

Director Networks, Turnover, and Appointments

Finance Working Paper N° 534/2017

April 2018

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ECGI Working Paper Series in Finance

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Keywords: Corporate Governance, Director Networks, Director Turnover, Director Appointments

JEL Classifications: G34, J4, L14

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This paper analyzes the labor market (turnover and appointments) of executive and non-executive directors by means of social network methodology. We find that directors with strong networks are able to obtain labor market information that enables them to leave their firm more easily for better opportunities. Networks also mitigate information asymmetry problems of external director appointments. Furthermore, the strong impact of indirect connections is in line with the ‘strength of the weak ties’ theory. The fact that direct connections are less important signifies that the connections to people that are close and local are likely to convey redundant information, whereas connections to distant individuals are more efficient in terms of information acquisition and labor market performance improvement.

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Director Networks, Turnover, and Appointments

1. INTRODUCTION

A company's shareholders are to elect or approve the appointment of the non-executive (or supervisory) directors whose fiduciary duties include monitoring the CEO and the other executive directors (the management). In case of continued poor corporate performance, one of the key responsibilities of the board is to contemplate the dismissal of the underperforming executives and to appoint successors. In this context, both networks of the executive and non-executive directors are likely to play an important role; the former network can facilitate the search for a new position in another firm, while the latter connections yield information on the pool of successors. The role of social networks in job-searching has been well studied in sociology and labor economics for laborers and employees belonging to minorities, but has not been examined intensively for corporate top management. Given that close professional and social connections exist among the corporate elites, it may well be that executive and non-executive director networks are even more important in a labor market context than employees' connections. Contrary to many existing studies that only focus on the CEO turnover, we evaluate the turnover and succession of all board members, comprising the CEO, executive directors, chairman and non-executive directors³.

We address the question: To what extent do director networks affect the top managerial labor market? We embed social network methodology into our analysis of this labor market and focus more specifically on two issues. First, we examine whether, through his corporate network, a director may be able to obtain information about which firms are seeking managerial profiles fitting the top manager, and this may improve the odds of finding a similar or better managerial position. Thus, a strong network may affect

³ In this paper (where we use the UK definition of director, which refers to both executive and non-executive directors). Whereas in the US, 'directors' usually refer to the non-executive directors who do not hold an executive position in the firm, we apply the UK terminology throughout the paper: the board comprises both executive and non-executive directors. The former category consists of the top management and the latter of (mostly) independent supervisor directors. So, in this paper, 'directors' stand for both executive and non-executive directors.

an executive director's decision to leave when he feels threatened by an approaching dismissal. His network may enable him to leave his company at an earlier opportunity and prior to dismissal. An executive director's network could also be a reflection of his power or influence which could affect the board's decision making and stall or ward off dismissal. As corporate underperformance may not only be the responsibility of executive directors but also of the non-executive directors on the board, we also study the impact of networks on the replacement of non-executives. Second, we turn to the perspective of the firm and examine the board's decision about hiring an internal versus an external candidate when a managerial or non-executive vacancy emerges. In general, an external director appointment involves more uncertainty due to asymmetric information, but the incumbent directors' networks mitigate the uncertainty. In the context of turnover and appointment, we focus on network centrality measures capturing information-gathering potential of directors and companies. Different types of centrality measures capture directors' connections to nearby and powerful other directors as well as directors' positions within the whole network.

This study yields some interesting results: first, directors with better global information access (through indirect networks) are more likely to leave their current position for another firm. In contrast, executive and non-executive directors' access to local information (proxied by direct connections) does not increase the probability of their departure. Nevertheless, a director with many direct connections stands a better chance of promotion and retention within his firm as the direct connections may be a proxy for his influence or power in his firm. Second, when we investigate the factors affecting the probability of an external appointment, it turns out that outside candidates with strong indirect networks (with higher global information collection ability) are more likely to be chosen as the new chairman or as non-executive directors. Specifically for the position of chairman, an external director with a strong direct connectedness has a higher probability of being invited to chair the board. We do not observe similar relations for executive directors. We conclude that director networks grant information access and hence enhance the directors' labor market opportunities. The positive impact of indirect connections reflects the network's information value and is in line with the 'strength of the weak ties'

theory (Grannovetter, 1973). This signifies that the connections to people that are close and local are likely to be stronger but then also convey redundant information. In contrast, connections to individuals on ‘brokerage’ positions, i.e., bridging to groups that are otherwise separated, are more efficient in terms of information acquisition and labor market performance improvement, even though such connections may only be indirect and hence weaker.

When analyzing each company’s position in networks at the company level, we reveal that the information gathering ability of a company, measured as the collective network of its individual directors, is positively related to the probability of hiring external non-executive directors (including chairmen). This implies that the network’s information value affects labor market behavior at the director as well as at the company level.

Our results reaffirm some findings in the recent literature, i.e., the information value of CEOs’ networks increases their turnover probability (Liu, 2014), which we extend by examining the networks of the whole corporate board. We also discover that directors’ direct and indirect connections affect turnover in different ways. Furthermore, we study the director appointment decision from both the hiree’s and company’s perspective. External and internal appointments have received less attention in the literature, but have strong implications for board diversity and non-executive director independence. We find that the candidate’s and the incumbent directors’ networks increase the probability of external appointments and hence enable the firm to cast their net wider, beyond the pool of internal candidates. Lastly, our empirical analysis is based on UK data, which generates some new insights into the director turnover literature currently dominated by US evidence.

The paper proceeds as follows. In the next section, we review the CEO labor market studies. In section 2, we introduce social network methodology and develop the hypotheses for our empirical analysis in Section 3. In Section 4, we describe the sample statistics, followed in Section 5 by our multivariate analysis. In Section 6, we formulate our conclusions.

2. THE LITERATURE

2.1 Director turnover

The pioneering empirical studies include those by Coughlan and Schmidt (1985), Weisbach (1988) and Warner, Watts and Wruck (1988), who reveal that CEO turnover is associated with poor performance, especially when an effective corporate governance system is installed. Since the early 1990s, studies on CEO turnover probability and corporate underperformance have been conducted: e.g. Kaplan and Minton (2012) and Bushman, Dai and Wang (2010) demonstrate that the turnover decision is closely related to the (relative) corporate performance, and this relationship has become stronger after 2000. Although in principle, turnover decisions ought to be made after filtering exogenous factors out of the corporate performance, Jenter and Kanaan (2015) demonstrate that CEOs are fired following industry and market shocks that are beyond their control.

