Peter D. Hahn[1]
Sir John Cass Business School
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p.d.hahn@city.ac.uk

VANISHING BOARD MEETINGS:

HAS GOVERNANCE DOOMED THE BOARD MEETING?

ABSTRACT

Using the agency framework, I test the hypotheses that boards of directors are either shareholders' or managements' agents by identifying determinants of the number of full boards of directors' meetings. Without any external requirement, boards of the UK's largest listed firms consistently choose to have fewer full board meetings and are choosing common frequencies for their meetings. My results show that firm financial factors (e.g. performance) affect the number of board meetings, however, I find stronger negative correlations for non-financial factors on the number of full board meetings (e.g. the addition of foreign non-executive directors strongly influences fewer board meetings). I suggest that a trade-off between increased advisory (diverse members) and reduced monitoring (fewer meetings) has occurred weakening the agency framework.

1.0.0. Introduction

Marconi[2] plc's 1999 annual report noted:

> "The non-executive Directors meet with the Chairman and Chief Executive <u>at least once</u> a year to discuss a wide range of matters affecting the Company."[i]

Marconi plc's 2000 annual report noted:

> "The non-executive Directors meet with the Chairman and Chief Executive <u>at least twice</u> a year to discuss a wide range of matters affecting the Company….."[ii]

How frequently should the board of directors of a large public corporation meet? The board of directors, in theory, provides an internal governance mechanism that is expected to mitigate the agency conflict between managers and shareholders (Fama and Jensen (1983)). However, empirical evidence provided to date on the role, composition, and functioning of the board is mixed with literature surveys on the effectiveness of the board illustrating conflicting results and demonstrating the lack of consensus on what the board does contribute (John and Senbet (1998), and more recently, Hermalin and Weisbach (2003)); the literature, at best, is inconclusive on the value added of the board. Yet the board is the most visible form of corporate governance and is clearly established in UK law and commercial practice.

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[1] The author thanks his supervisor and friend, Professor Meziane Lasfer, Cass Business School, for his guidance and comments.

[2] During the year financial years 1998-2000, General Electric Company plc, one of the twenty largest listed firms in the United Kingdom, sold its largest revenue and profit generating businesses, primarily in the defence industry, and made substantial speculative acquisitions adding to its existing telecommunications and technology businesses renaming itself Marconi plc. Marconi plc defaulted in 2001.

Boards of directors are most often forgotten in good times and quickly rise to prominence in times of firm turmoil. The popular explanation is that boards of directors do not matter (or no one cares) when all is working well and boards are there to grasp control when management is failing. Inevitably, the directors must monitor in order to know when to exert control.

UK corporate governance provides substantial guidance for the activities and procedures of boards of directors and their committees (i.e. what they do at meetings), but corporate governance provides no guidance on how often full boards should meet allowing firm specific needs to determine the necessary number of meetings (Combined Code on Corporate Governance (2003)).[3] The Companies Act (2006) provides that directors can call meetings of members (shareholders) and, thus, indirectly call meetings of the board; noting also that the Act details substantial legal requirements for minutes from meetings. In 1998, when my study begins approximately 85% of the UK's largest listed firms disclose the number of times their boards met in the prior year without any corporate governance requirement to do so. Business precedent, law, corporate governance, and firms themselves ascribe significant value to board meetings yet the literature devotes little attention to such highly documented events.

In 1998 the UK's first Combined Code of Corporate Governance (incorporated Cadbury (1992), Greenbury (1995), and Hampel (1998)) was adopted by the London Stock Exchange, being substantially revised and expanded in successive years (Turnbull Guidance (1999), Smith Guidance (2003) and most recently the Higgs Review (2003)). Indeed, at each expansion the investing public is reminded of the greater burden placed upon board directors and non-executive directors specifically.[4] High profile corporate crises including Enron of the US and Marconi, changing accounting (IAS) and auditing standards, the market balloon and collapse, the continuing pension crisis, and ever greater global competition are all thought to have substantially added to all boards of directors' workload and time commitments. Has board meeting frequency been responsive to such influences? The Combined Code on Corporate Governance, by providing no guidance on full board meetings, allows individual firms this flexibility and given that the Code is almost entirely focused on the board's monitoring and control efforts, I would expect board meetings to have increased through time.

[3] Technically, the Combined Code on Corporate Governance advises (page 5) that "The board should meet sufficiently regularly to discharge its duties effectively."

