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The UK’s Director Daisy Chain: Empirical Evidence of the Interconnectivity of Directors of UK Publicly Traded Companies

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Abstract

Independent non-executive directors (iNEDs) play a key role in UK corporate governance. This empirical, interdisciplinary study explores how interconnected directors of UK companies listed on the London Stock Exchange are. This is the first article to deploy graph theory tools to the directors of all 767 UK companies listed on the LSE’s main market. We find that 550 of these companies are linked by one large daisy chain that arises as a result of the deployment of iNEDs. However, this network is sparse rather than dense – meaning that there are approximately 6 directorships needed to link any two directors together. This helps clarify the role that iNEDs can play in corporate governance – they can help combat managerial opportunism and excesses that are unique to a company. However, they are inherently linked within the same structural system, and therefore are less likely to be able to push the boundaries of conventional wisdom within corporate governance. Thus, an iNED can protect shareholders against agency costs between shareholders and directors, but only insofar as those costs are out of step with wider practice across the corporate governance of listed companies.

Keywords: Independent Directors; Company Law; Corporate Law; Empirical Study; Director Network

1. Introduction

Independent non-executive directors (iNEDs) are a key part of global corporate governance frameworks. They have a long history in the UK1 and have spurred a large amount of literature as to their importance.2 INEDs are not seen as providing universal (or, at least, uniform) benefit - the suitability of a legal system mandating iNEDs may vary depending on a number of

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factors. INEDs are also a frequent area of analysis for economists. However, it is acknowledged that the specifics of the regime governing INEDs are flawed. This paper provides empirical evidence in respect of certain of those flaws. In particular, it explores the degree of connectivity of directors of all UK companies whose shares are listed on the Main Market of the London Stock Exchange. We apply methods from graph theory to explore connections between directors via the companies they are appointed to. In turn, UK companies themselves are connected via individuals who hold multiple directorships simultaneously. The overall fragmentation of this network contains insights into the systemic overlap across UK listed companies, and network density statistics can be used to quantify the proximity of any two directors and therefore if any two directors seem to be linked.

Empirical studies into directors abound. First, empirical studies have tried to link efficacy of boards of directors to whether directors are independent or not. These studies tend to be inconclusive. Gutiérrez & Saez\(^6\) identify that some empirical studies show board independence increases the financial performance of the firm. Sometimes this is worded as a stark proposition that having an independent board is beneficial. They also identify that some empirical studies show that INEDs decrease firm performance. Finally, they identify some have shown no difference. UK empirical studies tend to emphasise this last option. Empirical work has also been undertaken into directors themselves: primarily to see how connected they are to each other. This paper develops this approach by examining UK director networks. Existing empirical research into director networks tends to focus on specific aspects of such networks. Thus empirical studies have examined the correlation between

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\(^5\) Gutiérrez & Saez, n. 3 above, 66.


director networks and executive turnover,\textsuperscript{13} correlations between director networks and takeovers,\textsuperscript{14} and the interaction between director networks and executive pay.\textsuperscript{15} Analysis has been undertaken on why networks are created,\textsuperscript{16} but tends to proceed on the basis of smaller case studies.\textsuperscript{17}

The novelty in this paper is that it uses new empirical techniques to map the director networks of all UK companies whose shares are listed on the Main Market of the London Stock Exchange to establish an holistic view of the directors’ network for UK Main Market listed companies. By analysing the full network of all such directors, we ensure that the entire picture is seen and nothing is accidentally missed. Whilst some empirical literature has found that strong director networks can improve decision making,\textsuperscript{18} it has been said that “it is clear that the regulatory authorities consider director networks potentially harmful... to the independence of non-executive directors”.\textsuperscript{19} The concern, then, is that director networks mean that an ostensibly independent director judges matters within a company by reference to what is seen as acceptable within that network rather than in objective isolation. Indeed, interlocking directorates can trigger certain competition law concerns,\textsuperscript{20} further adding to the concern that director networks may encourage collusive behavior. Certainly, even if networks of directors could be considered beneficial, there are evident dangers if this network expands to the majority of companies – the risk that endemic issues across the market are not identified as the external, independent voice tasked with challenging them has seen, and accepted, the same issue elsewhere. In other words, if all listed companies are interconnected by a director network, there is a risk that decisions which are also taken elsewhere are accepted, even if they should objectively be challenged.

The aim of this paper is therefore to explore this issue: can empirical, quantitative analysis of the UK’s corporate registry reveal connections between companies caused by directors, and

\begin{itemize}
  \item Luc Renneboog and Yang Zhao, \textit{Director Networks and Takeovers} 28 \textit{The Journal of Corporate Finance} 218 (2014); Gerald F. Davies, \textit{Agents without Principles? The Spread of the Poison Pill through the Intercorpore Network} 36 \textit{Administrative Science Quarterly} 583 (1991); Donald Palmer, Brad M. Barber, Xueguang Zhou & Yasemin Soysal, \textit{The Friendly and Predatory Acquisition of Large U.S. Corporations in the 1960s: The Other Contested Terrain} 60 \textit{American Sociological Review} 469 (1995).
  \item For example tech companies – Yin M. Myint, Shailendra Vyakarnam & Mary J. New, \textit{The Effect of Social Capital in New Venture Creation: the Cambridge High-Technology Cluster} 14 \textit{Strategic Change} 165 (2005); or supermarket trading techniques – Gareth Shaw & Andrew Alexander, \textit{Interlocking Directorates and the Knowledge Transfer in Supermarket Retail Techniques from North America to Britain} 16 \textit{The International Review of Retail, Distribution and Consumer Research} 375 (2006); Renneboog & Zhao, 2013, n. 12 above, 206.
  \item Renneboog & Zhao, 2013, n. 12 above, 203.
  \item Florence Thépot, \textit{The Interaction between Competition Law and Corporate Governance}, Ch 5 (Cambridge: Cambridge University Press, 2019).
\end{itemize}
(if so), how strong are these connections? The answers to these questions are greatly significant for the deployment of iNEDs within corporate governance. In particular, they will help us identify limitations on what can be achieved by utilising iNEDs.

Our first challenge was to access this data. Sources of data for director networks vary. Some papers concentrate on specific known clusters of companies, whereas some use specialist providers of data on directors. Our dataset takes a different approach, and includes all UK companies listed on the Main Market of the London Stock Exchange as at a specific time. We do this by taking the details of these companies from the London Stock Exchange, and cross referencing these companies to the information filed at the UK’s company registry, Companies House. The documents uploaded to Companies House are now free to download. In addition, Companies House now publishes regular data as to the content of the corporate register.

A number of studies try to capture networks between former directors as well as current directors, but we are less concerned with mapping past networks and more with capturing a snapshot of the network as at a specific date to see how interconnected the market of current directors is. The outcome is clear: current iNEDs cause 550 of the 767 UK companies to be linked into a giant daisy chain. The nature of the chain, though, is not dense.

The UK adopts a “one tier” approach to company boards, without any company law requirements as to appointment of iNEDs. Company law is supplemented where relevant, though, by capital market rules which require such appointments. There are two potential regimes that are applicable to the companies within our study. First, the UK Corporate Governance Code applies to those companies whose shares are listed on the premium segment of the Main Market. Second, companies which are closed ended investment companies and who are members of the Association of Investment Companies (AIC) can choose to apply the AIC’s own corporate governance code. Both codes provide that whether a director is deemed to be an iNED or not is a matter for the board of directors, and provide an indicative non-exhaustive list of criteria that boards may think preclude independence – although in each case directors can consider one of their number to be an iNED even if these criteria are present, and can deem a director without those characteristics to be non-independent. This subjective focus makes it very difficult, then, for boards to breach these terms - which is further exacerbated as this weak regime operates on a “comply or explain” basis.