CEO turnover is not only driven by poor performance but also affected by many other factors, the remaining contract time of the incumbent director (Cziraki and Groen-Xu, 2017), board size (Yermack, 1996, and Renneboog and Trojanowski, 2005), large outside ownership (Denis, Denis and Sarin, 1997), overall corporate governance efficiency (Fisman, Khurana, Rhodes-Kropf and Yim, 2013), CEO shareholdings (Denis *et al.*, 1997), institutional ownership (Parrino, Sias and Starks, 2003), risk (Bushman, Dai and Wang, 2010), changes in legislation (Dah, Frye and Hurst 2014), and corporate culture (Fiordelisi and Ricci, 2013).⁴Aharony, Liu and Yawson (2015) report that the probability of CEO and other executive director turnover increases following contractual lawsuits. In recent years, an increasing number of studies on developing countries, such as China, unveils that the relationship between turnover and performance is weakened in the context of political connections (You and Du, 2011, and Liang, Renneboog and Sun, 2015) and state ownership (Canyon and He, 2012). CEOs with political connections, with a former government position, or military background are less likely to be dismissed when their

⁴ The relationship between turnover probability and performance is also tested in the presence of other corporate events as Mikkelsen and Partch (1996) demonstrate that the relation is only significant in periods of high takeover activity and hence mainly in the context of strong takeover threat. Still, this finding is contested by Huson, Parrino and Starks (2001).

companies perform poorly. In France, a large percentage of top corporate careers are preceded by an education in a few top schools (*écoles supérieures, écoles polytechniques*, or ENA, the *école nationale d'administration* or top training ground for civil servants), and a period as a civil servant in a top ministry or *cabinet* of a government minister whereby the civil servant chooses a political color. Those political connections and support are important to advance one's career (Kramarz and Thesmar, 2013). These studies reveal that director turnover is not only driven by underperformance. Other factors, such as a director's power and connections play important roles as well. We use network analysis to comprehensively evaluate the advantages of a director's network with regard to information access and power, which may affect turnover.

2.2 Director appointment

Dalton and Kesner (1985) document that the choice between an internal and external CEO depends on the company's performance prior to the turnover. Average performing companies most frequently opt for external candidates whereas the well-performing and poorly-performing firms seem to prefer an internal successor. Furthermore, Brickley, Linck and Coles (1999) show that CEOs with better performance are more likely to continue serving on the board (possibly as chairman) after retirement from their executive positions.

Besides performance, some other factors affect the decision on the appointment of a new director: e.g. the desired skill-set for professional managers has shifted from firm-specific human capital and specialized-technical skills to more general management skills (Murphy and Zbojnik, 2007), which has increased the hiring of external candidates to succeed the incumbent CEO. Moreover, Custódio, Ferreira and Matos (2013) confirm that CEOs with general skills have an advantage over those with specialized skills in terms of compensation and in the managerial labor market. The type of CEO also depends on the firm's board composition: the frequency of external appointment increases with the proportion of external directors on the board, regardless of whether turnover is forced or not (Borokhovich, Parrino and Trapani, 1996). Ownership concentration may also affect the choice of a CEO as e.g. in Japan where the presence of a house bank as a large

blockholder increases the odds of an outside CEO appointment (Kang and Shivdasani, 1997).

Relative to the analysis of turnover, the empirical research on director appointments is rather underdeveloped. We address this issue in this paper by examining director appointment from a network perspective.

2.3 Director networks

Since the 1960s, many sociological studies have focused on interpersonal influence, the small world effect⁵, and how networks generally affect the job market behavior of individuals and organizations. Among the early studies, Rees (1966) gives evidence of the importance of social contacts for job searching: more than 60% of the subjects in his survey find jobs via friends and relatives rather than by direct applications or via job searching agencies. Granovetter (1973) focuses on the strength of social network contacts and unveils that information transmission through weak links (e.g., more distant acquaintances) is even more important than strong links (e.g., family and close friends). The main explanation for the success of weak ties in job searching is that they are more likely to transmit information from distant parts of the network. On the other hand, strong links provide more local information, which is prone to generate redundancy. Nevertheless, some researchers offer different interpretations about the relevance of weak/strong ties: e.g. Lin (1982) argues that the number of weak links is usually much larger than that of the strong ones, which entails that the information inflow via all weak links is more intense. Furthermore, Montgomery (1991) shows that more than half of the jobs are obtained through social contacts regardless of ethnicity, gender, education, current occupation, and social status.

In the corporate finance literature, studies on director networks and CEO turnover reveal that the information value of networks contributes to the individual success in the top managerial labor market. For instance, Barnea and Guedj's (2009) and Nguyen (2011)

⁵ More specifically, the distance between two random individuals in a large network is much smaller than the number of individuals. For example, in 1967, Stanley Milgram's famous experiment shows that it takes a median of five intermediate acquaintances (i.e. six Degrees of separation) for a post to reach the unknown destination recipient.

report that better-connected CEOs are more likely to be offered non-executive positions on other boards. Likewise, Liu (2014) demonstrates that a CEO's connectedness expands the number of outside options. Besides improving a director's external labor market opportunities, networks can augment the odds of internal promotions as well; e.g. Mobbs (2013) reports that executives who are not CEO and have more external directorships are likely to replace a resigning CEO.

Nevertheless, Ballinger, Cross and Holtom (2016) do not agree with the above findings: individuals in the 'brokering' positions, characterized by the ease with which information is collected and exchanged, have a lower turnover probability because the advantages brought about by their central network positions are not transferrable to another company. Furthermore, some studies document a dark side of director networks, namely that they can lead to managerial entrenchment. Fich and White (2005) and Fich and Shivdasani (2006) reveal a negative relation between the number of CEO interlocks (CEOs sitting on each other's boards) and CEO turnover, which implies that interlocks hinder good corporate governance practice. Kramarz and Thesmar (2013) find that a CEO's social network arising from a former career as a top civil servant is detrimental to the value of his firm because the political connections of the CEO impede penalization when performance is poor.

To sum up, director networks can facilitate the generation of additional (labor market) information but may also enhance managerial power that results in managerial entrenchment. Access to labor market information can provide more and better external opportunities, which augments turnover, whereas networks may yield excess managerial power, which protects directors from disciplinary dismissal. We examine this dichotomy in our empirical analysis below. We also analyze how external appointments are influenced by candidates' and hiring companies' network status. Given that the study on external appointments is relatively underdeveloped, our research can further our understanding of this important topic.

3. HYPOTHESES AND METHODOLOGY

3.1 Definitions of Networks, Turnover, and Appointments

In director-level networks, we consider two directors as being connected when they both serve on the same board in a specific year. We evaluate a director's network centrality by three centrality measures: Degree, Closeness, and Betweenness. We explain each briefly and provide detailed definitions in the Appendix. Degree counts the number of connections of a director and hence focuses on the *direct connections* to other directors. Directors with a high Degree may have better access to *local information*. Furthermore, strong direct connections may also grant managerial power to directors (Renneboog and Zhao, 2011). Closeness and Betweenness evaluate a director's position in the whole network and thus focus on the *indirect connections*. More specifically, Closeness is based on the average distance to other reachable directors and Betweenness reflects the likelihood that a director acts as an information broker between other directors. Directors with high Closeness and Betweenness may collect *global information* (even from firms and directors they are not in direct contact with) more efficiently. Although both Betweenness and Closeness are based on indirect connections and consider all reachable directors, they still measure different aspects of information gathering as their correlation is merely 0.295. When we consider networks at the company level, we identify a connection between two companies as they have one or more directors in common. Centrality measures for a company are calculated using similar methods as those for director-level networks.

We define turnover as a director leaving the company's board. When studying turnover, we exclude 'natural' turnover, defined as directors leaving the firm for reasons of retirement. We consider retirement as natural when the director's age is 65 or higher; it should be noted that many directors still continue beyond the retirement age of 65. More specifically, 4.5% (24.3%) of the executive (non-executive) directors are 65 or older. Given the frequent use of euphemisms in press releases by the firm and the involved director (e.g. 'the director leaves the firm in mutual agreement', 'the CEO, aged 45, retires in order to spend more time with family'), we do not attempt to identify true disciplinary turnover. The real reason behind a departure of a director may be poor corporate

performance, strategy conflicts, or the presence of attractive outside options. While we examine turnover for all (non-)executive directors, we do not consider promotions as turnover (e.g. the promotion of a CFO to CEO is not real turnover from the CFO perspective, but the CEO departure is included in our turnover models).