[4] See Association of British Insurers, 2005, "Less than half of FTSE 100 companies comply with Combined Code on Corporate Governance", Ref 103/05, 12 October. Maitland, Angus, 2002, "Time for a pause in corporate governance reform" Financial Times, 29 April. Fielding, Rachel, 2005, "Non-executives: Balancing the burden", Accountancy Age, 24 June. London Stock Exchange, 2001, "LSE to assist on corporate governance burden", press announcement, 1st April.

Stewardship theory would deem board characteristics (such as meetings) as irrelevant to the execution of a board's governance obligations on the basis that monitoring is an entirely endogenous process. Historical unitary board practice and company law are also blind to board characteristics and composition and deem board responsibility a joint or collective responsibility of all directors; for example, The Companies Act (2006) does not differentiate duties amongst different categories of director [iii] and states that directors' primary responsibility is to shareholders.[iv] However, agency theory (Jensen (1993)) and modern corporate governance (Cadbury (1992)) accentuate that board characteristics are essential to manage the agency conflict and that it is not just that a board exercises governance but that specific board constituents are necessary to exercise governance.

Corporate governance efforts over the past fifteen years which required the audit (Cadbury), remuneration (Greenbury (1995)), and nominating (Higgs (2003)) committees may have also served to muddy the waters on director responsibility and the need for board meetings with the misperception that committee members and their meetings have assumed or bear certain specific key responsibilities and not all board members. The law, however, is very clear that a director who is not on any committee bears equal responsibility to committee members – thus, while an uneducated potential director might conceive that increased committee activity would decrease his or her efforts, *in fact, more committee work undertaken by committee members implies more effort on behalf of directors not on those committees to review the work for which they share equal responsibility – a seemingly strong incentive for more full board meetings.*

The fundamental underpinning of the agency framework is that non-executive directors exercise monitoring and control of management and the agency conflict (Fama and Jensen (1983)). And with some urgency, greater monitoring demand and agency conflicts arise from factors such as negative performance, financial stress, and market collapse --- these events would be expected to result in more monitoring. However, managerial power theory suggests that boards and non-executive directors are controlled by executive directors, and particularly CEOs, whose ability to set agendas (Jensen (1993)) and control information circumvents non-executive directors' monitoring efforts (Bebchuk and Fried (2004)). Multiple board commitments (Fich and Shivdasani (2004)), and lack of clear duties (Lipton and Lorsch (1992)) have also been suggested as limiting non-executive directors efforts to increase their own board contribution or activity. Thus, managers' needs, interests, and efforts may determine board meeting frequency more than non-executive directors needs suggesting the possibility that executive directors use non-executive directors for desired advisory but do not allow optimal monitoring by non-executive directors.

Following the framework of agency theory, if non-executive directors exercise their roles as monitors, where and when do non-executive directors exercise these roles? "Non-executive" specifically incorporates the concept of providing limited commitment or having other commitments or both and significantly highlights the fact that non-executive directors may not spend time monitoring the firm outside of formal meetings.[5] Supporting the agency framework, Lorsch and MacIver's (1989) survey and case based study of US boards in the 1980s provided evidence that boards of directors increased their meeting frequency in times of crises and major challenges and Vafeas' (1999) empirical study of US boards in the early 1990s found that boards increased their meeting frequency following financial distress.

Full board meetings are the only occasions when non-executive directors formally participate in the corporate process; such meetings have minutes and their occurrence is generally reported to shareholders (now required). It is a widely held belief that board meetings and their challenges for non-executive directors have become more demanding and it would be a natural assumption that more demands may require more full meetings. Boards of directors may meet informally or as individuals, by video or telephone, but the sole time they have for formal (and publicly disclosed) face to face reviewing their various committees' work (monitoring) and the debating of corporate strategy (advisory) is at full board meetings. The minutes of full board meetings are not disclosed publicly though actions and approvals may be or become visible, but it is self evident that boards with fewer full board meetings provide fewer opportunities for formal full board discussion and provide less frequent formal reviews of committee work. Thus, the number of full board meetings is one measurement of non-executive director contribution to the corporate process and certainly one of the most visible measures of monitoring the corporate process.[6] [7]

I empirically examine large UK firms' board meeting frequencies from 1998 to 2004 using firm and market data and board demographic and remuneration data. The model developed in this paper finds, in line with prior research (Vafeas (1999)), that firm performance influences the number of meetings but this declines over my study period; however, the model developed finds that the most influential independent variable affecting the number of meetings is the percentage of non-executive directors that are foreign nationals, a variable not previously examined in the literature (see Chart A and Table A). It finds very strong statistical support that percentage of foreign non-executive directors is negatively correlated to the number of