21 Like Shaw & Alexander, n. 17 above; Myint, Vyakarnam & New, n. 17 above.
24 See https://www.gov.uk/government/organisations/companies-house/about/statistics.
29 Andrew Keay, Comply or Explain in Corporate Governance Codes: In Need of Greater Regulator Oversight? 34 Legal Studies 279 (2014); Eddy Wymeersch, The Enforcement of Corporate Governance Code, 6 Journal of
The indicative and non-exhaustive list of criteria that preclude independence overlap greatly between our two codes. For example, both codes provide that a director should not be considered to be an iNED if they have served in such capacity for more than 9 years. Similarly, both codes provide that two directors in cross directorships are generally precluded from being treated as both iNEDs (if A is an executive director of company 1, and B is an executive director of company 2, they should not act as iNEDs for each other). This clearly attempts to limit an iNED’s independence being compromised by professional appointments which are external to the company: a limit on highly dense director networks producing iNEDs. Indeed, there are regular accusations that board actions frequently take place as a result of cronyism, based on personal relationships. If companies were complying with this prohibition on cross-directorships in the most formalistic manner possible, but attempting to still take advantage of the private benefits of cronyism by sailing as close to these rules as possible, we would expect to see a number of small chains in which we add in a third company (company 3), with executive director C, and A acting as an iNED for company 2, B acting as an iNED for company 3, and C acting as an iNED for company 1. In graph theory terms, this would be a dense network. It would appear to be evidence of a form of such cronyism, as it would hint that directors were actively looking to prevent a cross-directorship (which would be an indicative non-exclusive criterion that boards may consider to preclude independence), but still be as closely linked to each other as possible. Our data reveals that the UK listed company director network is actually quite sparse: there is no significant evidence of such cronyism, with pairs of directors usually linked via a very circuitous route through a chain of six (median value) intermediate companies.

To an extent, this daisy chain is intuitive. When searching for an independent director, a board is likely to look to the most qualified candidate. It would be logical that a key factor in such qualification is experience of being a director. A previous empirical study into iNEDs highlighted that 92 per cent. of iNEDs were, or had been, executive directors elsewhere. Our analysis reveals that the vast majority of companies are linked by iNEDs. As such, existing iNED rules in the UK may help overcome opportunism by a rogue manager.

The interconnectivity across the entire network, though, means that iNEDs are not likely to be useful gatekeepers against systemic risk across the corporate governance landscape. The interconnectivity means that those appointed as iNEDs are likely to lack independence from the wider corporate governance framework, meaning that they may be unlikely to object to a decision or process (however objectively objectionable) that has been approved elsewhere. In other words, there is a risk that the interconnectivity of the UK director market caused by

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30 UK Corporate Governance Code, n. 27 above, at Provision 10; AIC Code of Corporate Governance, n. 28 above, at Provision 13.


32 Our results are displayed in Nicholas Rowell and Jonathan Hardman, Company-Director graphs for UK publicly traded companies between January and July 2020, (2020) [Dataset] https://doi.org/10.7488/ds/3050.

iNEDs could encourage a form of “group think” – that iNEDs will not objectively scrutinise every decision but instead will bring ideas into the relevant company from decisions seen in other companies: less whether proposal X is acceptable objectively than whether it is acceptable because it has been seen elsewhere.

Accordingly, iNEDs may help protect against rogue actions which are unique to a particular company, but are unlikely to object to actions undertaken by all managers across all companies, however rogue they may seem in the abstract. An iNED’s link to other companies is likely to influence whether something they have seen elsewhere is acceptable or not: creating a risk that iNEDs do not evaluate proposals in the abstract, but instead by reference to whether they have seen them done elsewhere. Thus, for example, they may review executive pay not on whether the metrics presented are objectively justifiable, but whether they match the metrics seen elsewhere. If so, then iNEDs would help target company-specific managerial opportunism, but not managerial opportunism which is endemic across all UK companies listed on the London Stock Exchange.

The rest of this article proceeds as follows. Part 2 outlines the advantages and disadvantages that are said to arise by the widespread use of iNEDs. Part 3 outlines the methodology and results of our empirical study. Part 4 outlines implications arising therefrom, and Part 5 concludes.

2. Advantages & Disadvantages of iNEDS

A. Advantages

iNEDs are said to provide four key advantages for shareholders. First, they act as a check and balance on executive directors. Eisenberg, whose work was dominant in the development of the concept of iNEDs,34 argued that iNEDs could have a key monitoring role.35 Thus iNEDs could provide an internal restraint against the executives abusing their position for personal gain.36 This check and balance function transcends passive monitoring - it also provides a disciplinary function should executive directors act in an inappropriate manner.37 It is claimed that a keenness of the iNED to retain their reputation will result in iNEDs performing this monitoring role well.38 Indeed, empirical studies have indicated that iNEDs who are seen to perform badly are less likely to obtain future iNED positions, whether that “bad performance”

is perceived to arise from the company becoming financially distressed, following claims of financial fraud or where the iNED is considered to have supported actions against the interests of the shareholders.

This creates the second key theoretical advantage, that of reduction of agency costs. In modern company law discourse, discussion of agency costs is rife. One of the key agency costs arises between managers and owners. The check and balance provided by iNEDs is said to reduce these agency costs by preventing executives taking advantage of their position, and preventing managers inefficiently avoiding their own removal.

The third key claimed advantage of an iNED is said to be that they are able to provide strategic guidance and oversight to the executive directors. In addition to stopping abuse by executives, the experience of iNEDs is said to be helpful in providing a better strategic oversight for the company: helping its long-term success. Fourth, it is said to be in the interests of executive directors to appoint independent directors - agreeing to such appointment acts as a bonding and signaling mechanism to potential investors that they are happy to be monitored. The inverse must also hold true - that an iNED has sufficient trust in the executive to join their board in a non-executive capacity. From both perspectives, an iNED joining the board provides a boost of legitimacy to the rest of the board, and in turn the company - helping to improve investor confidence in the company.

B. Disadvantages

It is not the case, though, that only positives have been said about the role of iNEDs in corporate governance. The need to protect their own reputations may create perverse incentives that encourages iNEDs to put their own interests ahead of those of the shareholders.

Indeed, if a particular iNED is seen as being a “good” iNED, this may create an incentive for them to reduce the time that they spend on such directorship. Pay structures for iNEDs frequently align their interests to those of executive directors, which may skew the monitoring role that

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47 William B. Chandler & Leo E. Strine, Views from the Bench: The New Federalism of the American Corporate Governance System: Preliminary Reflections of Two Residents of One Small State 152 University of Pennsylvania Law Review 953 (2003); Gutierrez & Saez, n. 3 above, at 64.
iNEDs can play.\textsuperscript{50} Even if iNEDs worked exactly as they intended to do, there is a likelihood of an expectation gap between what shareholders think iNEDs are doing, and what iNEDs think they are doing.\textsuperscript{51}

Eisenberg stated that a strong criteria of independence was a prerequisite to effective iNEDs. Neither of the potentially applicable UK codes has such strong criteria - instead, each leaves it to the company to decide whether a director qualifies as an iNED, based on a series of non-exhaustive, merely indicative, characteristics.\textsuperscript{52} Thus UK listed companies can provide other criteria which precludes independence, can decide that a director is independent even if such a characteristic exists, and neither of these codes provides a wider definition of actually what independence means. In addition, they are able to use “comply or explain” mechanics to merely explain why they consider these rules should not be applicable to them.\textsuperscript{53} As such, the rules do not effectively bind executive directors to them: they can decide that directors with characteristics which the relevant codes provide should preclude independence are, in fact, sufficiently independent to justify the label of iNED.