Upon the departure of the predecessor, a new director is needed and is selected by the board that considers the candidates' ability, experience, and reputation. The board's nomination committee evaluates the pool of potential candidates from both inside and outside the company. An internal manager has the advantage of being familiar with the firm but concerns may arise about managerial entrenchment and his ability to innovate. For external candidates, asymmetric information may be an obstacle as well as the potential fit with the firm. We investigate whether director networks mitigate these issues.

3.2 Turnover

We study whether a director's high network centrality, reflecting better access to labor market information through his network, generates new employment opportunities, captured by a higher frequency to leave the firm for other outside options. As Granovetter (1973) argues, weak links may be more effective in gathering information than strong ones, which is why we expect, in our context, that indirect connections (measured by Closeness) are more effective than direct connections (measured by Degree). Furthermore, a director's direct connections may also reflect his managerial power or influence (Renneboog and Zhao 2011) which may reduce the possibility of being dismissed. Therefore, we expect that directors with strong Degree centrality measures are less likely to be dismissed. This leads to the following hypotheses:

A director's turnover probability increases with the strength of his/her network centrality (H1a), especially when (s)he has stronger indirect connections (H1b).

3.3 Appointment

Director networks may also play an important role in the selection of new directors. As we do not have data on the whole pool of potential candidates for a directorship, our analysis is necessarily confined to observing the results of the selection process, namely

the internal or external appointment. External directors have several disadvantages compared to internal directors. First, as internal directors have been working with the board members, possible friendships between the internal candidate and the other board members may increase the support for an internal candidate's candidacy. Second, the company has less information about the quality of the external candidates and how they would fit in the incumbent team and, in order to avoid adverse selection, the nomination committee may prefer an insider. Third, a new external director may need considerable time to fully understand the company's operations and culture. Director networks that improve information diffusion can help the external CEO candidates to overcome the above obstacles. Therefore, we expect that strong networks increase the odds of external appointments:

External director appointments are more likely to occur when the candidates have stronger network positions (H2a).

We note that a small proportion of directors appointed from outside the UK top managerial labor market (e.g., US) may not be fully covered by our network analysis since we only consider connections among UK directors. Due to data limitations, we cannot construct complete networks comprising directors' overseas connections. Furthermore, the foreign connections are expected to be less valuable than domestic ones in terms of information access and power.

Lastly, the chance of appointing directors from the outside may be increased by companies' access to information. Companies with many well-connected (non-executive) directors have more information of managerial labor market. Therefore, these well-connected boards are more likely to appoint directors from outside. This leads to the following hypothesis:

External director appointments are more likely to occur when the company has stronger network position (H2b).

A company's access to information can be measured by its position in the company-level networks (see Section 3).

3.4 Other related factors

In addition to the centrality measures described above, we also employ many other variables to control for the factors that may affect turnover and appointment, the descriptive statistics of which are presented in the next subsection. As turnover is often triggered by poor performance (see e.g., amongst many papers, Coughlan and Schmidt, 1985; Franks, Mayer and Renneboog, 2001; Kaplan and Minton, 2012), we include the return on assets (ROA) and the market-to-book ratio. Furthermore, Jenter and Lewellen (2010) find that the relationship between CEO turnover and performance is non-monotonic, which is why we conduct a regression analysis with sub-samples of different performance groups as a robustness test. Potentially important director traits are gender, age, tenure in his/her position, membership of the remuneration, audit, nomination, or other committees. More senior executive directors are more likely to have a well-established career, more experience, as well as a stronger reputation which provide them with more job opportunities. Thus, we expect that older and more experienced executive directors are more likely to leave their positions to accept a board position elsewhere. Alternatively, executive directors may be entrenched in cases where they have a longer tenure than the non-executive directors whose appointments they may have overseen, which entails that these executives are less likely to be dismissed. Being a member of nomination or remuneration committees strengthens a director's (bargaining) power when the questions of his departure emerge, which leads to a lower turnover frequency.

We also control for various internal and external governance mechanisms (Weisbach, 1988, and Brickley, 2003). A higher proportion of non-executive directors on the board, and absence of CEO-Chairman duality may reflect more effective governance, which translates into a higher turnover probability. We expect various aspects of ownership concentration (held by institutional investors, corporations, families and individuals, and other types of large investors) to affect turnover (Denis et al., 1997). Large shareholdings induce investors to invest more into monitoring and interventions, which should lead to turnover in case of underperformance.

Lastly, we also control for measures of financial stability and firm size. We expect that director turnover is more likely to occur in financially distressed companies, which is why we include interest coverage (EBIT to interest payment ratio) and leverage (debt

on total assets). Larger firms are expected to have a higher turnover rate, as they have a larger internal pool of potential top managers who participate in the corporate tournament for the top jobs, and they may be able to offer more attractive remuneration packages to attract the external CEOs.

3.4 Regression models

In the regression analysis, we use random effects probit regressions as the base-line models; compared to a standard probit model with pooled data, the random effects probit model considers the correlations across periods and thus estimates coefficients more efficiently (Robinson, 1982). Moreover, although the standard probit model can generate consistent estimates, the routinely computed standard errors are incorrect (Verbeek, 2008), and this is also addressed by random effects probit models. The variable specification is as follows:

$$\begin{aligned} \text{Director turnover}_{it} = & \alpha + \beta_1 \times \text{Performance measures}_{it-1} + \beta_2 \times \text{Centrality measures}_{it-1} \\ & + \beta_3 \times \text{Director traits}_{it-1} + \beta_4 \times \text{Board characteristics}_{it-1} \\ & + \beta_5 \times \text{Ownership concentration}_{it-1} + \beta_6 \times \text{Firm characteristics}_{it-1} \\ & + \text{Industry fixed effects}_i + \text{Time fixed effects}_t + \varepsilon_{it} \end{aligned}$$

where director turnover equals 1 if the director leaves the company and zero otherwise. All explanatory variables are lagged by one year.

In the appointment analysis, we also employ random effects probit models to analyze the internal/external appointment decision:

$$\begin{aligned} \text{External appointment}_{it} = & \alpha + \beta_1 \times \text{Performance measures}_{it} + \beta_2 \times \text{Centrality measures}_{it} \\ & + \beta_3 \times \text{Director traits}_{it} + \beta_4 \times \text{Board characteristics}_{it} \\ & + \beta_5 \times \text{Ownership concentration}_{it} + \beta_6 \times \text{Firm characteristics}_{it} \\ & + \text{Industry fixed effects}_i + \text{Time fixed effects}_t + \varepsilon_{it} \end{aligned}$$

where external appointment equals 1 if the new director is an external candidate and zero otherwise.

4. DATA DESCRIPTION

Our turnover and board data are primarily collected from BoardEX, while company

characteristics, including financial information, sector categorization, and stock information, are acquired from Datastream Advance. Our dataset spans 12 years (period 2004 to 2015) and comprises all companies listed in the London Stock Exchange (the members of the FTSE 100, FTSE 250, FTSE SmallCap, FTSE Fledgling, and FTSE AIM). In the following sections, we detail datasets of turnover and appointment, centrality measures, and the other variables.