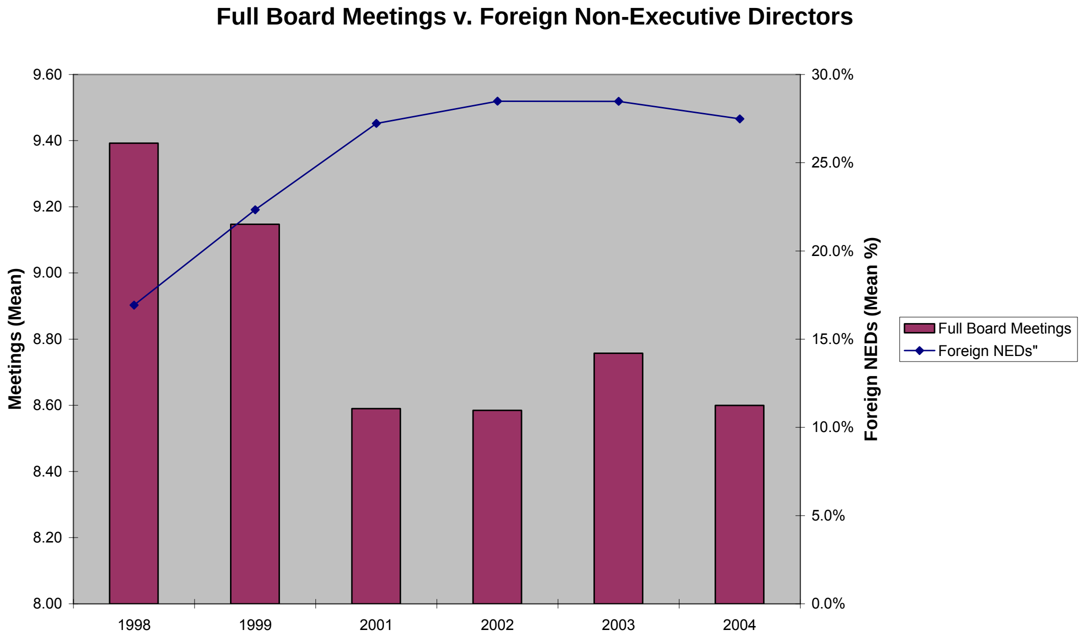
[5] Whilst groups of non-executive directors may meet at committee meetings or informally, non-executive directors are not expected to organise themselves outside of board meetings and, indeed, it has been suggested that non-executive directors follow an unwritten code of not discussing board business amongst themselves outside of board meetings (Lorsch and MacIver (1989)).

[6] It may be argued that recent requirements have created more committee activity as opposed to full board activity; however, of the required three board committees it is likely that only the audit committee would have more than a few meetings per annum and then not all non-executive directors are members of the audit committee.

[7] More than a shareholder or an investor issue, with the demise of active portfolio management and commensurate move into index funds pensioners are ever more dependent on boards and non-executive directors to act on their behalf. Simultaneously, the rise of hedge funds has thrust sudden demands on boards to make quicker decisions.

board meetings. Similar to other board of directors research this paper uses various financial control and governance factors (e.g. independence); however, it is the use of demographic factors such as foreign non-executive directors, gender, and age that have provided new insight. Perhaps, more important to the study of boards of directors' firm specific monitoring efforts is the suggestion that board meeting frequency is becoming more standardised and potentially more bureaucratic as it becomes less idiosyncratic to the firm and seemingly determined as a more convenient or publicly acceptable number (see Charts I, II, and III in section 3.1.0).

Chart A



See Table I below for data description.

Table A

Percentage of Foreign Non-Executive Directors & Mean Number of Full Board Meetings

% of Foreign NEDs on the Board of Directors	Obs.	No. of Meetings (μ)	No. of Meetings (σ)
None	255	9.75	2.13
to 20%	151	9.52	2.42
21 to 33%	122	8.55	2.34
34 to 50%	115	8.03	2.26
51 to 100%	121	6.93	1.44
Total Sample	764	8.81	2.38

See Table I below for data description.

This paper suggests that key factors determining board meeting frequency are not based solely upon firm performance and needs but also upon specific board member factors; and that whilst board meeting frequency is endogenous to the firm, it is also an evolutionary process subject to mean reversion. This paper does not purport to assess boards' contributions, a substantial literature exists; however, *a priori* I make the assumption that those boards of directors that do not meet cannot be providing their non-executive directors the optimum opportunity to exercise their monitoring responsibilities. I further suggest that boards of directors' activity, as measured by meeting frequency, does not strongly support agency theory, and may support managerial power theory.