INEDs may not have sufficient time to devote to this role. INEDs normally have other roles, outside the company, which reduce the time that they have to undertake their monitoring function within the company.\textsuperscript{54} INEDs will rely on receiving information from those they are meant to monitor. As such, there is an inherent contradiction in their monitoring function - they need to obtain information from those who they are meant to monitor, and thus there is an information asymmetry between iNEDs and those they are supposed to monitor.\textsuperscript{55} Such limitations have been argued to cause failures by iNEDs in preventing previous corporate scandals and collapses.\textsuperscript{56} This provides a structural issue for independent directors, who may be unwilling to challenge the executive to obtain such information to prevent restrictions on future information flow.\textsuperscript{57} These structural issues may be insurmountable without legal changes to strengthen the ability of iNEDs to act independently.\textsuperscript{58}

It has been argued that the iNED structure does not work for companies with concentrated ownership, as dominant shareholders already play this role.\textsuperscript{59} Then, though, a similar

\textsuperscript{50} Assaf Hamdani & Reinier Kraakman, \textit{Rewarding Outside Directors} 105 Michigan Law Review 1677 (2007). This is a US source, but the problem has been identified as being of universal application, including the UK – see Charles A. E. Goodhart & Rosa M. Lastra, \textit{Equity Finance: Matching Liability to Power} 6 Journal of Financial Regulation 1 (2020).


\textsuperscript{52} The phrase “Circumstances which are likely to impair, or could appear to impair, a non-executive director’s independence include, but are not limited to, whether a director:” appears in both UK Corporate Governance Code, n. 27 above, at Provision 10 and AIC Code of Corporate Governance, n. 28 above, at Provision 13.

\textsuperscript{53} Keay, n. 29 above; Wymeersch, n. 29 above; Moore, n. 29 above; Duhamel, n. 29 above.


\textsuperscript{55} Elizabeth Cosenza, \textit{The Holy Grail of Corporate Governance Reform: Independence or Democracy?} Brigham Young University Law Review 1 (2007); Gutierrez & Saez, n. 3 above, 66.


\textsuperscript{58} Lisa M. Fairfax, \textit{The Uneasy Case for the Inside Director} 96 Iowa Law Review 126 (2010).

\textsuperscript{59} Mike Burkart, Denis Gromb & Fausto Panuzi, \textit{Large Shareholders, Monitoring and the Value of the Firm} 112 Quarterly Journal of Economics 693 (1997).
monitoring function will be required, merely against a different party.\textsuperscript{60} In such circumstances, the function of iNEDs normatively moves from protecting shareholders against management to protecting minority shareholders against majority shareholders.\textsuperscript{61} This analysis feeds in to trends for corporate ownership between jurisdictions. iNEDs originated in jurisdictions with a single tier board and dispersed share ownership, and are less likely to be needed in a two-tier board system.\textsuperscript{62} This lack of universality is demonstrated by the variety of rules that different jurisdictions have deployed for identifying iNEDs, the functions of iNEDs and their role in governance.\textsuperscript{63} Accordingly, it cannot be said that having iNEDs provides universal benefits, nor indeed that where there are benefits, those benefits are uniform. This lack of universality of definition and approach has been acknowledged for a long time.\textsuperscript{64}

There are two key challenges to the role of iNEDs in respect of which we present empirical evidence in this article. First, as noted above, there are allegations that iNEDs are subject to cronyism, and therefore that they are subject to capture by executives, undermining their advantages. Indeed, most definitions of iNEDs do not include social ties which arise outside their appointments.\textsuperscript{65} Whilst the relevant UK definitions exclude close family ties,\textsuperscript{66} they do not list any other social ties. By focusing on professional links, criteria for independence miss out on more personal ties that may compromise independence as much, if not more, than the cross-directorships which are prohibited. The argument is that, ultimately, iNEDs are being appointed for reasons other than their independence and expertise. Further, it has been empirically shown that overlapping backgrounds between executive and iNEDs reduces the monitoring skill of the latter.\textsuperscript{67}

Second, even if iNEDs are not the cronies of executives, their professionalised function means that they may be independent from the management of the company in question, but are not independent from the wider corporate governance system in which they operated. This can be seen as a corollary of the third advantage outlined above: the strategic guidance that iNEDs can provide must come from their experience as a director (iNED or not) elsewhere. As such, there is a risk that they test behavior within their company not by objective analysis but by whether they have seen similar behavior in their other roles. This may lead them to judge performance on what is taking place endemically across all UK companies listed on the LSE, rather than on what a particular company’s shareholders would like them to do. In other words, rather than establishing in the abstract whether a particular course of action should be undertaken, it is evaluated by reference to the iNEDs experience as a director elsewhere. This can be evidenced by the series of failures of iNEDs to challenge executives in the run-up to the

\begin{thebibliography}{99}
\bibitem{Hopt} Hopt, n. 26 above; Ferrarini & Filippelli, n. 34 above, 269.
\bibitem{Brudney1982} Victor Brudney, \textit{The Independent Director – Heavenly City or Potemkin Village?} 95 Harvard Law Review 597 (1982).
\bibitem{CorporateGovernance} UK Corporate Governance Code, n. 27 above, Provision 10; AIC Code of Corporate Governance, n. 28 above, Provision 13.
\end{thebibliography}
global financial crisis. Earlier than this, it has been argued that Enron’s independent directors failed to make any change to the ultimate fate of Enron. Such outcomes remain pervasive - for example, in Carillon. Ultimately, if iNEDs consider activity to reflect market practice (as identified by their other directorships and wider links of all directors), they may not critically engage with it to the level they would have to if they had not seen it before.

Our empirical study explores these two criticisms of the iNED framework. We explore the entire UK corporate database to see if companies are generally connected (which explores how connected directors are across the market), and (if so) how densely (which explores professional cronyism). A network which is interconnected provides evidence for the risk that directors may judge performance by familiarity rather than objectivity, as it shows that directors, including iNEDs, are all connected. This creates potential for systemic risk – a risk which pertains to a system - across the UK corporate governance landscape. In the case if iNEDs, the systemic risk is that the interconnectivity risks iNEDs judging performance by familiarity and also the expectation that iNEDs will do so. If directors are not interconnected, these risks are not present, whereas if the network is highly connected then these risks are present. A network which is densely interconnected would verify the charge of professional cronyism, as it shows that there is proximity between iNED appointments, indicating cronyism in appointment.

3. Empirical Evidence

A. Primary Datasets

To explore the interconnectedness of the director network across UK listed companies, and how dense this network is, we collated our own datasets. In this section we describe the externally-curated datasets that were collated for, and used in, this study.