4.1 Turnover and appointment

As shown in Figure 1, our sample can be partitioned into six categories based on position status. Of the directors aged less than 65 (segments A, B, and C), 3682 leave the firm (segment C), 28991 directors maintain their current position in the company (segment A), and 2226 directors also stay in the firm but are promoted (segment B). The turnover variable is zero in A and B and equals one in C.⁶ We confine our main regression analysis to directors who are less than 65 years old because at this age or above, a change in position is likely to be motivated by retirement rather than exercising outside options or disciplinary dismissal.⁷ It is striking that a large percentage of directors, namely 15.7% ($(D+E)/(A+B+D+E)$) continue beyond the official retirement age.

[Insert Figure 1 about here]

Table 1 Panel A shows director turnover rates (based on $C/(A+B+C)$ of Figure 1) by type of position whereby we distinguish between CEOs, other executive directors, (non-executive) chairmen, and other non-executive directors. The yearly turnover rate of all directors below 65 amounts to 10.6%. Every year, 8.5% of the CEOs (below retirement age) leave their firm, and other executive directors are more likely to relinquish their position and depart (12.50%). The turnover rate of non-executive directors and chairman is around 10%. We also calculate annual turnover probability by year and find that the turnover rate is stable over the whole period (not shown).

Panel A also shows the probability of promotion. On average, 7.13% directors before

⁶ We cannot identify turnover in the last firm year in the sample; turnover value is set as missing in these cases.

⁷ In the UK, the state pension age and ordinary retirement age for men is 65 during the sample period. The retirement age for women was lower than 65 but gradually increasing to match that of men during the sample period).

the retirement age are promoted to a position within the company ($B/A+B$). Retirement-related turnover occurs for 15.13% of the director above the retirement age ($F/(D+E+F)$). In Panel B, we disclose the new director appointments to the board and distinguish between the percentages of internal or external appointments. Of all newly appointed CEOs and other executive directors, 42% and 50%, respectively, are external successors. More than 60% of the chairmen are internally promoted, which implies that either a non-executive director or an executive director (such as the CEO) takes up the position of (non-executive) chairman. The vast majority of new non-executive directors are external appointments (76%), which is explained by the independence requirement in the UK Corporate Governance Code (formerly known as the Combined Code).

[Insert Table 1 about here]

4.2 Director network centrality

The average director is directly connected to 11 directors (Table 4). The Closeness measure examines how close a director is to all other directors in the network. The normalized Closeness has a mean value of 0.073. In addition to the normalized and measures (which we will use in the regression analyses), we also calculate the Betweenness centrality measure, to quantify how often a director acts as an information broker on the geodesic path between other directors. As many directors never act as ‘bridges’ on the geodesic paths, the median Betweenness score is zero and the mean Betweenness is small. In company-level networks, each vertex now represents a company and the average company is connected with five other companies by means of common directorships.

[Insert Table 2 about here]

5.3 Director traits and company characteristics

As director traits may affect the degree of their labor market success, we include in our models: gender, age, tenure, and board position. Table 3 shows that merely 7% of the directors are female, and that the average CEO is around 55 years old and has a tenure in his company of seven years. Almost 60% of the board members are non-executive

directors. As the UK Code of Corporate Governance frowns on a CEO also serving as chairman of the board, CEO duality is rare (6%). The cumulative stake held by institutional investors is large (about 50% of the equity). Corporations and Families both hold on average about 10-11% of the equity. The median interest coverage amounts to 5.6 and the debt ratio is about 50%.

[Insert Table 3 about here]

5. EMPIRICAL ANALYSIS

5.1 Turnover

We report the results of models explaining the turnover of the CEO, other executive directors, non-executive directors, and all director turnover, respectively, in Table 4. Turnover is here defined as the director leaving the company; the determinants of promotions or departures related to retirement are investigated below in Table 6. As expected, poor firm performance (as measured by negative ROA) induces the replacement of the top management (CEO and other executives) but also non-executive directors. Degree, which captures one's ability of collecting local information as well as a director's influence, is not correlated to turnover. Closeness, which in contrast captures the benefits of indirect connections that proxy for the information collection ability throughout the global network, is positively related to turnover for each of the director categories (columns (2), (4), and (6)), which is in line with our hypotheses (H1a and H1b) that directors with better information collection ability are more likely to leave their position and firm. Let us take the CEO sub-sample regression (column (2)) as an example: The most well connected CEOs (top quartile) are 4% more likely to leave their companies than poorly connected ones. As the position of a director in the global network (Closeness) matters in this context whereas the local network (Degree) does not, we conclude that the indirect networks which capture (more distant) global information affects the top managerial labor market more than local information does. Renneboog and Zhao (2011) find that directors with multiple directorships possess stronger managerial power. In our context, the managerial power may protect managers from disciplinary turnover. However, we cannot support this alternative explanation because the parameter estimates

of Degree are not statistically significant in any of the models. We also test the relationship between centrality measures and turnover for the full sample after including the director positions (columns (7) and (8)) and confirm that the turnover likelihood increase with Closeness, whereas this is not the case with Degree. Models (7) and (8) also reveal that the CEO and chairman positions are more stable than those held by the executive and non-executive directors.

[Insert Table 4 about here]

As for the control variables, CEO gender does not influence the turnover likelihood in any model specification. The older the executives (including the CEOs), the larger are the odds that they leave their company (even when they have not reached the official retirement age). In contrast, the probability of non-executive director turnover decreases with age (models (5) and (6)). Committee membership lowers the turnover probability, which may be partly explained by the fact that more skilled directors (in the sense that they have accounting, audit, or financial expertise) are appointed to board committees which may shield them from dismissal, or that directors with larger responsibilities are more reluctant to move. The percentage of non-executive directors and CEO-chairman duality on the board do not affect the turnover probability of executive directors (including the CEOs). In larger companies, the CEO and other executive directors are more frequently replaced as these firms may have a larger internal pool of managers to recruit from and also have more resources to search for external talent. In highly levered firms, non-executive directors are more often replaced.

We conduct a number of robustness tests, the results of which we show in Tables 5 and 6. First, we investigate whether the relation documented in Table 4 between centrality measures and turnover varies across companies of different performance, sizes, and industries. We divide the sample into three performance terciles (see column (1) to (6) in Table 5) and reveal that the turnover decision is indeed not related to good performance because in Models (1) and (2) neither Degree nor Closeness are associated with turnover. Even if directors in the best performing companies may have many outside options, possibly even strengthened by their connections, they may be highly valued by the shareholders and retained by means of generous compensation. For the middle tercile, our

analysis generates results similar to those of Table 4 (columns (7) and (8)). In the lowest performance group (columns (5) and (6)), network connectedness are not related to the turnover likelihood which implies that turnover is here most likely to be disciplinary rather than voluntary. In this case, better access to job market information may play a less important role. We also run regressions with interaction terms between centrality and performance in order to analyze whether the turnover-performance sensitivity is systematically influenced by centrality, but the parameter estimates of those interaction terms are not statistically significant (not tabulated).

