total compensation for CEOs was £2.8 million on average, and decreased in 2008 because of the financial crisis, but rose to £3 million in 2010. Over the entire sample period, the total compensation remained very high at £2.68 million on average and almost doubled compared to the £1.5 million in 1996 reported by Renneboog and Zhao (2011).

Figure 4.1

The level and components of Total CEO Compensation (£) over the sample period 2007-2010.

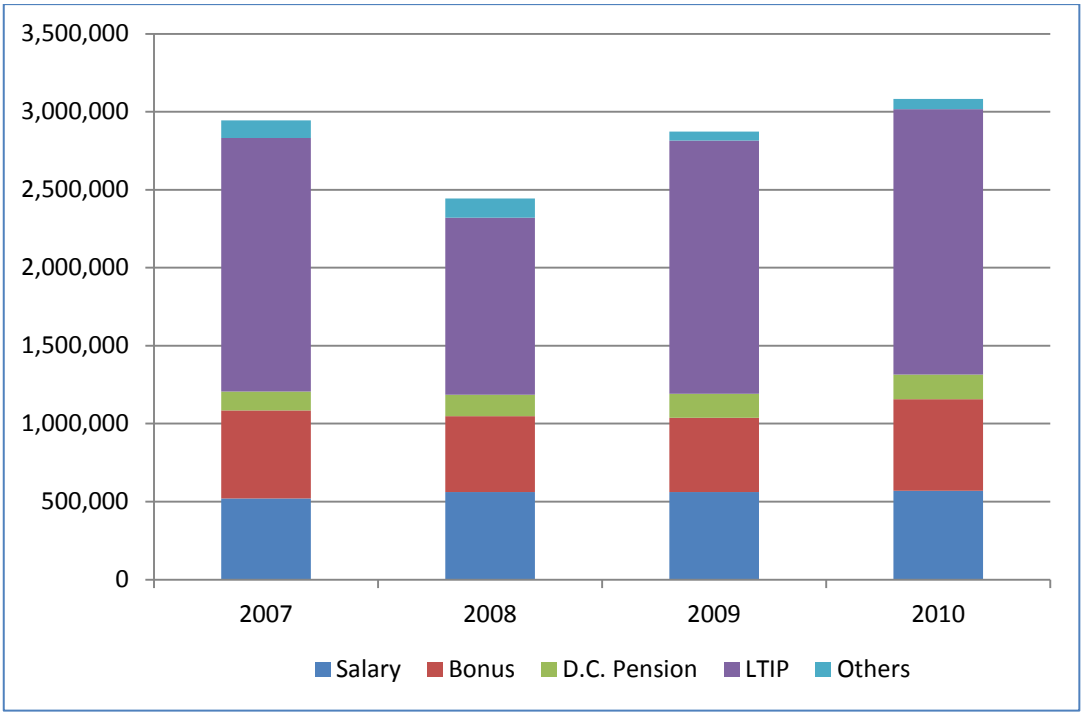


Table 4.4 Panel A and Figure 4.2 report the descriptive statistics for CEOs' total compensation from 2007-2010. The most important components of CEO compensation are salary, bonus and LTIPs (Share plan, Share matching plan, options plan and cash plan). On average, CEOs received £1.53 million as LTIPs,

which accounted for 55% of total compensation. The median value of LTIPs, at £0.67 million, is much lower, indicating that the distribution is skewed toward the right end of the scale. On average, £1 million was paid to CEOs each year as salary (19%) and bonus (18%) compensation, or 37% of the total compensation. Pension and others are only marginal components and account for 8% of the total compensation.

Panel B of Table 4.4 presents summary statistics for the five centrality measures. The degree centrality of a CEO has an average value of 0.19. The average closeness centrality is 0.09 and between centrality is 0.07. The average eigenvector and information centrality is 0.39 and 4.78. Panel C of Table 4.4 shows that the average age of a CEO was 51.37 and the average tenure was 5.3 years. Age and tenure will enable us to test if compensation depends on the CEO's experience. The average value of gender is 96%, which means that 96% of the CEOs are male, with only 4% female. Panel D of Table 4.4 indicates that on average there were 9 directors sitting on the board, 64% of whom were non-executive directors. Virtually all firms (95%) separated the role of CEO and Chairman, which was encouraged by the UK Corporate Governance Code, which also requires that a firm have audit, nomination and remuneration committees. In Table 4.4 panel E, it can be seen that firms on average had 4 board members on the audit committee, 5 on the nomination committee and 4 on the remuneration committee.

Table 4.5 depicts the Pearson correlation matrix for all the variables used in this study. The Pearson correlation matrix is used to assess the extent of any multicollinearity in our model, for the reasons described in Chapter 3, Section 4.

Basic salary is found to be positively and significantly correlate with degree (0.43) and eigenvector (0.42) and information (0.46) centrality. Board size is positively correlated with firm size (0.48) measured by market value, which indicates that larger firms tend to have bigger boards. In terms of director networks, measured by degree, betweenness, closeness, eigenvector and information centrality, the results show that all of the centrality variables are negatively correlated to directors' career paths measured by CEO' tenure. This means that more specialized directors have less central positions in their social networks, since directors spent their career in only a few firms and therefore had less opportunity to build their social network. The positive correlation (0.56) between board independence and busy board suggests that busy boards usually have more non-executive directors. None of the correlation coefficients are large enough to suggest that multicollinearity is a significant problem. We also use the Variance Inflation Factor to examine whether multicollinearity is a significant problem (see Table 4.6). O'Brien (2007) suggests that there is a problem with multicollinearity if the VIF is more than 10 or the tolerance level (1/VIF) less than 0.10. Table 4.6 shows that none of the VIFs are greater than 10 and none of the tolerance levels are less than 0.10. The mean VIF value is 2.10 and the overall tolerance level is 0.48. The results indicate that multicollinearity is not a significant problem in our model.

Table 4.4 Descriptive Statistics

Panel A presents CEO Compensation including different components for the non-financial FTSE 350 firms from 2007-2010 (781 firm years).

Panel A CEO Compensation

Variable (£)	Mean	Median	Min	Max	Std. Dev.
Salary	555,609	504,000	10,000	2,023,000	270,925
Bonus	523,087	362,500	0	5,000,000	624,967
Pension	83,919	22,000	0	2,550,000	187,669
Other	89,681	45,321	0	390,000	60,774
LTIPs	1,532,166	671,500	0	42,406,000	1,467,837
Total Compensation	2,697,215	1,695,500	10,000	43,282,000	1,267,894

Panel B presents the five centrality measures (Degree, Closeness, Betweenness, Eigenvector and Information) of the CEO in the sample.

Panel B Centrality Measures

Variable	Mean	Median	Min	Max	Std. Dev.
Degree	0.19	0.08	0.00	1.25	0.43
Closeness	0.09	0.05	0.00	0.19	0.58
Betweenness	0.07	0.04	0.00	1.65	1.09
Eigenvector	0.39	0.42	0.00	35.38	0.59
Information	4.78	5.42	0.00	32.16	0.61

Panel C presents CEO Characteristics including Tenure, Age, Education and Gender for the non-financial FTSE 350 firms from 2007-2010. Tenure is the number of years of CEO at the firm as CEO. Age is the CEO's age. Education stands for the number of degrees the CEO has. Gender equals to 1 if CEO is male, zero otherwise.

Panel C CEO Characteristics

Variable	Mean	Median	Min	Max	Std. Dev.
Tenure	5.30	3.70	0.00	34.40	5.32
Age	51.37	51.00	34.00	75.00	6.48
Education	1.76	2.00	0.00	5.00	1.09
Gender	0.96	1.00	0.00	1.00	0.20

Panel D presents board characteristics for the whole sample period from 2007-2010. BoardSize (BS) is the total number of directors sitting on the board. Board Independence (BI) is the percentage of non-executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. BusyBoard is a dummy variable, which equals to 1 if more than half of directors holding three or more directorships, otherwise it is zero.

Panel D Board characteristics

Variable	Mean	Median	Min	Max	Std. Dev.
BoardSize	8.98	9.00	5.00	19.00	2.36
BoardIndependence	0.64	0.67	0.24	0.93	0.12
Duality	0.95	1.00	0.00	1.00	0.22
BusyBoard	0.46	0.00	0.00	1.00	0.50

Panel E presents the number of board members serving on Audit, Nomination and Remuneration Committees for the whole sample period from 2007-2010.

Panel E Membership of Board Committees

Variable	Mean	Median	Min	Max	Std. Dev.
Audit	3.55	3.00	2.00	8.00	0.90
Nomination	4.69	5.00	0.00	10.00	1.60
Remuneration	3.83	4.00	2.00	8.00	1.00

Panel F presents firm characteristics for the whole sample period from 2007-2010. MV stands for market value (Millions). MTBV is calculated by market value divided by book value. Leverage is the ratio of total debt to total equity.

Panel F Firm Characteristics

Variable	Mean	Median	Std. Dev.	Max	Min
MV	5160.48	1224.45	12652.31	114583.60	108.74
MTBV	2.37	2.27	32.06	247.45	-589.39
Leverage	0.17	0.18	0.11	0.48	0.00

Figure 4.2

The percentage of each compensation component in CEO total compensation for the non-financial FTSE 350 firms between 2007 and 2010.