1. Companies House Database

Companies House is the registrar for companies in the UK, and contains the records of all UK companies. It maintains a database containing records for all registered companies, active and inactive, dating back to 1844. In addition to companies it contains many different types of record, including details of individual officers and their appointments. At the time of writing, the database contains over 170 million different records for around 4.3 million companies. This is obviously limited to UK incorporated companies. Non-UK companies can

68 Ringe, n. 37 above; Michael E. Murphy, Assuring Responsible Risk Management in Banking: The Corporate Governance Dimension 36 Delaware Journal of Corporate 121 (2011); Lynne Dallas, Short-Termism, the Financial Crisis, and Corporate Governance 37 Journal of Corporation Law 264 (2012).
70 Edwin Mujih, Corporate governance reform and corporate failure in the UK 42 The Company Lawyer 109 (2021).
72 When company incorporation by registration was introduced in the UK in the Joint Stock Companies Act 1844.
and frequently do list on the London Stock Exchange, but as these are not always listed at Companies House, these records are not included in any of our datasets.

The contents of the Companies House database are freely available to the public via a simple search function. Whilst this system enables a simple search for a single company, it lacks functionality for wider searching. There are two further ways to access the contents of the database, and we have relied on both of them for this study. First, every month Companies House publishes a limited snapshot of the current database contents that is known as the Free Company Data Product. This contains partial records for all companies present in the database, including their type and status at the time of publication. For the purposes of this study, it identifies public companies and provides company numbers. Secondly, Companies House provides real-time digital access to the database via a service called the Companies House API. The API allows software developers to write applications that connect to the database and retrieve records. All records in the database are assigned a unique URL, which clients can use to locate and retrieve them by issuing suitable HTTP URL requests. For example, the company with number 00214436 is located at https://api.companieshouse.gov.uk/company/00214436. The records are returned in JavaScript Object Notation (JSON) format, which is a simple and flexible standard for storing and exchanging data. The information available through the API is far richer than that contained in the Free Company Data Product, and crucially it allows the connections between companies and their officers to be queried. Connections to the API from individual clients are throttled to ensure quality of service: a maximum of 600 queries can be issued in a five minute period. This introduces some practical limitations for studies like this; for example, this would impose a major bottleneck if a complete analysis of the c.4 million UK private companies was to be carried out. An additional complication is that company numbers must be known in advance in order to locate the records. This information is obtained from the Free Company Data Product.

2. London Stock Exchange Issuers List

There are two primary markets of the London Stock Exchange (LSE): the Main Market and the Alternative Investment Market (AIM). The LSE publishes a list every month of companies that issue shares on each market. We used this to determine the subset of public companies that are traded on the Main Market. Issuers on the premium section of the Main Market must utilise the UK Corporate Governance Code (or AIC code, as applicable) on a “comply or explain” basis. Other sections of the Main Market are not obliged to utilise such codes, but they have to disclose information about their corporate governance arrangements to the market, and compliance with the UK Corporate Governance Code (or, if applicable, the AIC Code) is deemed compliance with this. As such, we include all Main Market listed companies.

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75 https://find-and-update.company-information.service.gov.uk/.
76 See Hardman, *Articles of Association*, n. 23 above.
78 A UK company must be a public company to be able to list its shares on the public market – s 755 (1) Companies Act 2006.
81 See Keay, n. 29 above; Wymeersch, n. 29 above; Moore, n. 29 above; Duhamel, n. 29 above.
companies in our dataset. AIM companies only have to state if they are voluntarily utilising a corporate governance code, and if so how. This means that there is less of an inevitability that AIM companies will follow the UK Corporate Governance Code or the AIC Code. As such, we do not include AIM listed companies within our datasets.

The list of companies published by LSE contains the name for each company but not the company number, which is required in order to uniquely identify companies and retrieve records from Companies House via the API. We therefore had to preprocess the list to associate the correct company number with each entry. This was done by conducting an automated search for the companies by name using the Companies House API, although care had to be taken in numerous cases to overcome small differences in the recording of the company name between the list supplied by LSE and the name registered with Companies House. This resulted in 767 companies being identified, with a total of 4986 directorships.

B. Auxiliary Datasets

Some additional auxiliary datasets were compiled during this study. These are described in this section.

1. Director Independence

In order to properly assess the role and influence of iNEDs, we need to know which of the directors of each company are treated as iNEDs. Although the full set of directors can be retrieved from Companies House via the API, Companies House itself does not record information on the independence of each director, nor is this information available in a consolidated fashion from the LSE (companies must notify the LSE that a director has been appointed, but not whether they are an iNED or not). Instead, this information had to be compiled by conducting a manual search through the annual reports, press releases and other publications issued by each company. Each annual report should provide this information, but annual reports are inherently historic, relate to specific time historic time periods and are published after the fact, whereas appointments at Companies House are more likely to be updated in real time. The difficulties that we faced in gathering data as to a director’s iNED status is set out more fully in section 4A below. Given the potential for discrepancy between these sources, we adopted a strict hierarchy for search. First, we reviewed the most recent annual financial report issued by the company and filed at Companies House. If this did not provide the necessary information, then we reviewed the company’s website, to establish whether they listed their directors and there indicated whether the director was considered an iNED or not. Third, if they did not, we checked the company’s website to see if a more recent annual financial report (one which was not yet registered at Companies House) indicated the status of directors. Fourth, if information was still not available, we reviewed the LSE’s announcements to establish if status was indicated upon appointment of directors.

Even then, the data was not always clear, and so we had to apply four further assumptions to compiling this auxiliary dataset. First, we assumed that the Chair of the

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84 For example, the company with number 01709784 is listed in the LSE file with name “WETHERSPOON (J.D.) PLC”, while the name registered with Companies House is “J D WETHERSPOON PLC”. 
company was independent unless the contrary was indicated, as both relevant codes provide that this should be the case on appointment of the Chair unless the company explains why it is inapplicable. Second, we assumed that non-executive directors were iNEDs unless there was evidence to the contrary. An example of such evidence to the contrary is the company drawing a distinction between iNEDs and other non-executive directors (where the former would be categorized as an iNED but the latter would not). Third, we assumed that directors of AIC member companies were iNEDs unless the contrary was indicated, as an executive director of an AIC member company is rare, and so it is assumed that any director will be a non-executive director, and (following assumption two) assumed to be an iNED unless the contrary was indicated. Fourth, in the rare (and counter intuitive) situation whereby a company listed by the LSE as being on the Main Market is a subsidiary of another company we looked to the parent company if the subsidiary did not undertake their own categorisation, such that an iNED of the parent is considered an iNED of the subsidiary. In the end, each of the 4986 directorships across all 767 relevant companies were accounted for.

2. **Investment Companies**

As noted above, AIC member companies are closed ended investment funds with fundamentally different characteristics to non-AIC member companies which apply slightly different corporate governance requirements to non-AIC member companies. In particular, iNEDs are expected to be independent from the investment manager, rather than from any the company itself and other directors. In this study we therefore needed to identify such AIC member companies. This was done by checking which of the companies are listed as members on the Association of Investment Companies. We used a previous dataset which had already undertaken such analysis.

C. **Caveats**

1. **Epoch of the Datasets**

The various datasets on which this study is based were produced at slightly different times, due for example to latency in the reporting of director appointments and resignations, company dissolution, associated updating of the Companies House database, and listing/delisting of companies with the London Stock Exchange. As such, it cannot be referenced to a particular instant in time, but represents approximately the situation over the first half of 2020 when the datasets were assembled. As far as possible we have checked and

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85 UK Corporate Governance Code, n. 27 above, Provision 9; AIC Corporate Governance Code, n. 28 above, Provision 11.
86 See Hardman, *Slow Death* n. 23 above.
89 Companies have 14 days after such appointment or resignation to register notification of this with the public register – s 167 Companies Act 2006.
resolved any ambiguous or conflicting entries in our dataset, such that any remaining issues are negligible and not expected to significantly affect the results.