The remainder of this paper is organised as follows. Section 2 reviews the theoretical framework for boards of directors and theoretical determinants of board meeting frequency. Section 3 presents data & methodology. Section 4 reports the results. Section 5 provides conclusions.

2.0.0. Influencing Board Meeting Frequency

Boards of directors are the apex of corporate governance and visibly exercise governance at board meetings. Without any guidance or instruction from external sources, the number of board meetings selected by a firm may appear a random event as boards chose different meeting frequencies, but do any factors influence the number of meetings? I examine factors that, under the agency framework, would be expected to influence the number of board meetings. A primary assumption is that board meeting frequency can be influenced and the determinants may be discerned.

Agency theory suggests that conflicting interests (Fama and Jensen (1983)) of residual claimants (more scrutiny) and management (less scrutiny) may result in management resisting more frequent meetings when shareholders may deem more frequent meetings necessary to protect their investment. Agency theory relies on non-executive directors exercising their power at board meetings and perhaps exacting the sufficient number of meetings for the exercise of their authority. As with many board characteristics, research has cast doubt on the motivation and effectiveness of non-executive directors to act for shareholders; for example, research on non-executive director remuneration opportunities in the US suggests that pay may serve to dissuade non-executive directors to act on behalf of shareholder interests (Yermack (2004)).

That boards of directors react to certain factors and then meet more or less to address these factors also assumes that we know how directors and boards commit their time. I am unaware of prior research that quantifies how full board meetings commit their time. [8]

Exogenously, increased corporate governance requirements are intended to place a greater responsibility burden and demand increased effort of the board of directors to specifically address certain tasks and over my study period it is expected that incremental corporate governance requirements and external events have substantially increased full board meeting frequency.

With the board playing the critical role defined in law, governance and theory, I suggest factors in six broad areas may influence the selected number of board meetings: Remuneration, Firm Performance, Firm Size, Firm Stress, Demographics of Board Composition, and Corporate Governance.

2.1.0. Theoretical Framework & Hypotheses

Remuneration

Agency theory suggests that non-executive directors exert control over executive directors through the board of directors' process or simply by being board directors. Both theory and governance requirements demand much of the board in setting and monitoring remuneration. Boards with higher paid chairmen and CEOs might be expected to meet more often to review remuneration packages. Contracting theory suggests that chairmen and CEOs provided with higher pay packages are encouraged to provide greater information and disclosure to non-executive directors (Hermalin and Weisbach (2003)) and may positively influence meeting frequency. With the bases of economic theory and incentive remuneration that individuals work more for more pay, higher paid non-executive directors could be expected to have more (or demand more) meetings. Whereas chairmen's and, more so, CEO's remuneration have ties to firm performance, UK non-executive directors are almost universally cash fee remunerated with the Greenbury Report (1995) having specifically recommending that their remuneration be based upon 'time' provided to the firm. I expect non-executive director remuneration and board meeting frequency to be highly correlated.

Firm Performance

[8] It is important to note that whilst corporate governance codes typically note the board's role in strategically leading or driving the business, these codes overwhelmingly focus on regular monitoring, control, and disclosure procedures.

Agency, stewardship, and contracting theories may all suggest that board meeting frequency is correlated to challenges. Firm earnings performance (Hermalin and Weisbach (2003)) and market performance or investor issues may all be expected to influence boards of directors to act and such action may increase or decrease their meeting frequency (Vafeas (1999)). Weakening firm dynamics may require immediate board consent or approval, and non-executive directors may realize an immediate risk to their professional reputations all demanding increased full board meetings[9] suggesting negative correlations with meeting frequency. I expect performance and board meeting frequency to be negatively correlated.

Firm Size

Agency and contracting theories suggest that firms with more challenging business tasks or complex structure have greater advisory and monitoring needs (Agrawal and Knoeber (2001) and Coles, Daniel and Naveen (2005)). In a broad sense, this suggests that firms with greater scale, more diversified activities, or larger staff may all have more monitoring and advisory needs and require more board meetings.[10] While there may be many measures of business complexity and structure, I use the number of employees as a measure of size of the task at hand. I expect the number of employees and board meeting frequency to be correlated.

Firm Stress

Agency theory suggests boards of directors becoming more active in response to financial stress (John and Senbet (1998), Vafeas (1999) and Hillier et al. (2003)) and I expect financial stress, as measured by debt to cash flow, and board meeting frequency to be correlated. Debt to cash flow is widely held to be the major determinant of debt ratings and indication of financial stress by both major agencies.