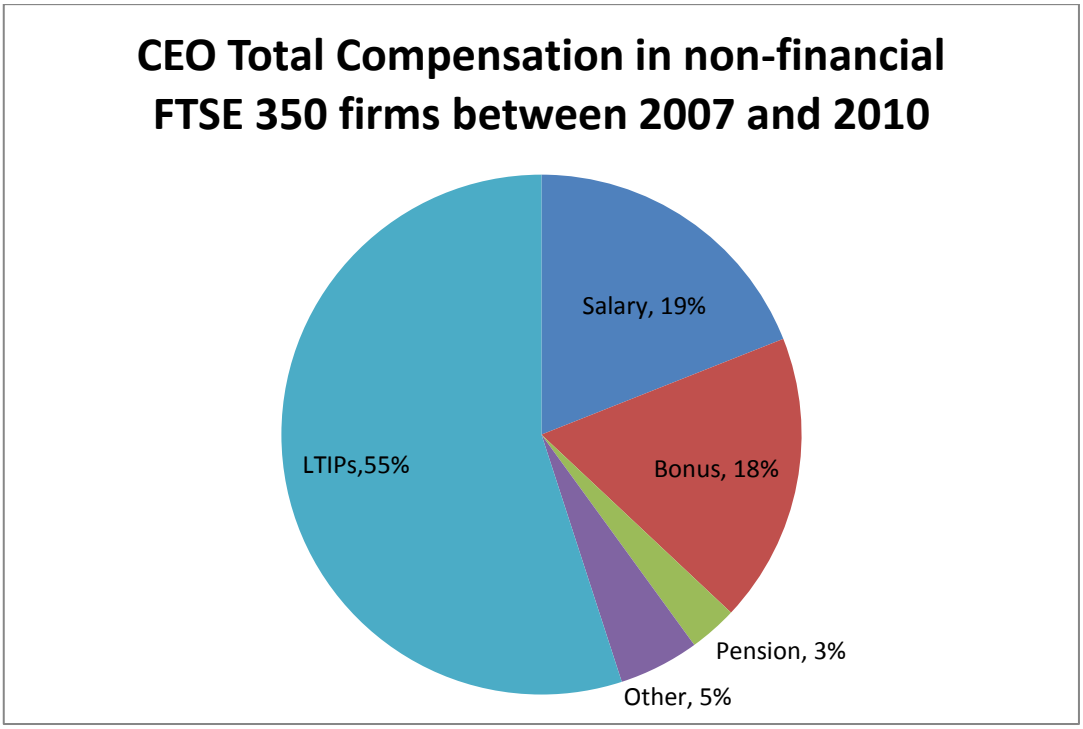


Table 4.5 Pearson Correlation Matrix

This table presents the correlation coefficients for all the variables used in this study. Salary, bonus, pension and LTIPs are different components of CEO compensation. Degree, Closeness, Betweenness, Eigenvector and Information are five different centrality measures. BS is the total number of board member sitting on the board. BI stands for the percentage of Non-Executive directors sitting on the board. Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split and zero otherwise. Tenure is the number of years of CEO at the firm as CEO. Age is the CEO's age. Education stands for the number of degrees the CEO has. BB is a dummy variable, which equals to 1 if more than half of directors holding three or more directorships, otherwise is zero. MV stands for market value. MTBV is calculated by market value divided by book value. Leverage is the ratio of Total Debt to the book value of Equity. The asterisks ***, ** and * show statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
(1)Salary	1.00																		
(2)Bonus	0.33**	1.00																	
(3)Pension	0.35**	0.36	1.00																
(4)LTIPs	0.13**	0.27**	0.30	1.00															
(5)Degree	0.43**	0.31**	0.12	0.25**	1.00														
(6)Closeness	0.32**	0.07**	0.22	0.11**	0.29***	1.00													
(7)Betweenness	0.36**	0.17**	0.14	0.12**	0.36***	0.03***	1.00												
(8)Eigenvector	0.42**	0.38**	0.17	0.31**	0.50***	0.21***	0.37***	1.00											
(9)Information	0.46**	0.36**	0.21	0.38**	0.31***	0.42***	0.21***	0.31***	1.00										
(10)BS	0.33**	0.09**	0.10	0.22**	0.42***	0.14***	0.25***	0.13***	0.31**	1.00									
(11)BI	0.18**	0.14**	0.42	0.56**	0.20**	0.15**	0.20**	0.31**	0.31**	0.15*	1.00								
(12)Duality	0.04*	0.12*	0.08*	0.15	0.12*	0.08*	0.04*	0.02	0.06	0.02	0.04	1.00							
(13)Tenure	0.04	0.29	-0.14	0.01	-0.34	-0.04	-0.21	-0.36**	-0.03	-0.18*	-0.20*	0.03	1.00						
(14)Age	0.07	0.29	0.40	0.17	-0.01	-0.10	-0.02	-0.12**	-0.13	-0.06*	0.22*	0.05*	-0.30*	1.00					
(15)Education	0.05	-0.21	0.02	0.16	0.39**	0.13**	0.49**	0.43**	0.34**	0.13	0.13	0.04	0.06*	-0.58*	1.00				
(16)BB	-0.25**	-0.22**	0.24	0.13**	0.19**	0.24**	-0.09**	0.17**	0.21**	0.02	0.56	0.07*	-0.44	0.48*	-0.29	1.00			
(17)MV	0.52**	0.43**	-0.44	0.37**	0.35**	0.31**	0.32**	0.15**	0.21**	0.48*	0.13*	0.12*	0.07	0.04*	0.08	-0.29	1.00		
(18)MTBV	-0.19**	-0.07**	-0.04	0.39**	-0.57**	0.31**	-0.56**	-0.42**	0.24**	-0.06*	-0.08*	0.02*	0.03*	-0.30	0.00	-0.07	-0.09	1.00	
(19)Leverage	0.55**	0.33**	-0.33	0.06**	0.31**	0.13**	0.32**	0.08**	0.11	0.31*	0.08*	0.05	-0.01	0.02*	0.27	-0.25	0.53	-0.50	1.00

Table 4.6 Variance Inflation Factor (VIF) Test Results

Variable	**VIF**	**1/VIF**
Information	6.14	0.16
Degree	5.27	0.19
Eigenvector	2.93	0.34
Betweenness	2.69	0.37
Closeness	2.19	0.46
BS	1.65	0.61
MV	1.48	0.68
Tenure	1.31	0.77
BI	1.30	0.77
Age	1.18	0.85
BB	1.16	0.86
Education	1.07	0.93
Duality	1.04	0.96
MTBV	1.03	0.97
Leverage	1.02	0.98
Mean	**2.10**	**0.48**

Table 4.7

Panel A: Top 10 Best Paid CEOs in 2007

Company Name	CEO	Salary (£)	Bonus (£)	Pension (£)	Other (£)	LTIPs (£)	Total (£)
CAIRN ENERGY	Sir Bill Gammell	480,000	240,000	72,000	84,000	42,406,000	43,282,000
RECKITT BENCKISER GROUP	Bart Becht	912,000	3,257,000	271,000	112,000	17,210,000	21,762,000
TESCO	Sir Terry Leahy	1,293,000	1,192,000	0	95,000	15,325,000	17,905,000
HOME RETAIL GROUP	Terry Duddy	708,000	744,000	0	341,000	14,593,000	16,386,000
GLAXOSMITHKLINE	Doctor Jean-Pierre Garnier	909,000	1,361,000	0	762,000	12,024,000	15,056,000
BG GROUP	Frank Chapman	992,000	900,000	0	9,000	10,252,000	12,153,000
ICAP	Mike Spencer	360,000	2,870,000	18,000	13,000	5,548,000	8,809,000
ANGLO AMERICAN	Cynthia Carroll	900,000	641,000	270,000	1,126,000	6,353,000	9,290,000
DIAGEO	Paul Walsh	1,035,000	1,533,000	0	36,000	4,897,000	7,501,000
RIO TINTO	Tom Albanese	751,000	642,000	0	161,000	5,578,000	7,132,000

Panel B: Top 10 Best Paid CEOs in 2008

Company Name	CEO	Salary (£)	Bonus (£)	Pension (£)	Other (£)	LTIPs (£)	Total (£)
RECKITT BENCKISER GROUP	Bart Becht	949,000	3,387,000	282,000	133,000	17,967,000	22,718,000
GLAXOSMITHKLINE	Andrew Witty	687,000	999,000	22,000	92,000	9,454,000	11,254,000
BURBERRY GROUP	Angela Ahrendts-Couch	850,000	2,908,000	255,000	420,000	6,241,000	10,674,000
VODAFONE GROUP	Arun Sarin	1,310,000	2,130,000	393,000	155,000	5.521.000	9,509,000
THOMAS COOK GROUP	Manny Fontenla-Novoa	633,000	1,364,000	0	5,040,000	2,171,000	9,208,000
ROYAL DUTCH SHELL	Doctor Jeroen Van der Veer	1,842,000	3,588,000	0	24,000	3,750,000	9,204,000
BHP BILLITON	Doctor Marius Kloppers	842,000	907,000	337,000	37,000	6,926,000	9,049,000
XSTRATA	Mick Davis	1,485,000	0	2,550,000	314,000	4,509,000	8,858,000
BG GROUP	Frank Chapman	1,082,000	1,400,000	0	5,000	5,229,000	7,716,000
BP	Doctor Tony Hayward	998,000	1,496,000	0	15,000	4,444,000	6,953,000

Panel C: Top 10 Best Paid CEOs in 2009

Company Name	CEO	Salary (£)	Bonus (£)	Pension (£)	Other (£)	LTIPs (£)	Total (£)
RECKITT BENCKISER GROUP	Bart Becht	987,000	3,523,000	296,000	83,000	2,0602,000	25,408,000
AFREN	Doctor Osman Shahenshah	304,000	325,000	30,000	11,000	1,7550,000	18,209,000
WPP	Sir Martin Sorrell	1,007,000	406,000	401,000	345,000	12,326,000	14,140,000
BHP BILLITON	Doctor Marius Kloppers	1,145,000	990,000	458,000	23,000	10,266,000	12,859,000
SABMILLER	Graham Mackay	1,145,000	1,580,000	344,000	111,000	8,957,000	12,026,000
BG GROUP	Frank Chapman	1,143,000	1,944,000	0	5,000	8,620,000	11,707,000
TESCO	Sir Terry Leahy	1,398,000	1,340,000	0	115,000	8,227,000	10,965,000
XSTRATA	Mick Davis	1,219,000	1,237,000	1,951,000	293,000	6,282,000	10,689,000
BP	Doctor Tony Hayward	1,045,000	2,090,000	0	23,000	7,104,000	10,239,000
VODAFONE GROUP	Doctor Vittorio Colao	932,000	0	280,000	171,000	8,739,000	9,951,000

Panel D: Top 10 Best Paid CEOs in 2010

Company Name	CEO	Salary (£)	Bonus (£)	Pension (£)	Other (£)	LTIPs (£)	Total (£)
RECKITT BENCKISER GROUP	Bart Becht	1,006,000	2,727,000	315,000	130,000	21,568,000	25,616,000
XSTRATA	Mick Davis	1,200,000	1,234,000	2,313,000	320,000	20,087,000	24,834,000
WPP	Sir Martin Sorrell	1,009,000	1,900,000	400,000	374,000	17,574,000	20,883,000
BERKELEY GROUP HDG	Tony Pidgley	750,000	1,500,000	128,000	29,000	12,480,000	14,858,000
BG GROUP	Frank Chapman	1,174,000	1,135,000	0	7,000	8,862,000	11,171,000
VODAFONE GROUP	Doctor Vittorio Colao	975,000	0	292,000	146,000	9,705,000	10,972,000
DIAGEO	Paul Walsh	1,155,000	1,975,000	0	45,000	7,114,000	10,244,000
REED ELSEVIER	Erik Engströ m	1,000,000	999,000	6,000	29,000	7,952,000	9,957,000
ANGLO AMERICAN	Cynthia Carroll	1,125,000	411,000	338,000	37,000	7,779,000	9,653,000
SHIRE	Angus Russell	705,000	604,000	207,000	20,000	7,779,000	9,295,000

Table 4.7 presents the top 10 best paid CEOs among non-financial FTSE 350 firms between 2007 and 2010. It shows that Sir Bill Gammell of CAIRN ENERGY earned the highest pay £43 million in 2007, of which more than £42 million from LTIPs, others included salary (£480,000), bonus (£240,000), pension (£72,000). In contrast, Tom Albanese of RIO TINTO only earned £7 million for his total pay including salary (£751,000), bonus (£642,000) and LTIPs (£5.5 million) in 2007.

4.5 Empirical results

4.5.1 The effects of CEO networks on CEO compensation

Table 4.8 presents the results for the effects of CEO networks on CEO total compensation, which includes basic salary, bonus, pension, other and LTIPs compensation. We find that the five network centrality measures are all positively and significantly associated with CEO compensation. Specifically, we find that CEO degree, closeness, betweenness, eigenvector and information centrality are significantly and positively related to CEO total compensation at the 1%, 5%, 10%, 1% and 1% levels respectively. CEOs with a high number of connections to other directors receive higher compensation. The results support hypothesis H1, which argues that a CEOs total compensation increases when the network centrality of the CEO increases. The magnitude of the coefficient estimated on degree centrality is stronger than the coefficient for the other centrality measures. CEO total compensation will increase by 2.12% as the degree centrality measure increases by 1%. The results also appear to indicate that the extent to which CEOs have a direct influence on other directors (degree centrality) and the extent of their connections to other well-connected directors (eigenvector centrality) significantly affects their total compensation. Borgatti (2005) argues that degree centrality is similar to

eigenvector centrality; the only difference is that whereas degree centrality only measures direct influence eigenvector centrality captures not only direct but indirect influences.