[Insert Table 5 about here]

In columns (7) to (10), we compare the relation between centrality and turnover for the largest UK companies (the members of the FTSE350 index) to that for the medium-size and small caps (including the fledglings) and find different results. For the largest firms, the direct centrality measure (capturing the local network) positively affects turnover (column (7)), whereas for the small firms, the indirect network of directors (proxied by Closeness) leads to higher departure probability. One explanation is that directors in the largest companies are connected with other well-connected directors, thanks to the large board size and their work experience. In such cases, strong local connectedness may be equivalent to strong global connectedness. In contrast, a director of a small company has a more limited number of connections to possibly less well-connected other directors. For these directors in smaller companies, connecting to the right individuals is more important than increasing the number of local connections. In other words, from a small-company director's perspective, a non-executive position in a FTSE100 company can be more valuable than a chairmanship in a FTSE fledgling company, as the former can provide more information on labor market opportunities. Therefore, in the subsample of small companies, we observe a more significant effect for Closeness centrality rather than for Degree centrality. Finally, we report the results for financial firms separately in columns (11) and (12) and conclude, as before, that Closeness is positively related to director turnover.

In the turnover analysis presented above, we focused on turnover cases in which

directors leave the company. However, in promotion and retention cases, directors who leave their positions do not depart from the company. For instance a CEO could leave the daily management and become (non-executive) chairman, or a CFO may succeed his CEO. We label these cases as promotions and investigate whether director networks are related to this type of turnover in columns (1) and (2) of Table 6. We find that strong direct connections (proxied by Degree) are positively and significantly associated with promotions, which is also the case for the indirect connections (Closeness) albeit to a somewhat lesser extent. Further sub-sample analysis reveals that such relationships are stronger for the non-executive directors (not tabulated). These findings imply that in order to be promoted, one needs strong direct connections which may proxy for influence or power, and that a global information advantage (indirect connections) is of limited use in this context.

[Insert Table 6 about here]

While in our baseline analysis (Table 4), we employed a ‘non-retirement’ turnover sample, in Table 6 (columns (3) and (4)) we perform a placebo test: we study the sample of retirement turnover, which comprises the directors of 65 and older for whom we expect connections not to matter anymore. Indeed, the relation between turnover and centrality measures disappears for people whom we expect to leave their firms for reasons of retirement. In section 3.1, we had introduced Betweenness as an alternative measure of Closeness centrality: directors who often act as bridges between otherwise separated groups in the networks score high in terms of Betweenness. In column (5) of Table 6, we find that Betweenness increases the turnover likelihood, which confirms that directors have more labor market opportunities thanks to their advantageous positions in the network and is in line with our earlier findings based on Closeness centrality.

While all of our above network analysis is based on individual level networks, we can also examine networks at the company level, whereby companies are the vertices and the connections between firms are based on the collective relations of the firm’s directors. When a company’s network is strong, better access to information may enable a company to detect a good successor more easily. Therefore, we expect a higher turnover probability

when the company's centrality measures are larger. As shown in Table 6 (columns (6) and (7)), both the company's Degree and Closeness measures are indeed significantly and positively associated with the turnover probability of executive and non-executive directors. This result is consistent with our expectation that strong company level networks are associated with higher director turnover.

5.2 Appointment

We now turn to modelling the appointment choice between an external or internal successor to a departing director. In the results disclosed in Table 7, we find that good corporate performance decreases the probability that an external director (CEO, executive, chairman, and non-executive director) is hired (column (1) to (8)). As there is no performance problem, there is then a less pressing need to find external help, and in cases where the incumbent management and non-executive team is deemed responsible for the good performance, a successor to a departing director is sought from within the firm's own ranks. The global information collection ability (Closeness) of an external candidate for the positions of chairman and non-executive director has a significantly positive impact on the probability to be hired (columns (6) and (8) of Table 7), which supports hypothesis H2a. This result is similar to the findings for CEOs in the studies by Barnea and Guedj (2009) and Nguyen (2011). Local information collection ability (the direct connections to the hiring company) significantly augments the chances of an external candidate applying for the chairman position.⁸ On the other hand, global information seems more valuable than local information in the context of external appointments of non-executive directors.

We also show in Table 7 that external appointments go less frequently to older directors. External chairmen are more likely to be male, whereas external non-executives are more likely to be female. Furthermore, we find that companies with a higher proportion of non-executive directors on the board hire external executives more often, possibly because non-executive directors provide valuable information on potential

⁸ In column (5) With one standard deviation increase in the degree centrality measure, the probability of hiring Chairman from outside increases by 11%.

candidates from outside. When corporations are the main shareholder, CEOs and non-executive directors are more frequently hired externally (columns (1), (2), (7) and (8)).

In Table 8, we show the relationship between the external/internal appointment choice and the company's centrality measures ((C) Degree and (C) Closeness). High centrality measures at the company level increase the probability that the chairman and other non-executive directors are external hires, which supports hypothesis H2b. The likelihood that an external candidate is to take an executive position (CEO or other executive director) is not related to the company's centrality measures. These findings suggest that the decision processes about managerial and non-executive director appointments may be quite different. The decision on how to fill executive vacancies may depend more on a performance track record, the corporate strategy, or specific required skills, whereas non-executive directors are selected for their experience, which is reflected in their information-gathering ability.

[Insert Tables 7 & 8 about here]

In our robustness analyses based on different corporate performance and size quantiles, our original findings hold regarding the impact of centrality on the external/internal appointment decision (not tabulated). Moreover, in order to address the concern that a newly appointed director's network also includes the connection with the hiring company, we retest the models presented in Table 7 with the newly appointed director's centrality scores measured in year prior to the hiring such that we only examine the possible network advantage prior to the appointment. This approach reduces the sample size somewhat, but we reach the same conclusion as in Table 7 (not tabulated).

6. CONCLUSION

We examine the role of director networks in the top segment of the labor market, namely that of executive and non-executive directors, by studying the relation between directors' centrality measures, and turnover and appointment decisions. We study these decisions for all members on the board: the CEO, non-CEO executive directors, and chairman and non-chairman non-executive directors. We focus mainly on turnover events

in which directors leave the current company (e.g. following poor performance or to pursue better outside options) and also investigate the change of director positions within the company (internal promotions). In our appointment analysis, we examine the firm's decision to hire internal or external candidates. The latter type may have a disadvantage in terms of asymmetric information, which may be mitigated by the value of their information-gathering ability derived from their networks.

Our results support our information value hypothesis which states that connections captured by the directors' professional networks have a significant impact on the turnover and appointment of top management and non-executive directors. We use two types of centrality measures, Closeness and Degree, to capture a director's network advantage in the global (or network-wide) and local (or direct) environments, respectively. We find that executive and non-executive directors with superior indirect connections (measured by Closeness) are able to collect more information about the labor market, spot outside opportunities, and thus leave their firms more frequently. We do not observe a similar effect for the direct centrality measure (Degree) on turnover. Nevertheless, we find that directors with a higher direct centrality measure (Degree) are more likely to change positions (e.g., a promotion) within the company. Turning to the appointment analysis, we find that the direct (or local) connectedness of candidates does not affect the likelihood of external or internal appointment (with exception of that of the chairman). Appointments of external non-executive directors or chairmen are more likely when they have higher indirect centralities.