D. Methods

The basic methodology employed in this study is to construct a graph data structure that represents the connections between companies and their directors via directorships, then analyse the graph using standard methods from graph theory. Graph theory\textsuperscript{90} is the mathematical study of graphs, which are structures that model the pairwise relationships between objects. A graph consists of a set of nodes or vertices that represent the objects of interest, and edges that connect pairs of vertices and which represent the relationship between then. In this case, vertices correspond to both companies and directors, and edges correspond to directorships. Every edge connects one company with one director. In graph theory terminology, the result is a bipartite graph. Figure 1 shows a simple visualisation of a graph data structure of the kind studied in this paper. The purpose of the graph was to establish how interconnected all companies and their directors were.

To implement this, we have developed an application in the Java programming language that communicates with the Companies House API to retrieve records for companies and their officers, and enters them into a graph data structure for storage and subsequent analysis. The application source code is available online on Github.\textsuperscript{91} We make use of several software libraries to assist in building and analysing the graph, including Gson\textsuperscript{92} to handle the JSON data format, and the open source Java graph theory library JGraphT.\textsuperscript{93} JGraphT provides efficient implementations of many graph theory data structures and algorithms, and is used in a wide variety of industrial and academic contexts including circuit verification, social networking and navigation of autonomous vehicles.\textsuperscript{94}

I. Construction of the Company-Director graph

The starting point for the construction of the company-director graph was the list of company numbers for UK public companies that are traded on the LSE Main Market, and which were not investment companies. This was compiled from the Free Company Data Product, LSE issuers list and the auxiliary dataset described in Section 3.B.2. For each company, the set of directors was then retrieved from the Companies House database by issuing a suitable request via the API. The record containing the details of all officers (past and present) of a given company is assigned a unique URL.\textsuperscript{95} Those officers that are currently in post can be identified depending on whether a resignation date is recorded. The role of each officer is also provided,

\textsuperscript{90}There are many good introductory texts on graph theory - two examples are Richard J. Trudeau, Introduction to Graph Theory (New York: Dover Publications, 2nd ed, 2003); Robin J. Wilson, Introduction to Graph Theory (Harlow: Prentice Hall, 5th ed, 2010).
\textsuperscript{91}https://github.com/NickRowell/companieshouseapiclient.
\textsuperscript{92}https://github.com/google/gson.
\textsuperscript{93}https://jgrapht.org/.
\textsuperscript{94}Dimitrios Michail, Joris Kinable, Barak Naveh and John V. Sichi, JGraphT – A Java library for graph data structures and algorithms 46 ACM Transactions on Mathematical Software (2020) DOI: 10.1145/3381449.
\textsuperscript{95}For example https://api.companieshouse.gov.uk/company/00214436/officers for the company with number 00214436.
which allows the directors to be identified. The company and each active director were then entered into the graph data structure as vertices, and edges are added linking the company with each of the directors. Individual officers are assigned a unique URL in the database that contains details of all their appointments. In this way, individuals that are directors of more than one company can be identified and merged in the graph as it is being constructed.

2. Multiplicity of Company Officer Records

While UK registered companies have a unique record in the database that is indexed by the company number, we found that the records for company officers may be duplicated, with more than one entry corresponding to the same individual. Each such occurrence results in a duplication of director nodes in the graph, and a failure to identify connections between the companies associated with the director. This has the potential to bias the results of our study, by reducing the overall connectedness of the graph.

In order to assess the impact of this, we investigated ways to use ancillary information on the directors to detect cases of duplication. Many fields are included in the officer record, which offers many possible ways to detect two distinct records for the same individual. However, the majority of the fields are not suitable for use due either to inconsistency of recording or the tendency to change over time (e.g. addresses). We found that the most reliable method was simply to compare names and dates of birth, and assume that two director records that have the same name and same date of birth are actually the same person that has been incorrectly stored twice in the database. When comparing names, we ignored any title present (as these may change over time), and also any middle names (due to inconsistency of recording) unless these were both present and different. When comparing dates of birth, only the year and month were compared as the day is not included in the record. In some cases the date of birth was missing entirely, which led to ambiguous situations where two director records contained the same name but a comparison of the birth date was not possible. We assumed these correspond to different people, though the occurrences were logged for further inspection.

The initial graph constructed from the raw Companies House records was post-processed to identify and merge cases of duplication, using the method described above. Every pair of director nodes was compared, and two (or more) nodes that are determined to correspond to the same person were merged into a single node and all edges transferred to it. Of the initial set of 4345 director nodes, we found that 3919 (90.2%) were unique. The remaining 426 were duplicated records for 204 individuals. In most cases of duplication (187) two records were present for a single individual, although there were 16 cases where three records are present and one case where the same individual has four different records. There were no ambiguous cases with matching names and insufficient date of birth information.

E. Results

The resulting graph consists of 767 companies and 4123 directors holding a total of 4986 directorships. The breakdown by directorship type and by AIC membership status is shown

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96 E.g. “WRIGHT, Christopher John” and “WRIGHT, Christopher” are considered to be the same name, but “WRIGHT, Christopher James” and “WRIGHT, Christopher John” are not.
in Table 1. In this section, we present some properties and features of the graph and discuss some of the insights that it provides.

1. Distribution of Directors and Companies

For a high level picture of the graph data, in this section we present the distributions of the number of directorships per individual and the number of directors per company.

Figure 2 depicts a histogram showing the frequency of the number of directorships held by individual directors, additionally split by directorship type and AIC membership status. This reveals that the great majority of individuals (3476 of 4123) hold only one directorship of either type. The numbers of simultaneously held directorships are heavily dominated by iNEDs. For example, while 375 individuals hold two iNED appointments only 13 individuals hold two non-independent directorships. No individual holds more than three non-independent directorships, while 31 individuals hold four or more iNED appointments. The removal of AIC members has a greater relative effect at the upper end of the distribution, where it eliminates all cases of five or more simultaneously held directorships. We examined the two cases of individuals holding six simultaneous directorships and found that all six were with AIC members. This is a significant result that indicates that the difference is not simply due to the smaller number of companies present when AIC members are removed, and instead suggests directorships at AIC members may have different overall properties to non-AIC member companies. This insight originally prompted us to split our analysis according to AIC membership status.

In Figure 3 we present histograms showing the frequency of the number of directors per company, split by directorship type and AIC membership status. These reveal some interesting properties. First, all companies within our study have at least two directors. The largest number of directors at a single company is 17, corresponding to Coca-Cola European Partners PLC with company number 09717350. This is made up of 9 iNEDs and 8 non-independent directors. Second, there are 18 companies with no iNEDs, and a further 224 companies that have only iNEDs; the great majority of this latter group (211) are AIC members. Finally, the median number of directors per company rises significantly when AIC members are removed; for example, across all companies 33% have more than seven directors, but when AIC members are removed that figure rises to 50%. This reveals that AIC members have significantly fewer directors on average than non-AIC members.

2. Distribution of Connected Set Size

We have computed the number and size distribution of the connected sets that the graph is composed of. As depicted in Figure 1, each connected set represents a portion of the graph that is isolated from the rest with no linking edges. The number and size distribution of the connected sets reveals how interconnected UK listed companies are - if the majority of companies reside in a large number of small connected sets that implies this market is not that interconnected. In contrast, if the majority of companies reside in a small number of large sets then that suggests greater market interconnectivity. The resulting distributions derived from our dataset are highly skewed and are therefore presented in tabular form in Table 2 – Table 4; the size of the connected sets is quantified in terms of the number of companies in each. The
distribution is broken down additionally by AIC membership status and according to the directorship type.