Table 4.8 CEO Total Compensation and CEO Networks

The dependent variable is the log of total compensation including salary, bonus, pension, other and LTIPs. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	2.123***				
	(4.93)				
Closeness		1.043**			
		(2.67)			
Betweenness			0.053*		
			(1.52)		
Eigenvector				1.243***	
				(3.96)	
Information					1.433***
					(3.68)
Audit	0.082	0.254	0.122	0.088	0.234
	(0.35)	(0.64)	(0.34)	(0.58)	(0.67)
Nomination	0.125	0.039	0.057	0.015	0.232
	(0.48)	(0.42)	(0.37)	(0.39)	(0.87)
Remuneration	0.215**	0.169**	0.192**	0.213**	0.348**
	(2.78)	(3.12)	(2.63)	(2.61)	(2.98)
BS	0.054**	0.055**	0.052**	0.049**	0.078
	(2.84)	(2.78)	(2.78)	(2.53)	(2.78)
BI	1.485***	1.419***	1.345***	1.393***	1.123***
	(3.88)	(3.68)	(3.71)	(3.82)	(4.831)
Duality	0.279	0.269	0.298	0.317	0.647
	(1.20)	(1.17)	(1.07)	(1.37)	(1.28)
Tenure	0.023	0.081	0.023	0.035	0.493
	(1.49)	(1.26)	(1.65)	(1.28)	(1.19)
Age	0.086	0.070	0.071	0.071	0.038
	(1.29)	(1.24)	(1.20)	(1.20)	(1.45)
Education	0.120**	0.159**	0.171**	0.272**	0.321**
	(2.89)	(2.95)	(2.92)	(2.97)	(2.99)
Gender	0.151	0.170	0.151	0.170	0.383
	(0.72)	(0.85)	(0.72)	(0.81)	(0.39)
BusyBoard	-0.010	-0.044	-0.055	-0.085	-0.424
	(-0.15)	(-0.62)	(-0.08)	(-0.12)	(-0.87)
MV	0.278***	0.282***	0.282***	0.289***	0.456
	(4.32)	(4.43)	(4.35)	(4.46)	(3.98)
MTBV	-0.823	-0.608	-0.821	-0.789	-0.449
	(-0.91)	(-0.71)	(-0.91)	(-0.87)	(-0.89)
Leverage	0.675	0.617	0.694	0.665	0.984
	(1.21)	(1.22)	(1.23)	(1.29)	(0.98)
Intercept	11.64***	11.83***	11.25***	11.45***	12.39***
	(23.12)	(23.18)	(22.55)	(23.87)	(26.49)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.38	0.38	0.36	0.35	0.37

The results also indicate that the length of time it takes information to arrive in a network (closeness centrality) and how information may be controlled in a network (betweenness centrality) have positive impacts on CEO total compensation. The results are consistent with the finding of Renneboog and Zhao (2011) and Horton et al. (2012). In addition, we find that a CEO's access to information (information centrality) also affects their total compensation.

In the regression model, we also control for CEO characteristics, corporate governance characteristics, firm characteristics and performance characteristics. We find that the number of members of the remuneration committee has a positive effect on CEO total compensation at 5% level. This suggests that CEO total compensation increases as the number of remuneration committee members increases. In all of the five models, both board size and market value have a significantly positive effect on total compensation. In line with previous literature, larger firms usually pay higher compensation to attract top managers. Board independence is also positively related to salary compensation, which means that firms with more non-executive directors award more compensation to CEOs. This suggests that CEOs are able to use their power to influence their director's compensation decision. Education is also positively associated with CEO total compensation, which suggests that a CEO holding more degrees will receive more compensation.

In Table 4.9, we investigate the impact of the CEO networks on the CEOs basic salary compensation. We find that all five centrality measures have positive and significant effects on CEO basic salary compensation. Therefore, the results support

the second hypothesis: the network centrality of a CEO has a positive effect on the basic salary level of CEO compensation. We also find the effect of the number of remuneration committees on CEO basic salary compensation. Both tenure and age have a significantly positive impact on CEO basic salary compensation, which suggests that CEOs with more experience receive higher basic salary compensation. We also find that board size, board independence and market value have significantly positive effects on CEO basic salary compensation, which is consistent with previous results.

Table 4.10 shows the results for the impact of CEO networks on CEO LTIPs compensation. We do not find any centrality measures to be significantly related to CEO LTIPs compensation. Therefore, the third hypothesis is not supported, which suggests that the network centrality of a CEO has no effect on the level of incentive-based CEO compensation. However, we find that the size of the remuneration committee has a significantly positive effect on CEO LTIPs compensation. Board size and market value also have significant positive impacts on the CEO LTIPs compensation, which is consistent with previous results. In line with the managerial power theory, we do not find that board independence has any effect on CEO LTIPs compensation. If directors have too much managerial power, they are very likely to raise their salary compensation rather than long term incentive-based compensation. We also find that education is significantly positive related to CEO LTIPs compensation. This suggests that a CEO holding more degrees will receive higher LTIPs compensation.

Table 4.9 CEO Basic Salary Compensation and CEO Networks

The dependent variable is the log of basic salary compensation. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	2.339***				
	(3.87)				
Closeness		1.252**			
		(2.53)			
Betweenness			1.226*		
			(1.98)		
Eigenvector				2.319***	
				(4.22)	
Information					1.878***
					(3.767)
Audit	0.076	0.037	0.083	0.073	0.337
	(1.12)	(1.45)	(1.35)	(1.26)	(1.25)
Nomination	0.076	0.035	0.033	0.035	0.075
	(1.06)	(1.09)	(1.31)	(1.33)	(1.25)
Remuneration	0.034**	0.014**	0.012**	0.012**	0.028**
	(2.62)	(2.63)	(2.52)	(2.54)	(2.91)
BS	0.072***	0.082***	0.075**	0.053**	0.047***
	(3.22)	(3.39)	(3.83)	(3.74)	(3.19)
BI	1.233***	0.492***	1.212***	1.133***	0.489***
	(4.82)	(4.72)	(4.88)	(4.84)	(3.98)
Duality	0.216	0.108	0.121	0.129	0.121
	(1.06)	(1.08)	(1.20)	(1.28)	(1.09)
Tenure	0.049***	0.019***	0.019***	0.023***	0.039***
	(3.96)	(3.85)	(3.93)	(4.23)	(3.15)
Age	0.084**	0.075**	0.070**	0.069**	0.391**
	(2.23)	(2.35)	(2.11)	(1.97)	(2.16)
Education	0.064	0.035	0.034	0.034	0.065
	(1.65)	(1.73)	(1.45)	(1.57)	(1.26)
Gender	0.067	0.049	0.051	0.060	0.219
	(0.37)	(0.38)	(0.40)	(0.47)	(0.39)
BB	0.033	0.062	0.040	0.058	0.059
	(0.15)	(0.15)	(0.09)	(0.14)	(0.35)
MV	0.213***	0.246***	0.214***	0.219***	0.328***
	(5.12)	(5.15)	(5.17)	(4.97)	(4.15)
MTBV	-0.281	-0.923	-0.145	-0.135	-0.393
	(-0.24)	(-0.29)	(-0.30)	(-0.28)	(-0.29)
Leverage	0.258	0.253	0.252	0.258	0.853
	(1.36)	(1.27)	(1.27)	(1.30)	(0.97)
Intercept	14.26***	13.33***	13.32***	13.28***	15.32***
	(38.20)	(37.27)	(37.11)	(38.44)	(32.24)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.34	0.34	0.33	0.33	0.38

Table 4.10 CEO LTIPs Compensation and CEO Networks

The dependent variable is the log of LTIPs compensation. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	0.259				
	(0.89)				
Closeness		0.308			
		(0.65)			
Betweenness			0.362		
			(0.53)		
Eigenvector				0.602	
				(0.31)	
Information					0.887
					(0.48)
Audit	0.326	0.335	0.282	0.197	0.535
	(1.17)	(1.15)	(0.99)	(1.31)	(1.05)
Nomination	0.195	0.239	0.177	0.189	0.339
	(1.26)	(1.43)	(1.14)	(1.23)	(1.03)
Remuneration	1.425**	1.365**	1.825**	1.828**	1.398**
	(3.19)	(3.29)	(3.12)	(3.15)	(3.31)
BS	0.703**	0.261**	0.876**	0.892**	0.219**
	(3.55)	(3.21)	(2.69)	(2.72)	(2.98)
BI	1.991	1.748	1.784	1.953	1.482
	(0.93)	(0.82)	(0.83)	(0.91)	(0.91)
Duality	3.356	2.221	4.416	5.497	1.473
	(0.26)	(0.17)	(0.32)	(0.40)	(0.49)
Tenure	0.049	0.039	0.048	0.057	0.184
	(1.04)	(0.83)	(1.01)	(1.20)	(0.89)
Age	0.022	0.025	0.020	0.019	0.125
	(0.64)	(0.72)	(0.58)	(0.56)	(0.74)
Education	0.823***	0.855***	0.837***	0.812***	0.725***
	(3.90)	(3.99)	(3.92)	(3.94)	(3.85)
Gender	1.573	1.465	1.554	1.693	1.432
	(1.31)	(1.24)	(1.29)	(1.41)	(1.24)
BB	0.693	0.683	0.727	0.715	0.643
	(1.57)	(1.55)	(1.64)	(1.62)	(1.02)
MV	0.535*	0.553**	0.655**	0.295*	0.549**
	(2.46)	(2.62)	(2.60)	(2.32)	(2.18)
MTBV	-0.869	-0.505	-0.617	-0.135	-0.584
	(-0.01)	(-0.09)	(-0.01)	(-0.02)	(-0.07)
Leverage	1.495	1.664	1.373	1.436	1.491
	(0.76)	(0.86)	(0.70)	(0.74)	(0.35)
Intercept	6.331	0.956	0.332	1.152	0.492
	(0.38)	(0.33)	(0.22)	(0.42)	(0.48)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.21	0.20	0.18	0.18	0.24

4.5.2 The effect of the board networks on CEO compensation

We not only investigate the effect of network measures at the individual level but also at the firm level, in which the centrality measures indicates the number of connections of all the board members (not just CEO). In Table 4.11, we find a positive relationship between all five board centrality measures and CEO total compensation. A firm with high network centrality has directors that have many connections that can bring useful information and resources to the firm, hence the firm should reward directors with higher compensation. This supports hypothesis H4 which states that well-connected firms award a higher level of total compensation to their CEOs.

We also examine whether board centrality measures have any effect on the two important components of CEO compensation. In Table 4.12, we do not find any evidence that centrality measures have any effects on basic salary compensation. This suggests that hypothesis H5 is not upheld. However, in Table 4.13, we find a positive relationship between board's centrality measures (degree, eigenvector and information) and LTIPs compensation. This evidence suggests that if a firm has better access to information, it will tend to award higher equity-based compensation rather than basic salary compensation. This supports hypothesis H6 which argues that well-connected firms award higher LTIPs compensation to their CEOs.

We also find that other variables have an impact on CEO compensation. For example, both board size and market value have positive effects on total CEO compensation and also on basic salary compensation and LTIPs compensation. The CEO total compensation and LTIPs compensation increases as the number of

members of the remuneration committee increases. A CEO holding more degrees receives higher total compensation and LTIPs compensation. Overall, the results are consistent with the findings for CEO networks.

4.5.3 Endogeneity

As discussed in the previous chapter, endogeneity could be a potential issue in our regression. For example, CEOs may be paid high compensation if they managed their firms well in the past. They are more likely to obtain non-executive director positions in other companies if they have a good reputation. This implies a possible reverse causality from CEO compensation to CEO networks. In order to examine the potential endogeneity issue, we use the one year lagged values of the centrality measures and compensation in the following regression model (4-3) as discussed in section 3.4.3:

The effect of director networks on the level of the CEO compensation (director level)

$$CEO\ compensation_{it} = \beta_0 + \beta_1 CEO\ Networks_{it-1} + \beta_2 Compensation_{it-1} + \beta_3 CEO\ Characteristics_{it} + \beta_4 Corporate\ Governance\ Measures_{it} + \beta_5 Firm\ Characteristics_{it} + \beta_6 Industry\ Dummies_{it} + \beta_7 Year\ Dummies_{it} \quad 4\text{-}3$$

The results are presented in Table 4.14. The coefficients of CEO centrality measures still remain statistically significant, consistent with the previous finding that well-connected CEOs receive higher compensation. Since the lagged value of the centrality measures still remain statistically significant, it appears that the centrality measures do not suffer from an endogeneity issue in our regressions.