We conclude that director networks serve different functions. Generally speaking, directors' indirect connections provide access to global information, which enables directors to detect external labor market opportunities more easily. Direct connections strengthen a director's access to local information and enhance his power in adjacent companies, which increases the likelihood of internal promotion and retention. Our results on company-level networks suggest that connections to other companies increase the likelihood of attracting more non-executive directors from outside the company, which extends the company's network further. In contrast, a board with poorly connected directors usually refuses outside candidates, which may result in group-thinking, more

conservative corporate strategies, and lack of information. To sum up, regulators and companies should consider a director's network strength when hiring and retaining directors, as connections affect a director's mobility, independence, and contribution to corporate value.

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Figure 1. Position Status

This figure partitions the director-years into six categories based on position status (no position change, promotion, and turnover) and age (below versus 65 and above). “No position change” (areas A and D) include directors that have remained in the same position in the same company. “Promotion” (area B and E) includes directors that have changed positions within the company in the most recent year. “Turnover” (area C and F) includes directors that have left the company.

	No position changes	Promotion	Turnover
Age < 65	A (28,991)	B (2,226)	C (3,682)
Age ≥ 65	D (5,495)	E (335)	F (1,039)

Total number of observations: 41768

Table 1. Turnover and Appointment of CEOs, Executive Directors, Chairmen, and Non-Executive Directors

Panel A. Turnover

This panel reports the turnover rates, promotion rates, retirement rates by position.

Director position	Turnover Figure 1: $C/(A+B+C)$	Promotion Figure 1: $B/(A+B)$	Retirement Figure 1: $F/(D+E+F)$
All	10.55%	7.13%	15.13%
CEOs	8.46%	5.31%	10.91%
Executive directors (excluding CEOs)	12.50%	8.76%	10.85%
Executive directors (including CEOs)	11.38%		
Chairmen	10.09%	6.23%	14.73%
Non-executive directors (excluding chairmen)	9.80%	6.68%	16.18%
Non-executive directors (including chairmen)	9.86%		

Panel B. Appointments

This panel reports the number of newly appointed and percentage of external appointments (relative to all appointments) by (new) director position.

Director position	Number of Appointments	Percentage of external appointments
All	7,397	61.02%
CEOs	839	41.48%
Executive directors (excluding CEOs)	2,061	49.59%
Executive directors (including CEOs)	2,813	48.03%
Chairmen	1,235	39.19%
Non-executive directors (excluding chairmen)	3,623	76.21%
Non-executive directors (including chairmen)	4,584	69.00%

Table 2. Director and Company Network Centrality

This table reports the mean, median, and standard deviation of centrality measures Degree, Closeness and Betweenness. (raw) refers to the raw data, not scaled by network size, whereas the variables without the indication (raw) are scaled. (C) stands for centrality measure at the company level (whereby the company connections are based on directors sitting on multiple boards), and the variables without (C) are calculated at the individual director level.

Centrality measures	Mean	Median	Stand. Dev.
Degree (raw)	11.221	9	7.624
Degree	0.001	0.001	0.001
Closeness	0.073	0.079	0.017
Betweenness	0.001	0	0.002
(C) Degree (raw)	5.098	5	3.395
(C) Degree	0.002	0.002	0.002
(C) Closeness	0.076	0.082	0.018

Table 3. Director and Company Characteristics

This table reports the descriptive statistics of the control variables. Return on assets (ROA) is the operating income divided by the book value of total assets. Market to Book Ratio is the market value divided by the book value of total assets. Male equals one if the director is male and zero otherwise. A director's Age is in years. Tenure is the number of years a director has served in the current company regardless of his position. Committee membership is a dummy variable that equals to one if the director is a member of any of the following committees: remuneration, audit, or nomination committee, and equals zero otherwise. % Non-executive is the proportion of non-executive directors on the board. Duality equals one if the CEO is also the chairman of the board, and is zero otherwise. The four ownership categories comprise the cumulative ownership (>3% each) held by institutions, companies, family and individuals, and other types of owners. Interest coverage is the EBIT divided by the interest payment. The debt ratio is the total debt divided by total assets. Ln(total assets) is the logarithm of the total assets.

Variables	Mean	Median	Stand. Dev.
Firm Performance			
ROA (%)	1.080	4.925	20.208
Market to Book Ratio	2.269	1.42	3.817
Director Characteristics			
Male (dummy=1 if male)	0.927	1	0.259
Age (years)	55.469	56	9.086
Tenure (years)	7.158	4.9	7.413
Committee Membership	0.609	1	0.488
Board Characteristics			
% Non-executive (%)	0.594	0.571	0.197
Duality	0.062	0	0.242
Ownership concentration			
Ownership: Institution (%)	0.502	0.486	0.333
Ownership: Company (%)	0.105	0.037	0.172
Ownership: Family (%)	0.098	0.002	0.179
Ownership: Other (%)	0.009	0	0.041
Financial characteristics			
Interest Coverage	21.459	5.643	84.650
Debt ratio (%)	58.205	50.551	472.041
Ln (total assets)	19.175	19.064	2.548

Table 4. Director Turnover

This table presents the Random effects Probit regression of director turnover. The dependent variable is the turnover (=1 for turnover, 0 otherwise) of directors in different positions (CEO, executive, non-executive and all directors) before the age of 65. Centrality measures and control variables are defined in Section 3, 5 and in appendix. Industry and year fixed effects are controlled. Standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

	CEO		Executive		Non-executive		All directors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ROA	-0.008*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)	-0.007*** (0.001)
Degree	39.774 (44.460)		48.235 (38.412)		4.916 (18.265)		21.438 (15.721)	
Closeness		3.745** (1.866)		3.850*** (1.318)		2.616** (1.146)		3.277*** (0.856)
Director characteristics								
CEO							-0.257*** (0.031)	-0.260*** (0.031)
Chairman							-0.120*** (0.030)	-0.117*** (0.030)
Non-CEO Executives							-0.027 (0.030)	-0.031 (0.030)
Male	0.100 (0.146)	0.099 (0.146)	-0.063 (0.067)	-0.062 (0.067)	0.013 (0.045)	0.015 (0.045)	0.010 (0.036)	0.010 (0.036)
Age	0.016*** (0.004)	0.016*** (0.004)	0.016*** (0.003)	0.016*** (0.003)	-0.005** (0.002)	-0.005** (0.002)	0.007*** (0.002)	0.007*** (0.002)
Tenure	-0.013*** (0.003)	-0.012*** (0.003)	-0.002 (0.002)	-0.002 (0.002)	0.033*** (0.003)	0.033*** (0.003)	0.012*** (0.002)	0.012*** (0.002)
Committee Membership	-0.118** (0.054)	-0.127** (0.054)	-0.306*** (0.064)	-0.301*** (0.064)	-0.290*** (0.041)	-0.296*** (0.041)	-0.248*** (0.028)	-0.249*** (0.028)
Board characteristics								
% Non-executive	0.125 (0.151)	0.069 (0.155)	-0.076 (0.142)	-0.138 (0.144)	-0.180* (0.097)	-0.218** (0.098)	-0.043 (0.076)	-0.093 (0.077)
Duality	0.034 (0.108)	0.047 (0.108)	-0.027 (0.070)	-0.018 (0.070)	-0.140** (0.070)	-0.134* (0.071)	-0.064 (0.050)	-0.058 (0.050)
Ownership concentration								
Ownership: Institution	0.001 (0.081)	-0.024 (0.083)	-0.023 (0.061)	-0.050 (0.061)	0.046 (0.049)	0.030 (0.049)	0.015 (0.038)	-0.002 (0.038)
Ownership: Company	0.092 (0.157)	0.107 (0.157)	0.049 (0.107)	0.061 (0.107)	0.170* (0.091)	0.177* (0.091)	0.157** (0.070)	0.166** (0.070)
Ownership: Family	0.036 (0.147)	0.052 (0.147)	-0.047 (0.097)	-0.037 (0.097)	-0.039 (0.091)	-0.030 (0.092)	-0.030 (0.065)	-0.019 (0.065)
Ownership: Other	1.222** (0.490)	1.212** (0.494)	0.542 (0.398)	0.505 (0.400)	0.110 (0.349)	0.112 (0.349)	0.392 (0.253)	0.379 (0.253)
Financial characteristics								
EBIT to interest ratio	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Debt ratio	0.021 (0.018)	0.021 (0.018)	0.012 (0.014)	0.012 (0.014)	0.025** (0.012)	0.026** (0.012)	0.025*** (0.009)	0.026*** (0.009)
Ln (total assets)	0.033** (0.014)	0.027* (0.014)	0.024** (0.011)	0.018* (0.011)	0.008 (0.008)	0.001 (0.009)	0.010 (0.007)	0.003 (0.007)
Constant	-2.903*** (0.366)	-3.017*** (0.362)	-2.477*** (0.245)	-2.570*** (0.243)	-1.072*** (0.209)	-1.110*** (0.208)	-1.791*** (0.169)	-1.855*** (0.169)
N	5735	5735	15841	15841	19058	19058	34899	34899
Pseudo R ²	0.699	0.700	0.703	0.703	0.681	0.681	0.689	0.689