The distribution for all companies and both directorship types (Table 2 columns 1–2) reveals a highly bimodal behaviour, with the great majority of companies (709 of 767) either completely isolated (159) or residing in a single large connected set (550). This behaviour is preserved when AIC members are removed (Table 2 columns 3–4), although the ratio of the largest set size to number of isolated companies (550/159) is reduced from 3.46 to 2.15, indicating that the main effect is to increase the number of isolated companies. This might suggest that the AIC members are systematically more connected than the average company, such that removing them from the graph results in a disproportionate reduction in the degree of connectedness. However, graphs are inherently nonlinear structures, and as such for many statistics the dependence on the graph size does not have a simple relationship. We have tested the significance of this result by removing random subsets of 280 companies (irrespective of AIC membership) and recomputing the ratio of largest set size to number of isolated companies. In 75.5% of trials a lower test score was obtained (indicating a greater increase in the number of isolated companies). The result for AIC members therefore is not significant and does not indicate any systematic difference from the non-AIC members.

By far the biggest effect on the connected set size distribution is the dependence on directorship type. Tables 3 and 4 show the distributions when only iNEDs and non-independent directorships are included. For iNEDs the overall picture remains unchanged, whereas for non-independent directorships the distribution is completely transformed with the second mode eliminated entirely. Evidently the presence of the iNEDs greatly increases the overall connectedness of the graph. From Figure 2 this is understood as arising from the large number of individuals that hold more than one iNED appointment simultaneously.

3. Distribution of Shortest Path Between Director Pairs

The fact that the majority of companies (550) reside in a single large connected set is important, but does not in itself reveal anything about the density of connections within the set or the average separation of directors. For example, the large set could be composed of a long linear chain of director-company links with pairs of directors distantly connected on average, or of a dense web with many interconnections and a much shorter average distance between directors.

To examine this, we introduce the idea of the shortest path between director pairs, which is the minimum number of steps required within the graph to link two directors. Two directors that hold directorships at the same company have a shortest path length of one, i.e. the shortest path is through a single company. A path length of two indicates that the shortest path is through two companies. This statistic quantifies the degree of separation of pairs of directors, with increasing separation implying a less determined effort to obtain proximity - in other words, less evidence of cronyism (based on existing joint directorships) driving appointments. For a pair of directors that lie in different connected sets no such path exists.

In Figure 4 we present a histogram of the shortest path length between all pairs of directors in the graph, split additionally by AIC membership. The different vertical scales of the two subsets simply reflects the fact that the set of all companies includes a larger number of directors than the set of non-AIC companies, with a correspondingly larger number of possible pairs of directors. The relevant feature is the overall shape of the distribution, with
both subsets showing a similar form. For the set of all companies, 52% of director pairs have shortest paths of length seven or more; for the subset of non-AIC companies the corresponding figure is 51%. This means that for a pair of directors picked at random (within the same connected set), it is more likely than not that the shortest path between them is through a chain of seven or more companies.

4. Examination of Cycles

The notion of a cycle within the graph is similar to that of the shortest path. A cycle is a path through the graph that starts at a particular director and traverses two or more different companies to arrive back at the same director. To illustrate this point, in Figure 5 we depict examples of two- and three-way cycles of directors that traverse two and three different companies, respectively. This is of relevance to this study because the relevant corporate governance rules indicate that a particular type of cycle should be expected to preclude mutual iNED status; specifically, two-way cycles consisting of two companies and two directors who hold opposing directorship types. An example is depicted in the left panel of Figure 5. We have searched the graph for any cases of this configuration and found none. We have also searched for cycles of increasing length that are not prohibited by this rule but which nevertheless may undermine iNED independence - by applying with the detail of this rule but undertaking appointments which were as close to the prohibited relationship as possible. The first such example is shown in the right panel of Figure 5, where a three-way cycle of directors hold opposing directorship types. Of the 110 three-way cycles present in the graph, none have opposing directorship types. We have also searched for corresponding four-way and five-way cycles and found none. On the basis of these results, it appears that the relevant corporate governance rule regarding two-way cycles holds and is not undermined by the presence of slightly longer cycles; there is no evidence that appointments are as close to the prohibited relationship as possible, and therefore no evidence for cronyism (based on directorships) in appointment.

4. Implications

A. Difficulties in Data Gathering

Three key implications arise from our empirical analysis. The first implication is that it is surprisingly difficult to ascertain whether any particular director is considered an iNED of any given UK company at any given time. This is because compliance with UK corporate governance requirements is, as a matter of the listing rules, disclosed in the relevant UK company’s annual financial statements. These are published within four months of the end of the financial year to which they relate. Thus the statements as to whether a director was deemed an iNED or not are inherently historic. Appointment of directors of UK companies is also notified to the public register ex post, but companies have 14 days to do so. Currently, companies listed on the main market of the LSE must notify the market if a new director is appointed, if a director is removed, if their functions change and the relevant date of any such changes.

97 Listing Rules, n. 82 above, Listing Rule 9.8.6.
change, and the details for any new director must include their other directorships. There is no requirement, though, to disclose whether a new director is an iNED or not, or if an existing iNED’s independence is otherwise compromised. Thus there is no real-time function to identify who is or is not a director, nor which of those are considered an iNED at any given time. When this is aggregated across the whole board, the position becomes even more uncertain. If researchers into the area find it difficult to ascertain the balance of iNEDs within a board, then retail investors are likely to find it even more challenging. This is easily resolved by requiring regulatory announcements to the market to be made promptly upon the appointment or removal of a director, for such appointments to indicate whether the director is deemed an iNED or not, and for any changes in status between iNED status and non-iNED status also requiring prompt announcement. This would still require a slight trawl through announcements, but at least there would be a centralised place to search through. Requiring any such update to include a running list of the full board, including whether each member is an iNED or not, would save a lot of this difficulty. Alternatively, the UK corporate registry could be updated for relevant companies to indicate whether directors are iNEDs or not, and require relevant companies to update this public register.

B. A Sparse Network

The second key implication of our research is that the links between directors are sparse. This means there is no evidence of cronyism based on directorship appointments - fears that the detail of the rules regulating the independence of iNEDs were being circumvented by a series of dense, 3-way cross-directorships are unfounded. If median shortest paths were a very low number, then such evidence would have been founded, but a median shortest path of 7 does not demonstrate that directors are using iNEDs with the shortest path possible but permissible within the rules. Similarly, a large number of 3-way cycles of iNEDs and executive directors would point in this direction, but there were none. Our research is limited to such directorships, and so does not cover the dark matter of personal relationships. It may be that factoring in school ties (both for directors and their families), university ties, or even social matters such as golf clubs may change this analysis. Our research is also limited to current directorships, and so it may be that either historic appointments or non-director managerial positions would unveil the overall network as being much denser. However, we limited our analysis to current directorships to ascertain the density with the overall UK public company market at (or as close as possible to) a particular time. We also limited it to professional appointments to ascertain whether there is evidence of groupthink based on cross directorships, for which only current directorships are relevant. Other measures may lead to accusations of cronyism, but our measure found no evidence of cronyism based on current directorship appointments.