Table 4.11 CEO Total Compensation and Board Networks

The dependent variable is the log of total compensation including salary, bonus, pension, other and LTIPs. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	0.254**				
	(2.94)				
Closeness		0.347**			
		(2.52)			
Betweenness			0.164*		
			(1.87)		
Eigenvector				0.124**	
				(2.39)	
Information					2.842**
					(2.48)
Audit	0.073	0.155	0.049	0.065	0.266
	(0.32)	(0.36)	(0.43)	(0.42)	(0.47)
Nomination	0.024	0.009	0.007	0.013	0.231
	(0.46)	(0.43)	(0.24)	(0.35)	(0.64)
Remuneration	0.335**	0.422**	0.312**	0.433**	0.483**
	(2.87)	(2.85)	(2.68)	(2.68)	(2.78)
BS	2.063**	2.057**	2.054**	2.059**	3.494**
	(2.76)	(2.86)	(2.83)	(2.87)	(2.84)
BI	1.343***	1.243***	1.353***	1.343***	1.878***
	(3.43)	(3.63)	(3.61)	(3.42)	(3.98)
Duality	1.479	2.569	2.439	1.376	2.494
	(1.23)	(1.26)	(1.24)	(1.47)	(0.46)
Tenure	0.143	0.007	0.014	0.035	0.383
	(1.49)	(1.36)	(1.66)	(1.31)	(1.02)
Age	0.227	0.017	0.014	0.026	0.022
	(1.29)	(1.24)	(1.27)	(1.23)	(0.94)
Education	0.064**	0.039**	0.061**	0.074**	0.087**
	(2.98)	(2.55)	(2.53)	(2.67)	(2.98)
Gender	0.261	0.173	0.351	0.140	0.254
	(0.72)	(0.87)	(0.62)	(0.81)	(0.64)
BB	0.114	0.045	0.005	0.008	0.048
	(0.15)	(0.52)	(0.28)	(0.32)	(0.84)
MV	0.278***	0.382***	0.454***	0.149***	0.478***
	(4.52)	(4.43)	(4.11)	(4.45)	(3.95)
MTBV	-0.776	-0.658	-0.851	-0.755	-0.484
	(-0.93)	(-0.51)	(-0.31)	(-0.56)	(-0.472)
Leverage	0.552	0.756	0.584	0.623	0.683
	(1.21)	(1.23)	(1.03)	(1.23)	(0.47)
Intercept	11.78***	11.68***	11.43***	11.78***	12.36***
	(14.53)	(15.38)	(14.55)	(14.46)	(16.38)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.34	0.34	0.33	0.33	0.37

Table 4.12 CEO Basic Salary Compensation and Board Networks

The dependent variable is the log of basic salary compensation. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	0.058				
	(0.67)				
Closeness		0.047			
		(0.49)			
Betweenness			0.214		
			(0.65)		
Eigenvector				0.293	
				(0.29)	
Information					0.028
					(0.48)
Audit	0.031	0.037	0.047	0.083	0.032
	(0.57)	(0.51)	(0.35)	(0.45)	(0.75)
Nomination	0.012	0.025	0.042	0.021	0.031
	(0.56)	(0.63)	(0.51)	(0.63)	(0.98)
Remuneration	0.013**	0.015**	0.015**	0.042**	0.047
	(2.52)	(2.61)	(2.42)	(2.34)	(2.74)
BS	0.039**	0.052***	0.039**	0.043**	0.047**
	(2.26)	(3.29)	(2.35)	(2.84)	(2.47)
BI	1.283***	0.849***	1.262***	1.143***	0.498***
	(4.82)	(4.52)	(4.41)	(4.72)	(3.948)
Duality	0.126	0.168	0.221	0.329	0.492
	(1.06)	(1.28)	(1.20)	(1.28)	(1.20)
Tenure	0.059***	0.038***	0.049***	0.032***	0.402***
	(3.56)	(3.35)	(3.85)	(4.23)	(3.75)
Age	0.065*	0.085*	0.083*	0.088*	0.166*
	(2.23)	(2.45)	(2.31)	(1.89)	(2.54)
Education	0.035	0.038	0.044	0.054	0.047
	(0.55)	(0.53)	(0.45)	(0.57)	(0.47)
Gender	0.037	0.039	0.051	0.055	0.058
	(0.37)	(0.38)	(0.40)	(0.47)	(0.47)
BB	0.053	0.032	0.044	0.068	0.038
	(0.15)	(0.16)	(0.19)	(0.24)	(0.37)
MV	0.211***	0.216***	0.214***	0.219***	0.473***
	(5.21)	(5.16)	(5.17)	(4.87)	(3.58)
MTBV	-0.123	-0.823	-0.345	-0.235	-0.442
	(-0.34)	(-0.29)	(-0.36)	(-0.26)	(-0.84)
Leverage	0.369	0.353	0.352	0.354	0.482
	(1.36)	(1.27)	(1.27)	(1.33)	(1.03)
Intercept	11.32***	11.54***	11.74***	11.25***	12.47***
	(18.19)	(23.18)	(25.21)	(18.21)	(28.43)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.31	0.28	0.29	0.32	0.30

Table 4.13 CEO LTIPs Compensation and Board Networks

The dependent variable is the log of LTIPs compensation. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	0.145**				
	(2.58)				
Closeness		0.0428			
		(1.15)			
Betweenness			0.246		
			(1.83)		
Eigenvector				0.0724**	
				(2.89)	
Information					0.482**
					(2.87)
Audit	0.536	0.330	0.592	0.277	0.473
	(0.57)	(0.42)	(0.69)	(0.41)	(0.48)
Nomination	0.391	0.217	0.217	0.389	0.731
	(1.36)	(1.41)	(1.16)	(1.53)	(1.03)
Remuneration	0.743***	0.861***	0.845***	0.878***	0.958***
	(3.24)	(3.93)	(3.26)	(3.35)	(3.76)
BS	0.077**	0.046**	0.097**	0.068**	0.031**
	(3.35)	(3.51)	(2.39)	(2.72)	(2.86)
BI	1.391	1.448	1.768	1.975	1.029
	(2.63)	(2.82)	(2.83)	(2.91)	(2.49)
Duality	2.456	2.321	1.456	2.467	1.948
	(0.26)	(0.17)	(0.32)	(0.43)	(0.49)
Tenure	0.069	0.079	0.058	0.055	0.049
	(1.14)	(0.87)	(1.31)	(1.23)	(0.49)
Age	0.032	0.035	0.032	0.039	0.049
	(0.64)	(0.72)	(0.58)	(0.56)	(0.87)
Education	0.862***	0.832***	0.845***	0.842***	0.948**
	(3.89)	(3.89)	(3.82)	(3.84)	(2.48)
Gender	0.543	0.665	0.564	0.663	0.498
	(1.33)	(1.44)	(1.23)	(1.43)	(1.34)
BB	0.793	0.643	0.723	0.745	0.585
	(1.57)	(1.55)	(1.64)	(1.62)	(1.48)
MV	0.565**	0.653**	0.562**	0.454**	0.492**
	(2.63)	(2.52)	(2.40)	(2.68)	(2.59)
MTBV	-0.884	-0.545	-0.657	-0.335	-0.492
	(-0.21)	(-0.39)	(-0.61)	(-0.42)	(-0.32)
Leverage	1.394	1.654	1.473	1.446	1.309
	(0.76)	(0.88)	(0.72)	(0.76)	(0.45)
Intercept	1.162**	0.456**	0.532**	1.352**	1.249**
	(2.42)	(2.31)	(2.42)	(2.44)	(2.39)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.22	0.22	0.19	0.19	0.23

Table 4.14 CEO Total Compensation and CEO Networks (One Year Lagged)

The dependent variable is the log of total compensation including salary, bonus, pension, other and LTIPs. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)
Degree	0.428***				
	(3.56)				
Closeness		0.649**			
		(2.76)			
Betweenness			0.482**		
			(2.22)		
Eigenvector				1.497***	
				(3.85)	
Information					2.361***
					(3.94)
Lag_Comp	0.683***	0.383***	0.032**	0.182***	0.348***
	(3.29)	(3.19)	(2.59)	(3.55)	(3.95)
Audit	0.151	0.948	0.312	0.219	0.592
	(0.53)	(0.05)	(0.59)	(0.37)	(0.91)
Nomination	0.256	0.459	0.250	0.259	0.250
	(0.89)	(0.09)	(0.62)	(0.54)	(0.38)
Remuneration	0.295**	0.640**	0.840**	0.239**	0.591**
	(2.60)	(2.32)	(2.51)	(2.44)	(2.57)
BS	0.029**	0.067**	0.064**	0.224**	0.120
	(2.36)	(2.63)	(2.77)	(2.50)	(1.05)
BI	1.294***	1.640***	1.312***	1.356***	1.124***
	(3.44)	(3.19)	(3.33)	(3.69)	(4.53)
Duality	0.649	0.150	0.552	0.342	0.576
	(1.32)	(1.06)	(1.02)	(1.32)	(1.19)
Tenure	0.659	0.395	0.921	0.313	0.396
	(1.21)	(1.67)	(1.31)	(1.50)	(1.27)
Age	0.031	0.053	0.056	0.251	0.132
	(1.42)	(1.26)	(1.23)	(1.27)	(1.43)
Education	0.151**	0.133**	0.122**	0.224**	0.423**
	(2.31)	(2.55)	(2.32)	(2.42)	(2.42)
Gender	0.128	0.142	0.055	0.143	0.321
	(0.14)	(0.32)	(0.63)	(0.32)	(0.53)
BusyBoard	-0.453	-0.344	-0.325	-0.222	-0.432
	(-0.43)	(-0.66)	(-0.27)	(-0.53)	(-0.54)
MV	0.484***	0.255***	0.232***	0.453***	1.131**
	(4.11)	(4.642)	(4.21)	(3.11)	(2.11)
MTBV	-0.322	-0.324	-0.326	-0.732	-0.395
	(-0.32)	(-0.55)	(-0.71)	(-0.84)	(-0.56)
Leverage	0.632	0.402	0.588	0.653	0.643
	(1.23)	(1.50)	(1.43)	(1.34)	(0.43)
Intercept	14.32***	14.54***	13.47***	12.45***	17.33***
	(19.32)	(21.96)	(15.75)	(22.47)	(22.42)
Industry and Time	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.33	0.33	0.32	0.32	0.32

4.6 Conclusion

This chapter investigates the relationship between director networks and CEO compensation. Two competing theories about the role of compensation dominate the literature: the optimal contracting theory and the managerial power theory. According to the optimal contracting theory, the compensation plan is designed to reduce agency costs and align the interests of directors and shareholders. In contrast, based on the managerial power theory (Bebchuk et al., 2002) directors of firms will use their power to design their remuneration package which leading to inefficiently high levels of compensation.

This chapter carries out an investigation based on CEO networks (individual level) and board networks (firm level). At the individual level, we generate network measures that capture several dimensions of CEO networks by collecting data across the entire network of all CEOs of non-financial FTSE 350 firms over the period 2007-2010. Controlling for CEO characteristics, corporate governance characteristics, firm characteristics and performance characteristics, we find that the more central the position of CEO, the higher the CEO total compensation. This result supports the managerial power theory (Bebchuk et al. 2002), which suggests that powerful CEOs can set their own compensation. In particular, we also investigate the effect of CEO networks on two components of CEO compensation, i.e. basic salary and LTIPs compensation. We find a significant positive relationship between basic salary compensation and CEO networks, but we do not find evidence of a relationship between LTIPs compensation and CEO networks. The results suggest that powerful CEO would like to increase their basic salary rather than LTIPs compensation, since salary compensation does not require any additional

effort from the CEO, whereas incentive based compensation normally depends on firm performance.

At the firm level, we find a positive and significant relationship between board networks and CEO total compensation and LTIPs compensation. However, we find no evidence that a CEO's basic salary compensation is positively related to board networks at the firm level. This suggests that firms tend to reward the CEO with more equity-based compensation if the firm has better access to resources and information through their overall director networks.

Chapter 5 The effects of directors' business and social networks and corporate governance mechanisms on firm performance

5.1 Introduction

The board of directors plays an important role in corporate governance, acting as a formal link between shareholders and managers. Recently, the 2008 global financial crisis has revealed shortcomings, and questions are being asked about the responsibility of boards of directors for failings that led to the crisis and turbulence in the global financial world. Growing research on board characteristics has focused on whether directors with multiple directorships are too busy to manage their business effectively. Using a sample of U.S. firms in 1999, Ferris et al. (2003) fail to find that the average number of directorships held by directors is associated with firm performance. However, Fich and Shivdasani (2006) find that boards where more than half the outside directors hold more than three directorships exhibit a lower market to book ratio. Their results are based on panel data for U.S. firms over the period from1989 to 1995.