Table 5. Robustness Analysis: Performance, Firm Size and Financial Firms

This table presents the Random effects Probit regression of director turnover in different sub-samples. The dependent variable is the turnover (=1 for turnover, 0 otherwise) of all directors before 65. Centrality measures and control variables are defined in Section 3, 5 and in appendix. Industry and year fixed effects are controlled. Standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

	Dependent variable = 1: Director turnover											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ROA Top 33%		ROA Middle 33%		ROA Bottom 33%		FTSE350		Non-FTSE350		Financial firms	
ROA	-0.000 (0.003)	-0.000 (0.003)	-0.034*** (0.009)	-0.038*** (0.009)	-0.005*** (0.001)	-0.005*** (0.001)	-0.010*** (0.003)	-0.010*** (0.003)	-0.008*** (0.001)	-0.008*** (0.001)	-0.009*** (0.002)	-0.009*** (0.002)
Degree	10.386 (25.068)		57.263** (24.377)		-16.512 (28.440)		94.419* (50.182)		25.437 (36.267)		46.958 (64.982)	
Closeness		1.852 (1.317)		6.989*** (1.314)		0.789 (1.189)		4.688 (3.787)		4.379*** (1.116)		5.299** (2.576)
Director characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership concentration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	13611	13611	12426	12426	8862	8862	4940	4940	10901	10901	2910	2910
Pseudo <i>R</i> ²	0.738	0.738	0.587	0.588	0.713	0.713	0.520	0.520	0.740	0.740	0.679	0.679

Table 6. Robustness Analysis: Internal Turnover, Retirement Turnover, and Alternative Centrality Measures

This table presents the Random effects Probit regression of director turnover with alternative variable specifications. In column (1) and (2), the dependent variable is promotion (=1 for promotion and 0 otherwise) for directors before 65. In column (3) and (4), the dependent variable is retirement (=1 for retirement and 0 otherwise) for directors at or beyond 65. In column (5) - (7), the dependent variable is turnover (=1 for turnover and 0 otherwise) for all directors before 65. Centrality measures and control variables are defined in Section 3, 5 and in appendix. Industry and year fixed effects are controlled. Standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

Dependent variable = 1: Director promotion, retirement and turnover							
Sample:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Promotion		Placebo test on Retirement		Turnover		
ROA	-0.002*** (0.001)	-0.002*** (0.001)	-0.007* (0.004)	-0.007* (0.004)	-0.009*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)
Degree	42.856** (17.256)		20.988 (157.507)				
Closeness		1.639* (0.840)		4.787 (5.123)			
Betweenness					44.243*** (23.689)		
(C) Degree						38.070*** (12.941)	
(C) Closeness							3.456*** (1.148)
Director characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership structure	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	31217	31217	754	754	7424	7424	2611
Pseudo <i>R</i> ²	0.666	0.666	0.678	0.677	0.527	0.690	0.690

Table 7. External/Internal Appointment Choice and the Candidate's Connections

This table presents the Random effects Probit regression of external appointment. The dependent variable is external appointment (=1 for external turnover, 0 otherwise) of directors in different positions (CEO, executive, Chairman and non-executive). Centrality measures and control variables are defined in Section 3, 5 and in the appendix. Industry and year fixed effects are included. Standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

	CEO		Executive		Chairman		Non-executive	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ROA	-0.004*	-0.004*	-0.003*	-0.003*	-0.006***	-0.006***	-0.003**	-0.003**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Degree	43.871		8.818		310.591***		6.677	
	(98.510)		(73.193)		(54.841)		(27.562)	
Closeness		-2.066		0.248		10.709***		3.444**
		(3.882)		(2.274)		(3.067)		(1.553)
Director characteristics								
Male	-0.088	-0.092	0.065	0.066	0.573**	0.471*	-0.383***	-0.378***
	(0.260)	(0.259)	(0.115)	(0.115)	(0.276)	(0.272)	(0.076)	(0.076)
Age	-0.024***	-0.024***	-0.024***	-0.024***	-0.009	-0.008	-0.043***	-0.043***
	(0.007)	(0.007)	(0.004)	(0.004)	(0.006)	(0.006)	(0.003)	(0.003)
Board characteristics								
% Non-executive	0.759**	0.794**	1.346***	1.343***	0.051	-0.013	-0.291**	-0.339***
	(0.325)	(0.327)	(0.228)	(0.230)	(0.259)	(0.263)	(0.124)	(0.126)
Duality	-0.100	-0.104	0.103	0.104	-0.344**	-0.355**	-0.130	-0.120
	(0.187)	(0.187)	(0.111)	(0.112)	(0.164)	(0.165)	(0.094)	(0.094)
Ownership concentration								
Ownership: Institution	0.099	0.111	-0.116	-0.117	-0.141	-0.147	-0.151**	-0.177**
	(0.176)	(0.178)	(0.108)	(0.110)	(0.142)	(0.144)	(0.069)	(0.070)
Ownership: Company	1.312***	1.311***	0.004	0.005	0.131	0.194	0.305**	0.307**
	(0.343)	(0.342)	(0.204)	(0.204)	(0.258)	(0.259)	(0.134)	(0.134)
Ownership: Family	0.123	0.105	-0.219	-0.218	-0.160	-0.170	-0.108	-0.085
	(0.291)	(0.292)	(0.175)	(0.175)	(0.233)	(0.237)	(0.122)	(0.122)
Ownership: Other	0.389	0.316	0.525	0.524	-0.083	0.030	0.443	0.422
	(1.331)	(1.331)	(0.829)	(0.829)	(1.076)	(1.079)	(0.549)	(0.548)
Financial characteristics								
EBIT to interest ratio	-0.000***	-0.000***	0.000	0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt ratio	0.052	0.051	0.004	0.004	-0.019	-0.020	-0.016	-0.016
	(0.041)	(0.041)	(0.026)	(0.026)	(0.031)	(0.031)	(0.016)	(0.016)
Ln (total assets)	-0.023	-0.011	-0.094***	-0.094***	-0.026	-0.016	0.063***	0.055***
	(0.030)	(0.030)	(0.019)	(0.018)	(0.022)	(0.023)	(0.011)	(0.011)
Constant	0.867	0.825	2.103***	2.091***	-0.346	-0.789	2.165***	2.086***
	(0.720)	(0.705)	(0.424)	(0.418)	(0.583)	(0.587)	(0.270)	(0.270)
N	839	839	2061	2061	1235	1235	4584	4584
Pseudo R ²	0.724	0.724	0.709	0.709	0.694	0.689	0.687	0.688