C. A Large Daisy Chain

Listing Rules, n. 82 above, Listing Rule 9.6.11.
Listing Rules, n. 82 above, Listing Rule 9.6.13.
Fairfax, n. 58 above; Page, n. 57 above.
The third key implication of our research is that there is a strong link between directors generally across UK companies listed in London, and that this is caused by the use of iNEDs. On one level, this is not surprising as there are times that this has been actively sought after. For example, in Sir David Walker’s review of the governance of banks in the financial crisis, he highlighted that part of the problem was that some iNEDs had no knowledge of banking at all. The need to have some knowledge of the sector was therefore deemed to be a good thing. However, this is paradoxical as it narrows the pool of those available to be iNEDs, and in turn narrows the monitoring role of the board. Even if they meet the requirement for independence, this risks them judging a proposal by familiarity rather than objective analysis. This may prevent opportunistic behaviour which was novel to the firm itself as an outlier to general practice across UK companies listed on the LSE, but not systemic risks applicable to such companies. This explains why issues endemic to listed companies are not addressed by ostensible iNEDs: why concerns about excessive remuneration, lack of diversity, and a lack of a sustainable focus - which are missed systemically across the market – are not remedied by iNEDs. This is because iNEDs might be independent from the managers, but they are not independent from the system. Not only are iNEDs unlikely to change matters undertaken across the corporate governance framework, all iNEDs have an incentive to maintain the status quo across sectoral issues, and executives who become iNEDs elsewhere will have only experienced their iNEDS applying this standard of analysis. Not only does this interconnectedness mean that iNEDs are not independent from the wider UK corporate governance market (i.e. the decision making process in all UK listed companies), it also means that they are structurally in hoc to wider trends in decision making across all UK companies listed on the LSE: the independent voice in the board room comes from those inherently connected to the other board rooms, meaning they may not challenge behavior that they have seen elsewhere.

It is almost impossible to amend current rules to correct this as it has been argued and empirically demonstrated that there is a tradeoff between independence and competence. Unless we mandate the appointment of total outsiders with no expertise in companies or business at all, all directors are part of the same system. Kershaw states that the current regime “elevates the importance of independence over knowledge and takes a risk that the pool of advisory talent will continue to be deep enough.” Our research unveils that this is only true to an extent - independence from the specific vehicle is achieved, but not from the wider corporate governance landscape. It is hard to imagine that any further independence could be

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obtained without sacrificing the quality of corporate governance.\textsuperscript{110} It seems incongruous, though, to continue to rely on letting the market set who qualifies as an iNED, when that approach has failed so far.\textsuperscript{111}

It is also difficult to imagine a tighter set of characteristics for independence. Irrespective of how many factors are included, they would not be exhaustive.\textsuperscript{112} There is an arbitrariness to the concept of independence as defined in different countries - indeed, there is no standard definition of independence. Ringe says “[c]omparing the concept of ‘independence’ in two countries therefore automatically comes down to comparing apples and oranges”.\textsuperscript{113} In part, this is because independence is always worded in such a negative and passive manner - it is freedom from a quality rather than possessing a certain quality. Unless this is coupled with some positive statement of what an independent director is or who they act for, it will remain illusory.\textsuperscript{114} However, as independence means different things across different ownership types,\textsuperscript{115} and indeed across different jurisdictions,\textsuperscript{116} a universal specific concept is likely to be beyond our grasp, even were independence considered an objective good to aim for.

Indeed, even if objective criteria for independence were established, it may be that we are considering the approach to establishing such independence in the wrong way. Under both codes examined, independence is determined by the board as a whole based on several factors about the previous interactions between the putative iNED and those connected to the company.\textsuperscript{117} As such, independence is determined by examining whether the director in question has an independent \textit{status} or not. It has been argued that it would be better to see if a director was acting independently of the dominant forces within the company for any given decision, instead of focusing on ongoing status.\textsuperscript{118} Certainly, the non-exclusive and non-exhaustive factors that a company may take into account when determining independence seem to be proxies for matters which could obstruct independence of thought. Thus, arguably, the codes reviewed use status merely as a way to establish the likelihood of independent thought when acting as a director. If this is the case, then perhaps the focus should not be the director’s status in respect of the company, but rather whether they are able to act independently on any given decision. Thus independence could become less a matter of status, and more a matter for the interaction between the director and powerful forces within the company at any time.

The issue then becomes who would be best to judge the whether a director could act independently in any given situation. Both current frameworks make the decision as to iNED


\textsuperscript{111} Parkinson, n. 1 above. It has been argued that independent shareholders may be the best constituencies to evaluate executive performance, rather than iNEDs – see Zahar Goshen, \textit{The Efficiency of Controlling Corporate Self-Dealing: Theory Meets Reality} 91 California Law Review 393 (2003).


\textsuperscript{113} Ringe, n. 37 above, 414.

\textsuperscript{114} Ringe, n. 37 above, 421.

\textsuperscript{115} Gutierrez & Saez, n. 3 above.


\textsuperscript{117} UK Corporate Governance Code, n. 27 above, Provision 10; AIC Code of Corporate Governance, n. 28, Provision 13.

status a collective one for the board as a whole to take.\textsuperscript{119} It would seem, though, that a decision as to whether a director can be independent on a particular issue would be best left to the director in question themselves rather than the board – only they can know whether, on any particular issue, they are independent enough of dominant forces.

Moving from a collective status based categorization (whereby the board decide whether a director is given the status of an iNED) towards an individual issue-by-issue based categorisation (whereby a director decides on a given issue whether they are capable of being independent) also would help focus responsibility for such a decision onto the individual director. This can only help holding such an individual liable for their decision.\textsuperscript{120} If collective status based identification of iNEDs within the UK does not (and cannot) cover all potential criteria for status based independence, and this approach results in all those in the network being strongly connected, then we can find other ways to ensure that dominant parties are monitored and held to account, without the systemic drawbacks for the wider market. Thus we could replace the iNED mechanic with a confirmation on every matter of board business from each director as to whether they feel that they are able to act independently to hold the powerful forces within the company to account. It would be easy to require a quorum on every decision of a majority who do.\textsuperscript{121} It would also be easy to crib existing regimes governing director conflicts of interest to ensure that each director considering themselves independent on any individual issue declares to the company anything that could appear to compromise their independence,\textsuperscript{122} and give the rest of the board an override to repeal an independent characterisation on a specific decision should there be a risk of perception that any director’s independence was compromised.

Such a mechanism would let the company appoint the most competent of directors, so long as sufficient of them felt they could be independent in any given situation – avoiding (or at least mitigating) the trade-off between competence and independence.\textsuperscript{123} This balancing act would still provide the advantages of iNEDs.\textsuperscript{124} However it may well break the director daisy chain connecting all UK companies listed on the Main Market of the LSE together – which is caused by the existing focus on the need for external iNEDs who have sufficient competence in being a director, but who also lack certain indicators of non-independent status in respect of the company. If status is just a proxy for the ability to provide the wider benefits of independence to the company, but this proxy has caused a potentially dangerous interconnection of UK listed companies, then this solution could remove these harms and retain the benefits.

\textsuperscript{119} UK Corporate Governance Code, n. 27 above, Provision 10; AIC Code of Corporate Governance, n. 28 above, Provision 13.

\textsuperscript{120} Directors’ duties are personal – see Rosemary T. Langford, General Law and Statutory Directors’ Duties: “Unmixed Oil and Water” or “Integrated Parts of the Whole Law”? 131 Law Quarterly Review 635 (2015) - but the focus on iNED status being collectively ascertained risks diluting attention for breach from the director to whom attention should be most acute – the putative iNED.

\textsuperscript{121} Without such a quorum, it would not be possible to conduct board business – e.g. Accumulator Co v. Phillipart (1988) 58 L.T. 525.