There is another strand of studies that focus on the relationship between firm performance and corporate governance mechanisms, such as board size, the proportion of independent directors, the frequency of board meetings and CEO duality (Yermark, 1996; Bhagat, and Black, 2002; Vafeas, 1999; Rechner and Dalton, 1991; Core et al., 1999). However, the results are mixed. Explanations for the conflicting results include different time periods and variations in the measurement of board characteristics and corporate performance.

This study extends previous studies by combining the two strands of studies

together using a UK dataset of board characteristics and investigating the effects of board networks and corporate governance mechanisms on firm performance. Whereas in chapter 3 we have discussed the effects of board networks through director interlocks measured by "centrality" on firm performance, we extend this analysis by taking into account social networks in this chapter. Specifically, we investigate the business and social connections of the non-financial FTSE 350 firms listed on the London Stock Exchange and measure board networks not only taking into account director interlocks (business connections) but also other social activities (social connections) to find out whether board networks improve or hurt the performance of the firms they manage, while controlling for the effects of corporate governance mechanisms.

There are two main theories relating to director interlocks in the existing literature. On the one hand, the "Reputation Hypothesis" suggests that the number of outside board seats may proxy for director reputation (Fama and Jensen, 1983). Directors are motivated to improve their reputation since they can use their directorships to signal to the market that they are good at decision-making, and at providing advice and monitoring management. Thus, a firm with more multiple directors could lead to an increase in firm value. The "Busyness Hypothesis" (Ferris et al. 2003), on the other hand, states that directors who hold more directorships are more likely to be overcommitted and thus lack time to adequately monitor management, which could increase agency problem and therefore adversely affect firm value. There are some concerns with directors who hold multiple directorships in the UK and US. For example, the UK Corporate Governance Code (2010, p15) states that "full-time executive directors should not take on more than one non-executive directorship in a

FTSE 100 company nor the chairmanship of such a company". In the U.S., the Council of Institutional Investors (2004) suggests that "absent unusual, specified circumstances, directors with full-time jobs should not serve on more than two other boards".

Despite the growing literature on director networks and firm performance, most studies only look at director interlocks (business networks) when measuring director networks and no research has focused on the relationship between board business and social networks and firm performance in the UK context. Therefore, the research reported here is unique in several ways. First, to the best of my knowledge, this chapter is the first to examine the influence of the board networks (business and social networks) on firm performance in the UK context. Second, director networks are usually measured by formal business networks (directorships) while this chapter also includes a multitude of business and social networks, including current and past employment, education background, and other types of social activities (membership of golf clubs, membership of charity organizations, universities alumni, etc). Finally, this chapter examines the effects of corporate governance mechanisms on firm performance using recent data (2009). The findings are important to regulators since they provide empirical evidence that network connections are valuable to firms, whereas one of the UK Corporate Governance Code (2010) best practice recommendations is that "full-time executive directors should not take on more than one non-executive directorship in a FTSE 100 company nor the chairmanship of such a company". The code does not therefore acknowledge the benefits that multiple board memberships may provide.

The remainder of this chapter is structured as follows. Section two provides an overview of the literature on directors' interlocks and corporate governance mechanisms and develops the hypotheses. Section three describes the data and methodology. The results are presented in Section four and conclusions are presented in Section five.

5.2 Literature Review and Hypotheses

5.2.1 Director interlocks

A board of directors is a team elected by shareholders to oversee the activities of a firm. The roles of boards can mainly be categorized into three types (Johnson et al., 1996). The first role of boards, called the "control role", which monitors management representing the interests of shareholders. The second role of boards is the "service role", which provides the directors some advice on administrative, managerial issues and strategy. The third role, called the "resource dependence role", treats boards as one of the instruments which management might use to access resources which are critical to a firm's development.

Boards typically consist of a combination of executive (inside) directors and non-executive (outside) directors. An executive director is a full-time employee of the firm who is involved in day-to-day running of the business while a non-executive director is not employed full-time and has a duty to monitor executive activity and develop strategy. One of the most obvious characteristics of non-executive directors is that they often sit on several boards at the same time. Fama and Jensen (1983) argue that the number of directorships may proxy for director reputation. Directors have the motivations to improve their reputation since

they can use their board positions to signal that they have expertise in decision-makings and can provide better advice and monitoring to the board.

Miwa and Ramseyer (2000) find that the board with directors holding six or more directorships are positively and significantly related to firm performance in the Japanese cotton textile industry. The findings suggest that multiple directorships could improve firm performance which is in line with shareholders' interests.

Bouwman (2009**)** investigates whether directors with multiple directorships may cause similarities in corporate governance structures across the firms where they have board positions. A set of eight corporate governance variables[2] for U.S. firms over the period 2002 to 2007 was regressed (one at a time) on the weighted average governance practices of firms sharing the same directors, while controlling for other factors, such as CEO and firm characteristics. The results show that director overlaps matter and help design corporate governance principals.

On the other hand, some studies argue that too many directorships might lower directorial effectiveness. Core et al. (1999) find that outside directors who hold more than three directorships provide higher compensation to CEOs, which leads to agency problem and lower firm performance. In the U.S., professional bodies have also recognized the possible detrimental effects of multiple directorships. The Council for Institutional Investors (2003)[3] has recommended that the number of

[2] The governance variables were: (1) board size measured as the number of directors; (2) the percentage of outside directors; (3) the number of board meetings; (4) director base pay; (5) log (CEO total pay); (6) the percentage of directors who are active CEOs; (7) the percentage of directors over the age of 70; and (8) CEO duality, a dummy that equals 1 if the CEO is the chairman.

[3] The Council of Institutional Investors (CII) is a nonprofit association of public, union and corporate pension funds. Member funds are major long-term shareowners with a duty to protect the retirement assets of millions of American workers.

directorships held by directors in publicly traded companies should be restricted. Shivdasani and Yermack (1999) provide evidence which suggests that busy directors are dominated by the CEO, thus compromising their monitoring role. If this indeed is the case, busy directors may not fully represent shareholder interests.

Ferris et al. (2003) argue that directors who hold more directorships are more likely to be overcommitted and thus lack time to adequately monitor management, which could increase agency problem and therefore adversely affect firm value. Although they didn't find that the relationship between the firm performance and the average number of board seats held by directors, Fich and Shivdasani (2006) find that busy boards do adversely affect firm performance between 1989 and 1995. They find that firms with busy boards which measured by the majority of outside directors who are holding three or more directorships are associated with weak corporate governance, lower market-to-book ratios, weaker profitability, and lower sensitivity of CEO turnover to firm performance. Jiraporn et al. (2009), examining the effects of multiple directorships on directors' meeting attendance using a sample of 1,510 U.S. firms over the sample period of 1998 to 2003, find that directors with more directorships are more likely to be absent from board meetings. The results suggest that directors with multiple directorships are overcommitted and so they are not able to attend all board meetings.

Kirchmaier and Stathopolous (2008) investigate the relationship between CEO's social networks and firm performance for 363 UK non-financial firms in 2005. CEO's social networking is measured by the total number of directorships in

publicly-listed firms and memberships of other non-profit organizations. They find that CEO's social network hurts firm performance.

Ahn et al. (2010) examine the impact of multiple directorships on the performance of mergers and acquisitions using U.S. firms' data over the period 1998 to 2003. They find that acquiring firms whose directors hold more directorships show more negative abnormal returns upon an M&A announcement.

In conclusion, based on the theory (reputation hypothesis) suggested by Fama and Jensen (1983) the number of directorships serves as a proxy for director reputation and so directors have the motivations to improve their reputation since they can use their directorships to signal to the market that they are good at making decision, providing good advice and monitoring to the board. Multiple directorships can add value by allowing directors to establish (or widen) their networks, which can be valuable to the firm. Thus, a board with more connected directors could lead to an increase in firm value. However, based on the theory (busyness hypothesis) suggested by Ferris et al. (2003) directors who serve on several boards are overcommitted and lack of time to adequately monitor management. We can imagine that directors' managerial performance might be affected if they join too many institutions and clubs, thus adversely affecting firm value. Hence the null hypothesis and alternative hypotheses are as follows:

The null hypothesis:

H_0: The total number of board networks including business connections and social connections has no influence on firm performance.

The alternative hypotheses:

H_{1a}: The total number of board networks including business connections and social connections has a positive influence on firm performance.

H_{1b}: The total number of board networks including business connections and social connections has a negative influence on firm performance.

5.2.2 Corporate Governance Mechanisms

5.2.2.1 Board Size

It is argued that firms with larger boards experience higher firm performance since they bring a range of expertise and possibly make good decisions (Pfeffer, 1973; Singh and Harianto, 1989). Based on the resource dependence theory, the ability of accessing external resources is crucial to the development of the company. Therefore, the chance to access to the external resources will increase as the board size increases (Goodstein et al., 1994). Bazerman and Schoorman (1983) argue that the benefit of having a large board is that firm could have more possibilities to access to valuable information through board interlocks, which leads to improving corporate performance.

However, some research has leaned towards smaller boards enhancing firm performance. Lipton and Lorsch (1992) argue that large boards are difficult to manage and control. Co-ordinating and free riding issues will arise if board getting too big. Firms could reduce these issues by having smaller board. Some literature supporting this argument includes Yermack (1996) who finds that the market values more highly U.S. firms that have smaller boards over the period 1984 to 1991.

Eisenberg et al. (1998) find that board size has a negative effect on firm financial performance when using a sample of Finnish firms. By studying a sample of the FTSE 100 firms between 2003 and 2005, Clacher et al. (2008) also find that board size is negatively associated with firm performance. Hermalin and Weisbach (2003) argue that when the board becomes large, the problem of free-riding by directors in monitoring management will increase. Thus, they expect the relationship between board size and firm performance to be negatively correlated.

Based on the above arguments, board size can either positively or negative affect performance, hence, the null hypothesis and alternative hypotheses are as follows:
The null hypothesis:

H_0: Board size is not associated with firm performance.

The alternative hypotheses:

H_{2a}: Board size is positively associated with firm performance.

H_{2b}: Board size is negatively associated with firm performance.

5.2.3.2 Board independence

Board independence is a type of mechanism used to assess the effectiveness of corporate governance by previous studies. The board should be comprised of an appropriate combination of executive and non-executive directors in order to make sure no one dominates board decision making. In particular, non-executive directors can be considered as an independent non-executive director if he or she can meet specific criteria (see the UK Corporate Governance Code section B.1.1). The assumption is that if the board consists of a majority of independent non-executive

directors, it can monitor managers more effectively and therefore decrease the agency costs. According to the provisions of the UK Corporate Governance Code (2010), all FTSE 350 firms should comprise a board with half of its members to be independent non-executive directors in character and judgement.

Although the relationship between the proper combination of executive and non-executive directors and firm performance has been well researched, the findings are still mixed (Baysinger and Butler, 1985; Forsberg, 1989; Agrawal and Knoeber, 1996).

On the one hand, non-executive directors are considered as independent directors and supposed to monitor the performance of executive directors, which make sure the objective of executive directors is to maximize shareholders' wealth (Fama, 1980). John and Senbet (1998) argue that the firm should have a majority of non-executive directors sitting on the board which could increase the board independence. Rosenstein and Wyatt (1997) find that stock price is positively correlated to the appointment of outside directors. Hillman et al. (2003) argue that firms are more likely to hire outside directors during difficult time because outside directors could bring outside resources and information to the firms.

On the other hand, executive directors are involved in day to day operation of the company and should be familiar with the firm's activities. Harris and Raviv (2008) find that if executive directors know important information about the company, giving control to non-executive directors may result in a loss of information that is more costly than the agency cost associated with executive directors' control. Thus,

shareholders will prefer executive directors can control the board. This result is contrary to conventional opinion that non-executive directors are responsible for monitoring the performance of executive directors.

Based on above arguments, we therefore hypothesize that:

The null hypothesis:

H_0: Board independence is not associated with firm performance.

The alternative hypotheses:

H_{3a}: Board independence is positively associated with firm performance.

H_{3b}: Board independence is negatively associated with firm performance.