Table 8. External/Internal Appointment Choice with Company-Level Director Networks

This table presents the Random effects Probit regression of external appointment. The dependent variable is external appointment (=1 for external appointment, 0 otherwise) of directors in different positions (CEO, executive, Chairman and non-executive). Company level centrality measures and control variables are defined in Section 3, 5 and in appendix. Industry and year fixed effects are controlled. Standard errors are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

	CEO		Executive		Chairman		Non-executive	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ROA	-0.004*	-0.004*	-0.003*	-0.003*	-0.005***	-0.006***	-0.002**	-0.003**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
(C) Degree	5.507		23.423		193.692***		46.463***	
	(42.095)		(26.178)		(34.006)		(14.825)	
(C) Closeness		-2.091		0.219		9.608***		3.515**
		(3.738)		(2.163)		(3.044)		(1.533)
Director characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership structure	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	839	839	2061	2061	1235	1235	4584	4584
Pseudo <i>R</i> ²	0.723	0.724	0.709	0.709	0.693	0.689	0.687	0.687

Appendix 1: Centrality Measures

To quantify a director's connectedness, we apply various graph-theoretical measures to capture the centrality of each director in the network. Essential in the analysis of a network based on professional relations (such as directorships) is that the database of relations/connections is comprehensive. This implies that a convincing director network analysis is only possible for countries with many listed firms, because in countries where the vast majority of large firms are non-listed, the network analysis is very incomplete due to the lack of disclosure. For instance, it may be that two listed firms may be connected via directorships in a non-listed firm, but such connections and hence the indirect link between the listed firms may not be picked up because of a lack of transparency. Consequently, the low network integrity (in the sense of exhaustively trying to capture all possible links) in some countries yields lower levels of measured indirect connectivity than exist in reality, and this has severe repercussions on how potential information flows can be captured. The fact that we focus on the UK, a market-based country with more listed firms than any other European country, and that we use panel data with all firms (from the FTSE100 to the Fledglings) entails that our network graph is more complete than a similar analysis on e.g. Germany or France. Furthermore, while some papers confine their network to studying only CEOs' and executive directors' connections, we consider all board members from two perspectives (that of the individual director and that of the firm).

Before we describe the centrality measures, we define some core notions: a vertex is the fundamental unit of which graphs are formed and this vertex can be either a director or a company. In the context of director-level networks, the vertices are directors who are connected with the directors of the board (or of all the boards) they serve on. At the firm level, the vertices are firms which are linked by means of interlocked directors. The shortest path between two vertices is called a geodesic path and the smallest number of links between any two vertices in a network is called the geodesic distance.

The *Degree* centrality of a vertex is calculated by summing the number of links of a vertex. The *Closeness* of a vertex is defined as the sum of geodesic distances between this vertex and all other vertices that can be reached. We define Closeness centrality of vertex v ($C_c(v)$) as one divided by the sum of the lengths of the geodesic paths (d_G) from v to any other vertex t :

$$C_c(v) = \frac{1}{\sum d_G(v, t)}$$

The *Betweenness* of vertex v ($C_B(v)$) is defined as the sum of its Betweenness ratios,

whereby such a ratio is equal to the number of geodesic paths from vertex s to vertex t passing through vertex v , divided by the sum of all the geodesic paths from s to t . Betweenness centrality,

which is the sum of all Betweenness ratios, is calculated as follows: $C_B(v) = \sum_{s \neq v \neq t \in V} \frac{\sigma_{st}(v)}{\sigma_{st}}$

where the denominator is the number of the geodesic paths from vertex s to vertex t , and the numerator is the number of geodesic paths from s to t through vertex v . Vertices with a higher Betweenness are more likely to act as information brokers between otherwise separated groups.

To sum up, we use Degree, Closeness, and Betweenness as measures to evaluate the network centrality in our graph. Degree focuses more on the *direct connections* to adjacent vertices as directors of high Degree may have better access to *local information*. Furthermore, strong direct connections may grant managerial power to directors (Renneboog and Zhao, 2011). Closeness and Betweenness evaluate a vertex's position by means of *indirect connections* to all reachable vertices in the entire network. This method entails that directors with high Closeness and Betweenness may collect *global information* (from firms and directors they are not in direct contact with) more efficiently. Finally, Betweenness captures the potential advantage of exerting a brokering position in the network. Although both Betweenness and Closeness are based on indirect connections and consider all reachable vertices, they still measure different aspects of information gathering as their correlation is only 0.295.

Appendix 2: Variable Definition

Variables	Definition	Source
Position change		
Turnover	Equals 1 if the director leaves the company next year	BoardEX
Promotion	Equals 1 if the director changes to a different position within the company next year	BoardEX
Retirement	Equals 1 if the director (older than 65) leaves the company next year	BoardEX
Centrality measures		
Degree	See section 3 for detailed definition	Self-calculated
Closeness	See section 3 for detailed definition	Self-calculated
Betweenness	See section 3 for detailed definition	Self-calculated
(C) Degree	See section 3 for detailed definition	Self-calculated
(C) Closeness	See section 3 for detailed definition	Self-calculated
Firm Performance		
ROA (%)	Operating income divided by the book value of total assets	Datastream
Market to Book Ratio	The market value of assets divided by the book value of assets	Datastream
Director Characteristics		
Male	Equals 1 if the director is male	BoardEX
Age	Director age in years	BoardEX
Tenure	Director tenure in company in years	BoardEX
Committee Membership	Equals 1 if the director is a member of any committees on board	BoardEX
Board Characteristics		
% Non-executive (%)	Percentage of non-executive directors on the board	BoardEX
Duality	Equals 1 if the CEO is also the chairman of the board	BoardEX
Ownership concentration		
Ownership: Institution (%)	Percentage of shares owned by financial institutions	Self-collected
Ownership: Company (%)	Percentage of shares owned by other companies	Self-collected
Ownership: Family (%)	Percentage of shares owned by family owners	Self-collected
Ownership: Other (%)	Percentage of shares owned by other investors	Self-collected
Financial characteristics		
Interest Coverage (%)	EBIT divided by total interest expense	Datastream
Debt ratio (%)	Total liabilities divided by total assets	Datastream
Ln (total assets)	Logarithm of book value of total assets	Datastream

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