\textsuperscript{122} In particular, obligations to disclose interests in transactions (s 177 Companies Act 2006) could be mirrored into disclosing matters which may preclude independence, potentially coupled with a corresponding duty to avoid compromising independence where undeclared (cribbing s 175 Companies Act 2006). For discussion of the operation of the conflicts regime, see Ernest Lim, Directors’ fiduciary duties: a new analytical framework 129 Law Quarterly Review 242 (2013).

\textsuperscript{123} E.g. Davies & Hopt, n. 107 above.

\textsuperscript{124} Being the monitoring of executives (Eisenberg, n. 35 above) to help reduce agency costs (Fama, n. 44 above), strategic guidance (McNulty & Pettigrew, n. 46 above) and signalling to the market (Chandler & Strine, n. 47 above).
This is not to say that iNEDs in their current status-based form provide no use - the long median path outlined in our research indicates that there is a directorship distance between iNEDs and executive directors, which will allow the former to monitor the latter for firm-specific managerial abuses. It means, though, that shareholders cannot rely on iNEDs to identify issues endemic across UK corporate governance. Shareholders therefore need to consider other disciplinary functions for management that exist within the market which can fill this delta. In other words, deployment of iNEDs can be seen as complementary to other governance mechanisms.125

It is important shareholders know the limitations of the deployment of iNEDs so they can establish exactly when other governance tools need to be deployed. They may need to undertake their own monitoring of market trends and undertake direct shareholder activism should they be unhappy with market-wide issues.126 Alternatively to activism, shareholder passivity can also help provide a disciplinary function to market-wide issues. In particular, the ability for shareholder exit encourages shareholder apathy, making it rational for them to exit over using their voice to change issues they are unhappy with in the market.128 Should sufficient investors be unhappy with the company performance, the price will drop to such an extent that the company becomes subject to takeover - known as the market for corporate control.129 Each of these has been criticised as being a blunt instrument which lacks nuance for shareholders.130 Nonetheless, when used in conjunction they could act to provide all of the benefits currently claimed of iNEDs. Indeed, other markets exist as well which may act to discourage behaviour endemic in the governance of listed companies which shareholders disagree with - such as the market that the company must try to make profit from, and the labour market. It is beyond the scope of this research to evaluate whether other markets make up for the shortfalls identified herein, but important to note that the limits of the current iNED formulation does not result in shareholders being ultimately

5. Conclusion

iNEDs play a key role in the UK, and global, framework for the corporate governance of listed companies. This is based on a theoretical conception of iNEDS monitoring dominant parties. Our empirical analysis of the directorships of all UK companies listed on the Main Market of the London Stock Exchange reveals that this works to an extent. There is no evidence of cronyism based on director appointments - many intermediate companies are needed to connect any two individual directors, meaning that it seems highly unlikely that directors are appointing iNEDs with whom they have current directorship links. Our study does not extend

125 Barnali Choudhury & Martin Petrin, Corporate governance that ‘works for everyone’: promoting public policies through corporate governance mechanisms 18 Journal of Corporate Law Studies 381 (2018).
to past links, personal links, or professional links falling short of directorships, but instead shows the position in respect of directorship appointments as at a particular time.

There is, though, evidence that the network is connected. Our research unveiled a giant daisy chain of 550 out of 767 companies in our study which are linked. The limitations on our conclusions on cronyism make this even starker - this only covers current director appointments. When we factor in past links, personal links and professional links falling short of directorships, this interconnectivity is only likely to be higher. This demonstrates that there is a limitation to the role of iNEDs. They are able to protect against managerial opportunism, but only to the extent that it is specific to the company. Opportunism seen across the market is not likely to be resolved, indeed the interconnectivity of directors, caused by iNEDs, means that iNEDs are likely to exacerbate this problem rather than resolve it. It remains an open question as to how is best to resolve systemic issues across the entire listed market. Our research shows, though, that iNEDs are not a method that will do so - the pool of those who are eligible to be appointed as iNEDs seems to encourage linkages across the wider listed market.

Most importantly, our research has mapped all directors of UK companies whose shares are listed on the Main Market of the London Stock Exchange for the first time. The new empirical possibilities made available by exploring the UK’s corporate database are endless. This research demonstrates that applying data science techniques to such database can unveil important insights into the application of corporate law and governance. It is important that we take advantage of this opportunity presented to us.
Table 1: Basic Accounting of the Companies, Directors and Directorships.

<table>
<thead>
<tr>
<th></th>
<th>All Companies</th>
<th>Non-AIC Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of companies</td>
<td>767</td>
<td>487</td>
</tr>
<tr>
<td>Number of directors</td>
<td>4123</td>
<td>3232</td>
</tr>
<tr>
<td>Number of directorships</td>
<td>4986</td>
<td>3686</td>
</tr>
<tr>
<td>- of which independent</td>
<td>3623</td>
<td>2409</td>
</tr>
<tr>
<td>- of which non-independent</td>
<td>1363</td>
<td>1277</td>
</tr>
</tbody>
</table>


Table 2: Connected Sets Size, For All Directorships

<table>
<thead>
<tr>
<th>Number of Companies in Set</th>
<th>Number of Sets</th>
<th>Number of Companies in Set</th>
<th>Number of Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>159</td>
<td>1</td>
<td>142</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>306</td>
<td>1</td>
</tr>
<tr>
<td>550</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Connected Sets Size, For Independent Directorships

<table>
<thead>
<tr>
<th>Number of Companies in Set</th>
<th>Number of Sets</th>
<th>Number of Companies in Set</th>
<th>Number of Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>196</td>
<td>1</td>
<td>170</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>283</td>
<td>1</td>
</tr>
<tr>
<td>521</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Connected Sets Size, For Non-Independent Directorships

<table>
<thead>
<tr>
<th>Number of Companies in Set</th>
<th>Number of Sets</th>
<th>Number of Companies in Set</th>
<th>Number of Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>731</td>
<td>1</td>
<td>472</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 1: Depicts an example of the graph structure representing the interconnection of companies and directors via directorships.

NOTE: The directorships may be independent or non-independent. Directors that hold directorships with two or more companies cause those companies and their associated directors to form linked groups. Each such group of interconnected companies and directors is known as a connected set; in this example there are two connected sets, indicated by the black dashed lines.
Figure 2: Frequency of the number of directors per individual, split by directorship type.

**NOTE:** The vertical scale is logarithmic to enhance the detail at low numbers of individuals. The top panel corresponds to all companies, the lower panel corresponds to non-AIC companies. Note that the distribution for all directorship types is not a simple sum of the distributions for independent and non-independent directorships, due to the fact that the e.g. three directorships held by an individual may consist of two independent and one non-independent.
**Figure 3:** Frequency of the number of directors per company, split by directorship type.

**NOTE:** The top panel corresponds to all companies, the lower panel corresponds to non-AIC companies. Note that the distribution for all directorship types is not a simple sum of the distributions for independent and non-independent directorships, due to the fact that the e.g. three directors appointed by a company may consist of two independent and one non-independent.
Figure 4: Distribution of shortest path length between pairs of directors, split by the AIC membership status of the companies they are appointed to.

NOTE: A shortest path length of one corresponds to two directors at the same company. For a pair of directors picked at random (within the same connected set), it is more likely than not that they are separated by a minimum of seven intermediate companies.
Figure 5: Examples of a two-way cycle (left) and three-way cycle (right) of directors with alternating directorship types.

NOTE: The legend is the same as in Figure 1. The two-way cycle depicted on the left, with the directors holding opposing directorship types, is regulated by governance codes.