5.2.3.3 CEO Duality

As noted earlier, CEO duality exists when the CEO also holds the position of Chairman of the board. Fama and Jensen (1983, p314) argue that "CEO duality signals the absence of separation of decision management and decision control", so agency problems are going to arise when the same person holds both CEO and chairman positions. CEO duality hurts board independence and diminishes the ability of the board to effectively monitor and evaluate the CEO (Fizel and Louie, 1990). Berg and Smith (1978) find that CEO duality has a negative effect on return on investments (ROI) when studying Fortune 200 firms in 1976. Yermack (1996) finds that firms are more valuable when the roles of CEO and chairman are separate using data for 452 U.S. firms over the period of 1984 to 1991. Sanda et al. (2003) find that Nigerian firms where the CEO and Chairman are separate tend to perform better than those with a combined role for the two posts.

Despite agency theory suggesting that there is a negative relationship between CEO duality and firm performance, stewardship theory assumes that CEO duality can improve the board effectiveness by making better and faster decisions and perform better compared to when the CEO and chairman roles are separated (Donaldson and Davis, 1991). Rechner and Dalton (1991) find that companies with CEO duality has stronger financial performance relative to other companies over the period of 1978-1983. Goyal and Park (2002) find that the sensitivity of CEO turnover to firm performance is higher for companies with CEO duality using a sample of U.S. companies.

Based on the two competing theories (agency theory and stewardship theory) we hypothesize that:

The null hypothesis:

$H_{0:}$ CEO duality is not associated with firm performance.

The alternative hypotheses:

H_{4a}: CEO duality is negatively associated with firm performance.

H_{4b}: CEO duality is positively associated with firm performance.

5. 3 Data and Methodology

5.3.1 Sample and Data

Based on a sample of the FTSE 350 non-financial firms on the London Stock Exchange in 2009, we collect the following data from the BoardEx database: board networks, board size, board independence, CEO duality, average number of directorships held by directors and outside directors, inside (outside) director's age

and inside (outside) director's tenure. According to the UK corporate governance code (2010), full-time employees of the firm are designated as executive directors (inside directors).

In addition to the data on corporate governance, we also source data from Datastream and FAME on accounting performance, leverage, market value, and growth opportunities. We measure firm performance using both Return on Assets (ROA) and Return on Equity (ROE), as in Core et al., (1999) and Tian and Lau (2001). Financial firms are excluded from the sample due to their special financial structure and accounting practices, Table 5.1 shows the industry distribution of the sample firms.

Table 5.1: Industry Distribution of the Sample Firms

The sample is made up of 196 firm-year observations collected in 2009. Industries are classified by the four-digit code based on the SIC (Standard Industrial Classification) Code collected from Datastream.

Industry	Number of Firms	Percentage
Mining and Quarrying	12	6%
Manufacturing	69	35%
Wholesale and Retail	31	16%
Transportation and Communication	29	15%
Utilities	10	5%
Construction	17	9%
Other	28	14%
Total	196	100%

5.3.2 Methodology

We examine the impacts of board networks on firm performance by running three regression models using both ROA and ROE as measures of firm performance while controlling for corporate governance mechanism variables and firm characteristics. For each firm, we apply three different measures of board networks. Each measure is calculated at the level of the firm's board, thereby allowing a match with firm level data for the other variables.

5.3.2.1 Board networks (business and social connections) and firm performance

We ran regression models in which the dependent variables are Return on Assets

(ROA) and Return on Equity (ROE). The independent variables include board networks, corporate governance mechanisms and firm characteristics. The full generic model is as follows:

$$ROA_{it} \text{ and } ROE_{it} = ß_0 + ß_1 Board\ Networks_{it} + ß_2 Board\_Size_{it} + ß_3 Board\_Interdependence_{it} + ß_4 CEO\_Duality_{it} + ß_5 Director's\_Tenure_{it} + ß_6 Director's\_Age_{it} + ß_7 Mark\_Value_{it} + ß_8 Leverage_{it} + \varepsilon_i \quad 5\text{-}1$$

Here, the dependent variable is firm performance which is measured by both the ratio of net income to total assets (ROA) and the ratio of net income to total equity (ROE). In this study, we not only take into account business connections (directorships) but also social connections (memberships of organisations) when measuring board networks. Specifically, the board networks is the accumulated number of firms and organisations with which directors are acquainted, through their current and past employment, their education, and other types of social activities (membership of golf clubs, membership of charity organizations, universities alumni, etc). The values of the board networks are calculated using the following steps:

1. Six different types of ties that linking board members are identified. These are quoted firm, private firm, club, universities, NFP (Non-for-profit), and others.

2. For each firm, the total number of ties (any of the six different types of the ties described above that actually exist) among board members is calculated.

Corporate governance mechanisms variables include board size, board independence, CEO duality, inside (outside) directors' age and inside (outside) directors' tenure. Firm characteristics consist of market value and leverage (see Table 5.2 for the definitions).

Table 5.2 Control Variable Definitions

Variable Name	Definition
Board size (BS)	The total number of directors on the board.
Board Independence (BI)	Number of non-executive directors divided by the total number of directors.
CEO Duality	A dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise.
IDT and ODT	The number of years the inside and outside directors has retained their current position.
IDA and ODA	The age of the inside and outside directors in calendar years.
Market Value (MV)	Market value of the firm in 2009.
Leverage	Total debt divided by total equity.

5.3.2.2 Multiple directorships and firm performance

We apply the methodology used by Ferris et al. (2003) in which they use the average number of directorships held by directors and the average number of directorships held by outside directors to capture the busyness of boards. Return on assets and Return on Equity are used to proxy for firm performance in this study whereas Ferris et al. (2003) use the market to book ratio. We also control for the effects of corporate governance mechanisms and firm characteristics. We estimate the following equation to examine the relationship between multiple directorships and firm performance:

$$ROA_{it} \text{ and } ROE_{it} = ß_0 + ß_1 ANOOD_{it} + ß_2 ANOD_{it} + ß_3 Board\_Size_{it} + ß_4 Board\_Interdependence_{it} + ß_5 CEO\_Duality_{it} + ß_6 Director's\_Tenure_{it} + ß_7 Director's\_Age_{it} + ß_8 Mark\_Value_{it} + ß_9 Leverage_{it} + \varepsilon_i \quad 5\text{-}2$$

The dependent variable is firm performance which is measured by both the ratio of net income to total assets (ROA) and the ratio of net income to total equity (ROE). ANOOD is the average number of directorships held by outside directors and ANOD is the average number of directorships held by all directors (executive and non-executive). Corporate governance mechanism variables include board size, board independence, CEO duality, inside (outside) directors' age and inside (outside) directors' tenure. Firm characteristics consist of market value and leverage (see Table 5.2 for the definitions).

5.3.2.3 Busy board and firm performance

The third measure we use in this study is derived from the methodology of Fich and Shivdasani (2006). Here, busy board is measured by a dummy variable which takes the value of one if 50 percent or more of the board's directors hold three or more directorships and zero otherwise. The full model is as follows:

$$ROA_{it} \text{ and } ROE_{it} = ß_0 + ß_1 Busy\_Board_{it} + ß_2 Board\_Size_{it} + ß_3 Board\_Interdependence_{it} + ß_4 CEO\_Duality_{it} + ß_5 Director's\_Tenure_{it} + ß_6 Director's\_Age_{it} + ß_7 Mark\_Value_{it} + ß_8 Leverage_{it} + \varepsilon_i \quad 5\text{-}3$$

As before, the dependent variable is firm performance which is measured by both the ratio of net income to total assets (ROA) and the ratio of net income to total equity (ROE). Busy board is a dummy variable which takes the value of one if 50

percent or more of the board's directors hold three or more directorships and zero otherwise. Corporate governance mechanism variables include board size, board independence, CEO duality, inside (outside) directors' age and inside (outside) directors' tenure. Firm characteristics consist of market value and leverage (see Table 5.2 for the definitions).

5.4 Empirical results

5.4.1 Descriptive statistics

Table 5.3 presents the summary statistics for all of the variables used in this part of the empirical analysis. In terms of board networks (business and social connections), the average board in the sample had established 47 (mean = 46.59) business and social connections at the time of measurement, with firm connections ranging from 4 to 234 ties. These results reflect the fact that larger firms have bigger boards, but also that larger firms have more connections than smaller firms. The average board size in the sample is 10 (mean = 9.5) and ranges from 6 to 20. The percentage of non-executive directors is 55% (0.55).

To capture the prevalence of busy directors on the board, we employ a dummy variable that takes the value of one if 50% or more of the board's directors are busy. We refer to this variable as the "busy board" indicator and find that 48% of firms have a board with more than half of the directors holding more than three directorships.

The average number of directorships held by non-executive directors is 2.65 while the average number of directorships held by all directors is 2.12. The average CEO duality is 95% which indicates that 95% of firms separated the roles of CEO and

Chairman. This indicates that the vast majority of firms comply with the recommendation of the UK Corporate Governance Code (2010) on this issue. Non-executive directors are older than executive directors: the average age of non-executive directors is 60 and that of executive directors is 51. Executive directors have a longer average tenure (5.19 years) when compared with the average tenure of non-executive directors (4.49 years) which indicates that executive directors have slightly more stable tenures than non-executive directors.

Table 5.4 depicts the Pearson correlation matrix for the variables we employ in this part of the study. The Pearson correlation matrix is used to examine the possible multicollinearity issue in our model. Standard errors of coefficients tend to become very large as the level of multicollinearity increases. Gujarati (2003) indicates that multicollinearity may affect the accuracy of results if the correlation coefficient is larger than 80% (p359). We find that BoardNetworks is positively and significantly correlated with board size (0.45) and BusyBoard (0.37), suggesting that larger boards have larger connections and tend to be boards where more than half of directors hold more than three directorships. Board size is positively and significantly associated with market value (0.47). ANOOD, ANOD, IDA and ODA are all positively correlated with BoardNetworks, although the coefficient of ADOD is not significant. BusyBoard is positively and significantly correlated with ANOOD (0.42). This makes sense as we expect that boards will become busier when the directorships of non-executive (outside) directors increase. We do not find a multicollinearity problem in our correlation matrix as no excessively high coefficient is observed. The Variance Inflation Factor (VIF) test was also used to examine the level of multicollinearity. Table 5.5 shows that the mean VIF value is 1.72 and the overall tolerance level is 0.58 (1/1.72). Based on the suggestion of

O'Brien (2007), the multicollinearity problem does not exist if VIF is less than 10 or the tolerance level (1/VIF) more than 0.10. Table 5.5 demonstrates that there is no multicollinearity issue with the data.

Table 5.3 Descriptive Statistics

This table reports the descriptive statistics of our sample. The total number of observations is 196. Board Networks is the total number of firms and organizations the board of directors is acquainted with, through their current and past employment, their education, and other types of social activities (golf clubs, charity organizations, universities, etc). Board size is the number of directors sitting on the board. Board Independence is the percentage of non-executive directors sitting on the board. CEO Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. Busy Board is a dummy variable for firms in which 50 percent or more of the board's directors hold three or more directorships. ANOOD is the average number of directorships held by outside directors. ANOD is the average number of directorships held by directors. Duality is a dummy variable identifying firms in which the roles of CEO and Chairman are split. IDA (ODA) shows the age of the inside (outside) directors in calendar years. IDT (ODT) is the number of years the inside (outside) directors has retained their current position. Leverage is the ratio of total debt to total equity. MV is market capitalization in 2009. The Return on Equity (ROE), Return on Assets (ROA) and market to book (MTB) annual figures are in percentages.

Variable	Mean	Median	Min	Max	Std. Dev
Board networks	47.59	51.00	4.00	234.00	32.62
Board size	9.50	10.21	6.00	20.00	0.84
Board Independence	0.55	0.61	0.28	0.90	0.23
CEO Duality	0.95	1.00	0.00	1.00	0.23
BusyBoard	0.48	0.46	0.00	1.00	0.50
ANOOD	2.65	2.71	1.78	8.88	0.41
ANOD	2.12	2.35	1.00	6.43	0.62
IDA	51.17	54.29	42.00	60.50	3.25
ODA	59.77	58.28	53.20	64.00	2.79
IDT	5.19	5.28	0.40	15.70	3.11
ODT	4.49	4.68	1.00	9.80	1.64
Leverage	0.41	0.45	0.00	1.53	0.34
MV	4,420.44	941.07	100.16	95,776.12	11,049.99
ROE	19.43	9.28	-76.03	673.17	95.54
ROA	8.26	7.42	-95.88	123.75	12.65

Table 5.4 Pearson Correlation Matrix

This table presents the correlation coefficients for all the variables used in this study. Board Networks is the total number of firms and organizations the board of directors is acquainted with, through their current and past employment, their education, and other types of social activities (golf clubs, charity organizations, universities, etc). Board size is the number of directors sitting on the board. Board Independence is the percentage of non-executive directors sitting on the board. CEO Duality is a dummy variable identifying firms in which the roles of CEO and Chairman are split. Busy Board is a dummy variable that is one if 50 percent or more of the board's directors hold three or more directorships and zero otherwise. ANOOD is the average number of directorships held by outside directors. ANOD is the average number of directorships held by directors. IDA (ODA) shows the age of the inside (outside) directors in calendar years. IDT (ODT) is the number of years the inside (outside) directors has retained their current position. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization in 2009. The asterisks ***, ** and * show statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

	1	2	3	4	5	6	7	8	9	10	11	12	13
(1)BoardNetworks	1.00												
(2)BoardSize	0.45***	1.00											
(3)BoardIndependence	0.23***	0.09***	1.00										
(4)CEO Duality	0.01***	-0.08***	0.03**	1.00									
(5)BusyBoard	0.37***	0.39***	0.12**	0.02**	1.00								
(6)ANOOD	0.14**	0.16**	0.10**	0.07	0.31**	1.00							
(7)ANOD	0.01	0.12	0.02	0.02	0.42**	0.26**	1.00						
(8)IDA	0.10**	0.16**	0.12**	0.01	0.21**	0.30**	-0.05	1.00					
(9)ODA	0.25**	0.23**	0.13**	0.05**	0.25**	0.16**	0.07	0.10**	1.00				
(10)IDT	-0.29**	0.27**	0.18**	0.02**	0.13**	0.09*	0.04*	-0.03	0.36*	1.00			
(11)ODT	-0.28**	0.26**	0.15**	0.09**	0.11**	0.14*	0.10**	0.01*	0.20**	-0.37**	1.00		
(12)Leverage	0.12**	0.19**	0.03**	0.02	0.25**	0.08	-0.03	0.01	0.13*	-0.07*	-0.15*	1.00	
(13)MV	0.36**	0.47**	0.17**	0.08**	0.25**	0.16*	0.07	0.20*	0.18*	0.05	0.19*	0.05	1.00

Table 5.5 Variance Inflation Factor (VIF) Test Results

Variable	**VIF**	**1/VIF**
BoardSize	2.56	0.39
BusyBoard	2.45	0.41
MV	2.01	0.49
Board Independence	1.87	0.54
BoardNetworks	1.75	0.57
ODA	1.68	0.59
IDT	1.63	0.61
ODT	1.61	0.62
CEO Duality	1.57	0.64
IDA	1.46	0.68
ANOD	1.38	0.72
ANOOD	1.25	0.80
Leverage	1.18	0.85
Mean	**1.72**	**0.58**

5.4.2 Empirical Tests of Reputation Hypothesis and Busyness Hypothesis

In this section, we test the reputation hypothesis and the busyness hypothesis by means of three different empirical tests. We first examine the relationship between board networks and firm performance using a multivariate model. The results are depicted in Table 5.6. We find that board networks including both business and social connections have a significant and positive impact on firm performance at the 1% level using both ROA and ROE. The finding suggests that networked directors use their connections to access internal and external information and resources, thus improving firm performance. Although we find the average number of directorships held by outside directors (ANOOD) and all directors (ANOD) to have a positive effect on firm performance the results are not significant (Table 5.7). Finally, we find that busy board has a negative and significant effect on firm performance at the 1% level (Table 5.8). The result suggests that boards with half of the directors holding more than three directorships might be too busy to effectively perform their duties, thus hurting firm performance. This result is consistent with previous empirical evidence that firms with busy directors have lower performance (Fich and Shivdasani, 2006; Jackling and Johl, 2009).

5.4.3 Corporate Governance Mechanisms

We find that board size is negatively and significantly associated with firm performance at the 5% level (Tables 5.6 to Table 5.8), therefore hypothesis 2b is supported. These results support the argument that when a board gets bigger, it is difficult to co-operate and manage, thus reducing its effectiveness. Board independence is positively and significantly related to firm performance (Tables 5.6

to Table 5.8), hence hypothesis 3a is supported. The percentage of non-executive directors is used to proxy for board independence in this thesis. The recommendation in the UK Corporate Governance Code (2010) that boards should comprise appropriate independent non-executive directors in order to make sure no individual director can dominate the board's decision thus appears to make sound financial sense. However, we do not find that CEO duality has any effect on firm performance, so neither hypothesis 4a nor 4b is supported. This result is contrary to what the UK Corporate Governance Code (2010) implies.

In conclusion, for both measures of performance, ROA and ROE, we find that our overall results support hypothesis 3 that the total number of board network connections (comprising business connections and social connections) has a positive influence on firm performance. We also find evidence that if a board is too busy firm performance is adversely affected.

Table 5.6 Board Networks and Firm Performance

This table presents the regression results for the impact of Board Networks on firm performance. The dependent variable is firm performance, measured by Return on Assets (ROA) ratio and Return on Equity (ROE). Board Networks is the total number of firms and organizations the board of directors is acquainted with, through their current and past employment, their education, and other types of social activities (golf clubs, charity organizations, universities, etc). Board size is the number of directors sitting on the board. Board Independence is the percentage of non-executive directors sitting on the board. CEO Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. Inside (outside) director's Age shows the age of the inside (outside) directors in calendar years. Inside (outside) director's Tenure is the number of years the inside (outside) directors has retained their current position. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization in 2009. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	Dependent Variable	
Independent Variable	**(1)Return On Assets**	**(2)Return On Equity**
Board Networks	0.12***	0.18***
	(3.51)	(3.15)
Board Size	-1.94**	-1.47**
	(-2.04)	(-2.35)
Board Independence	0.57**	0.86**
	(2.58)	(2.45)
CEO Duality	0.12	0.16
	(0.56)	(0.34)
Inside Director's age	0.08	0.25
	(0.20)	(0.25)
Outside Director's age	0.18	0.87
	(0.24)	(0.60)
Inside Director's Tenure	0.29	0.61
	(0.27)	(0.27)
Outside Director's Tenure	0.31	0.97
	(0.38)	(.24)
Leverage	-0.78	-0.98
	(-1.61)	(-1.17)
MV	0.75	0.02
	(0.14)	(0.40)
Intercept	5.94	6.24
	(4.97)	(4.32)
Adj R^2	0.13	0.16
F	3.55	3.99

Table 5.7 Multiple Directorships and Firm Performance

This table presents the regression results for the impact of multiple directorships on firm performance. The dependent variable is firm performance, measured by Return on Assets (ROA) ratio and Return on Equity (ROE). ANOOD is the average number of directorships held by outside directors. ANOD is the average number of directorships held by all directors. Board size is the number of directors sitting on the board. Board Independence is the percentage of non-executive directors sitting on the board. CEO Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. Inside (outside) director's Age shows the age of the inside (outside) directors in calendar years. Inside (outside) director's Tenure is the number of years the inside (outside) directors has retained their current position. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization in 2009. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	Dependent Variable	
Independent Variable	**(1)Return On Assets**	**(2)Return On Equity**
ANOOD	1.26	1.47
	(0.37)	(0.24)
ANOD	0.18	0.98
	(0.48)	(0.57)
Board Size	-0.23**	-0.19**
	(-2.31)	(2.23)
Board Independence	0.12***	0.36***
	(3.28)	(3.29)
CEO Duality	0.25	0.27
	(0.51)	(0.43)
Inside Director's age	1.70	3.23
	(0.44)	(0.48)
Outside Director's age	1.85	4.49
	(0.46)	(0.64)
Inside Director's Tenure	0.80	0.65
	(0.22)	(0.10)
Outside Director's Tenure	0.93	0.85
	(0.64)	(0.73)
Leverage	-0.32	-0.41
	(-0.07)	(-0.75)
MV	0.37	0.35
	(0.36)	(0.44)
Intercept	5.59***	6.48***
	(4.39)	(3.58)
Adj R^2	0.11	0.09
F	3.92	3.37

Table 5.8 Busy Board and Firm Performance

This table presents the regression results for the impact of Busy Board on firm performance. The dependent variable is firm performance, measured by Return on Assets (ROA) ratio and Return on Equity (ROE). Busy Board is a dummy variable that is one if 50 percent or more of the board's directors hold three or more directorships and zero otherwise. Board size is the number of directors sitting on the board. Board Independence is the percentage of non-executive directors sitting on the board. CEO Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. Inside (outside) director's Age shows the age of the inside (outside) directors in calendar years. Inside (outside) director's Tenure is the number of years the inside (outside) directors has retained their current position. Leverage is the ratio of Total Debt to Total Equity. Market Value is the market capitalization in 2009. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	Dependent Variable	
Independent Variable	**(1)Return On Assets**	**(2)Return on Equity**
Busy Board	-3.45***	-3.61***
	(-3.72)	(-3.61)
Board size	-1.62**	-2.28**
	(-2.39)	(-2.57)
Board Independence	0.37***	0.48***
	(3.85)	(3.57)
CEO Duality	0.39	0.64
	(0.34)	(0.56)
Inside Director's age	0.19	0.36
	(0.32)	(0.05)
Outside Director's age	0.80	0.30
	(0.47)	(0.64)
Inside Director's Tenure	0.83	0.93
	(0.23)	(0.15)
Outside Director's Tenure	0.51	0.21
	(0.74)	(0.78)
Leverage	-0.11	-0.20
	(-1.39)	(-0.98)
MV	0.27	0.20
	(0.13)	(0.40)
Intercept	4.29***	3.59***
	(3.49)	(3.21)
Adj R^2	0.12	0.19
F	3.43	3.78

5.5 Further analysis: business networks and social networks

In order to further understand the relationship between board networks and firm performance, we examine the separate effects of business and social networks on firm performance to establish whether the social capital built by director networks plays a more or less important role than business networks in affecting firm performance. According to Coleman (1990) social capital can be defined as a useful resource created from a network of social ties that allow members of organizations to trust each other and co-operate. Directors are not just members of the board but have various social connections, for example they are often common members of golf clubs or the alumni of the same university. A high level of social connections is associated with a high level of social capital, therefore possibly enhancing firm performance. Other prominent definitions of social capital include that of Burt (1992) who views it as consisting of relationships with others, both friends and colleagues, through which opportunities arise to use financial and human capital; and Putnam (1993) who views it as a property possessed by groups or communities, rather than by individuals, consisting of features of social organization, such as trust, that facilitate coordinating actions by these groups.

In this study business networks are defined as those that arise from director interlocks while social networks arise from common membership by directors of other organisations, be they alumni of a university, a golf club, etc. The organizations in our board networks include public firms, private firms, universities, clubs, charities, governments, the army and sports organisations. Therefore, we separate our board networks into two components depending on the types of organization:

1. Business networks: public firms and private firms.
2. Social networks: universities, clubs, charities, governments, the army and sports.

This breakdown of board networks into two categories mirrors the division of social capital into internal and external categories by Kim and Cannella (2008) in their theory of director selection. They argue that much board research tends to be dominated by the agency theory perspective which emphasises the monitoring role of the board and therefore fails to take account of additional attributes that directors bring to their role. Kim and Cannella (2008) distinguish between internal social capital, which they define as ties and relations with others within the firm, mainly other directors, and external social capital, which they define as ties and relations with various contacts outside the firm such as investors, customers, suppliers, legal authorities and political elites. They argue that each type of social capital represent different types of network linkages and provides different resources to the board. High internal social capital improves trust between directors and thus reduces costs of communication and cooperation at the firm level. By enhancing the efficiency of knowledge sharing among directors, internal social capital can be a crucial source of competitive advantage. Those possessing high external social capital act as linkage linking their firm to critical resources or information in the environment. Directors collect external information and make sure the objectives of the organization fit in with the industry environment.

Table 5.9 lists the top 10 most well-connected non-financial FTSE 350 firms in 2009. ROLLS ROYCE, for example, a power system provider, had a total of 234

board networks in 2009, of which 176 (49+127) were business networks and 58 (21+18+8+11) were social networks. Table 5.10 presents the separate effects of business and social networks on firm performance. We find that business networks have positive and significant effects on firm performance, but only at the 10% significant level (and only for ROA). However, social networks are found to have a positive and significant effect on firm performance at the 5% significance level for both ROA and ROE. The results suggest that social networks play a more important role than business networks in affecting firm performance.

Table 5.9

Top 10 Well-Connected FTSE 350 Non-Financial Firms in 2009

Company Name	Public	Private	University	Charity	Club	Government	Army	Sport	Total networks
ROLLS-ROYCE	49	127	21	18	8	11	0	0	234
WPP	25	157	18	17	10	3	0	0	230
TESCO	18	163	6	11	2	4	0	0	204
ITV	9	162	2	8	1	3	0	0	185
VODAFONE GROUP	29	111	14	9	3	7	0	0	173
BP	27	97	24	13	3	6	1	0	171
GLAXOSMITHKLINE	24	98	17	10	10	5	3	0	167
UNILEVER	36	94	13	7	6	6	0	0	162
BT GROUP	27	92	12	17	4	3	2	0	157
AVIVA	24	71	9	15	6	5	0	1	131

Table 5.10
The effects of Business and Social Networks on Firm Performance

This table presents the regression results for the impact of business and social networks on firm performance. The dependent variable is firm performance, measured by Return on Assets (ROA) ratio and Return on Equity (ROE). Business networks are the total number of connections with public and private firms. Social networks are the total number of connections with universities, clubs, charities, governments, armies and sports. Board size is the number of directors sitting on the board. Board Independence is the percentage of non-executive directors sitting on the board. CEO Duality is a dummy variable taking the value of one if the roles of CEO and Chairman are split, zero otherwise. Inside (outside) director's Age shows the age of the inside (outside) directors in calendar years. Inside (outside) director's Tenure is the number of years the inside (outside) directors has retained their current position. Leverage is the ratio of Total Debt to Total Equity. MV is the market capitalization in 2009. Asterisks indicate significance at 10% (*), 5% (**) and 1% (***) levels.

	Dependent Variable	
Independent Variable	**Return On Assets**	**Return On Equity**
Business networks	0.06*	0.15
	(1.98)	(1.48)
Social networks	0.05**	0.13**
	(2.58)	(2.24)
Board Size	-2.32**	-1.66**
	(-2.56)	(-2.47)
Board Independence	3.27**	1.48**
	(2.83)	(2.58)
CEO Duality	0.64	0.72
	(0.42)	(0.28)
Inside Director's age	0.23	0.35
	(0.84)	(0.21)
Outside Director's age	0.28	0.75
	(0.68)	(0.47)
Inside Director's Tenure	0.36	0.56
	(0.47)	(0.37)
Outside Director's Tenure	0.41	0.39
	(0.68)	(.64)
Leverage	-0.68	-0.88
	(-1.31)	(-1.27)
MV	0.55	0.22
	(0.34)	(0.46)
Intercept	3.29	5.14
	(1.87)	(1.36)
Adj R^2	0.18	0.19
F	3.73	3.88

5.6 Conclusion

In this chapter, we investigate the effects of directors business and social networks on firm performance using three different measures: board networks including business and social connections; the average number of directorships held by outside directors; and the busyness of a board, where more than half of the directors hold more than three directorships.

Overall, our findings are consistent with the "Reputation Hypothesis" (Fama and Jensen, 1983) which argues that the number of directorships may proxy for director reputation. Directors are motivated to improve their reputation since they can use their directorships to signal to the market that they are good at decision-making, and at providing advice and monitoring management. Therefore, a board with more multiple directors increases firm value. In particular, we find that board networks (both business and social networks) have a positive and significant effect on firm performance. However, the average number of board seats (i.e. business networks) held by directors is not significantly related to firm performance. This suggests that social networks play a more significant role in affecting firm performance, given that board networks in general (including both social and business networks) are positively related to firm performance. In addition, we find that if the board is recognized as a "busy board", firm performance is adversely affected.

We also test the effects of corporate governance mechanisms on firm performance. We find that board size is negatively and significantly associated with firm performance. This result suggests that smaller boards could be more effective and perform better than larger boards. Board independence is found to be positively and

significantly associated with firm performance in line with the recommendations of the UK Corporate Governance Code (2010). However, we do not find that CEO duality has any effect on firm performance.

We further split the effects of board networks into business networks and social networks. We find that social networks play a more important role than business connections in improving firm performance. The results support social capital theory (Coleman, 1990) which argues that networks of social connections can provide firms with valuable resource and information.

Chapter 6: Conclusion

6.1 Introduction

This thesis tests the effect of director networks and corporate governance mechanisms on firm performance and CEO compensation. In this final chapter we summarize the major contributions and findings of the three empirical studies and the practical implications of the findings. We also discuss the limitations of the study and provide suggestions for future research.

6.2 Summary

An interlock occurs when a director of one firm sits on the board of another firm. As a result, director interlocks, or networks, generate connections between firms. Unlike the conventional measure of director networks, namely the total number of directorships, which only captures the quantity of directors' obligations not their quality, this thesis measures director networks based on five different centrality measures. In contrast to simply calculating the number of directorships, centrality measures take into account not only the quantity of directors' obligations but also their quality. In addition, director networks are measured not only in terms of current employment but also take account of past employment, education, and other types of social activities (golf clubs, charity organizations, universities, etc).

Chapter two explains the terminology and methodology used in this thesis. Chapter three presents the extent of board networks among non-financial FTSE 350 firms listed on the London Stock Exchange and shows whether board networks measured by "centrality" are related to firm performance. Our study applies a set of very comprehensive measures of director networks, namely degree centrality,

betweenness centrality, closeness centrality, eigenvector centrality and information centrality. To the best of our knowledge, we are the first to test the effects of board networks on firm performance in the UK context using all of these measures. We find that firms with well-connected directors are positively correlated with firm performance. Consistent with the arguments (Fama and Jensen, 1983) that the number of connections may proxy for director reputation. Directors have the motivations to improve their reputation since they can use their directorships to signal to the market that they are good at making decision, providing good advice and monitoring to the board. Thus, a firm with more multiple directors can experience an increase in firm value.

Chapter four investigates the effects of CEO and board networks on CEO compensation using a sample of non-financial FTSE 350 firms between 2007 and 2010 while controlling for CEO characteristics, corporate governance characteristics, firm characteristics and performance characteristics. In contrast to most prior studies, this study examines not only the total remuneration of the CEO but also two important components of the remuneration package, i.e. basic salary and long-term incentive plan (LTIPs). At the individual level, we find that if the CEO is well-connected, as measured by five centrality measures, the CEO receives higher total compensation. This result supports the managerial power theory (Bebchuk et al., 2002) which suggests that powerful CEOs can effectively influence their compensation decisions. Although we find a positive relationship between basic salary and CEO networks, we do not find evidence of a relationship between LTIPs compensation and CEO networks. The results suggest that powerful CEOs would like to increase their basic salary rather than LTIPs compensation, since basic salary

does not require any additional effort from the CEO, whereas incentive-based compensation is normally dependent on firm performance. At the firm level, there is a positive relationship between board networks and CEO total compensation and LTIPs compensation. However, we find no evidence that a CEO's basic salary compensation is positively related to board networks at the firm level. The results suggest that firms tend to reward the CEO with more equity-based compensation if the firm has better access to resources and information through their overall director networks.

Chapter five examines the effects of directors' business and social networks and corporate governance mechanisms on firm performance. Most previous studies only consider director interlocks (business connections) while this study measures both business connections and social connections, such as current and past employment , education background, and other types of social activities (membership of golf clubs, membership of charity organizations, universities alumni, etc). We find that firms with well-connected directors seem to use their networks to enhance firm performance and therefore in line with the interest of their shareholders. In addition, we separate board networks into business and social connections and then examine the effects of these two sets of connections on firm performance. We find that social connections play a more important role in improving firm performance. This is in line with social capital theory (Coleman, 1990) which argues that the network of social connections can provide firms with valuable resource and information.

6.3 Practical implications

This thesis provides some practical implications for regulators, firms and

individuals. Our results suggest that firms with well-connected directors can improve their performance by obtaining a central position in a network, giving them more opportunities to access different kinds of information and resources. Hence, it is not always necessary to restrain the number of the directorships held by executive directors as stated in Section B.3.3 of the UK Corporate Governance Code (2010). Director networks comprise not just business connections but also common social connections (e.g. charity, education and sporting activities). The UK Corporate Governance Code (2010) recommends that "evaluation of the board of FTSE 350 companies should be externally facilitated at least every three years". This makes it easier for companies to get rid of bad directors. The results of this thesis would suggest that the value of network connections should also be taken into account when companies are evaluating the worth of incumbent directors. The ability to access external resources and information becomes even important to firms during difficult financial times, so firms should pay attention to both business and social network connections when selecting, appointing and reviewing the performance of directors. Similarly, individual directors need to develop not only their business connections but also their social network connections if they wish to fully enhance their managerial ability and career mobility.

6.4 Limitations

6.4.1 Sample limitation

In this thesis, we employ a sample based on the FTSE 350 index which includes the largest 350 firms in the UK. Therefore, the sample is not randomly selected. This could result in a sample size bias since the sample is limited to the largest firms in terms of size. However, there are several reasons why we chose the FTSE 350 index.

First, although the sample only consists of the top 350 UK firms, the sample represents about 97% of UK market capitalisation data. Second, all of the FTSE 350 firms are required to report their accounting and corporate governance data publicly according to the UK Corporate Governance Code, while some requirements of UK Corporate Governance Code give permission for small firms not to opt out. Therefore, we would not be able to collect all of the accounting and corporate governance data for the smaller firms.

6.4.2 Variable limitations

Although we include a number of variables to control for the effect of corporate governance, it is possible that other factors not included in the multivariate regression models may also affect firm performance and the level of CEO compensation. For example, even if we control for some CEO characteristics in our model, i.e. CEO age, CEO tenure, CEO gender, the CEO's share ownership may also affect the CEO's compensation. If the CEO owns a large amount of shares in his firm, a large percentage of his pay is tied up with firm performance. The omission is mainly because the data is not available on Datastream (Basic version).

6.5 Suggestions for future research

Although the results of this thesis provide some evidence that director networks and corporate governance mechanisms significantly affect firm performance and CEOs compensation, some factors not covered in this thesis might be pursued in future research.

When measuring firm performance, we use both Return on Equity (ROE) and

Return on Assets (ROA) to measure the firm financial performance. The results can be strengthened by using alternative variables to proxy for the financial performance, such as Tobin's Q, the market to book ratio, etc. Besides, in order to capture different aspect of firm performance, stock returns can also be used to proxy for financial performance. Furthermore, although the sample includes the largest 350 UK firms and excludes all the financial firms, it might be worth looking at the effects when including small firms and financial firms. Although we use a lagged values approach to deal with the endogeneity issue in the thesis, there is another way to deal with the endogeneity issue, namely by using the instrumental variable approach (Fang et al, 2012). To use this approach, we need to find an instrumental variable which is strongly correlated with the independent variable (the potential endogenous variable) but is not directly correlated with dependent variable. The death and retirement of directors, as suggested by Fracassi and Tate (2012), could be appropriate instrumental variable because both events are exogenous shocks that affect networks directly but not firm value and CEO compensation. Another interesting topic for the future research would be undertaking a comparative study between one-tier board where all directors (both executive directors and non-executive directors) are sitting on the same board (e.g. UK) and two-tier board where executive directors and non-executive directors are sitting on two different boards: executive board and supervisory board (e.g. Germany) on the effects of director networks and corporate governance mechanisms. Last but not least, although this study employs quantitative method to examine the effects of director networks and corporate governance mechanisms on firm performance and CEO compensation, it can be supplemented with qualitative method to conduct the interviews with board members. It will be useful for the researchers to know what

actually happens in the corporations and therefore provide further explanations for the results and also increase the reliability.

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