Demographics

Contrary to the agency framework of this paper, the managerial power theory suggests that executive directors may select board members to facilitate executive control circumventing monitoring and control by non-executive directors (for example, Kaufman, Englander and Tucci (2005) discuss the selection of other US CEOs as non-executive directors to enhance executive remuneration) and implying reduced

[9]In the US, Gilson (1990) and Kaplan and Reishus (1990) suggested that directors of distressed firms were not as likely to obtain subsequent directors positions.
[10] Such factors may be misleading in that the largest, most international firm may have a limited business activity or firms with large numbers of employees may be in less complex businesses.

meeting frequency[11]. The agency framework suggests that shareholders' monitoring interests may be met with more diverse board directors as certain groups of directors may provide special skills or experience. Research that has reviewed specific directors groups and/or types of directors or includes director characteristics as descriptive or independent variables includes: busyness (Core et al. (1999), Cotter et al. (1997), Brown et al. (1999), Ferris et al (2003), Fich et al. (2004)), diversity (Carter et al. (2002), van der Walt et al. (2003), and Singh (2004)), age factors (Core et al. (1999), Chhacochharia et al. (2004), Yermack (2004)), gender (Agrawal et al. (2001), Singh et al. (2004), Farrell et al. (2005)), and professional backgrounds (Kroszner et al. (1999), Jagannathan et al. (2004), Helland et al. (2003), Dionne et al. (2005), Borokhovich et al. (2004), among others, but provides little information about their influencing board meeting frequency.

No prior research has addressed the effects of foreign directors on the board, yet they have become a major presence in the UK's boardrooms. Amongst the 150 largest listed firms in the UK, foreign directors (executive and non-executive), i.e. those directors with non-British nationality, held a mean 1.82 board seats in 1998 and 2.51 board seats in 2004. Whilst this represented a change of 38% in total board seats it occurred during a period of declining board size with total foreign directors representing a mean 15.5% of the mean board in 1998 and 22.0 % in 2004 for an increase in representation of 42.1%. Firms with foreign non-executive directors increased substantially from 50% in 1998 to 67.3% in 2004 with a peak occurring in 2002 at 71.3%. The mean percentage of foreign non-executive directors on the largest 150 listed firms' boards was 18% in 1998 and 28% in 2004.[12] Foreign non-executive directors are thought to provide knowledge of international markets that domestic non-executive directors may lack but foreign directors may also lack knowledge of local corporate governance standards or be unfamiliar with local accounting, for example. By definition, a foreign director is less likely to reside in the UK and I expect foreign non-executive directors and board meeting frequency to be negatively correlated.

The growing literature on gender in the UK has noted a significant increase in women becoming non-executive directors whilst also noting that a significant percentage of women joining large firms' boards that do not have related work experience (Singh and Vinnicombe (2004)), I have found no research relating to gender and board meetings. Since the arrival of the Labour Government in 1997 and its significant and visible addition of women to senior roles, boards have been strongly encouraged to add women directors (Higgs (2003)) to increase the diversity of skills on the board. The addition of added skills suggests increased board meeting frequency to exercise these skills. I also expect that women increase their

[11] Whilst Berle and Means (1932) had suggested management control of the board in an earlier age, Bebchuk and Fried (2004) provide extensive evidence of US CEO compensation that suggests managers controlling boards for their own purposes.
[12] The number of foreign non-executive directors divided by the total number of non-executive directors. For this calculation, a foreign non-executive chairman would be included in the calculation (rare).

presence on boards that may be less desirable (poor performance firms) (Ryan and Haslam (2005)) and their presence will be correlated with board meeting frequency.

I have found limited research on age, and note that the age of directors may represent or signify entrenched interests. Entrenched interests may desire or circumvent monitoring efforts and I expect older boards to have reduced meeting frequency in order to reduce monitoring (Hermalin and Weisbach (2003)).

Corporate Governance

Board independence has been extensively and inconclusively studied as a variant of corporate performance (Hermalin and Weisbach (1991), Bhagat and Black (1999 and 2002), and Coles, Daniel and Naveen (2005)), but less so as an influence on board meeting frequency (Vafeas (1999)). Increasing board size has negative associations, the Combined Code (2003) suggests that larger boards are 'unwieldy' and research (for the US, Yermack (1996), for the UK, Lasfer (2005)) suggests that larger boards do not or cannot monitor or control the agency problem as well as smaller boards. Vafeas (1999) found a positive correlation between US board size and meeting frequency suggesting this was due to increased board education efforts and inefficiency, however, due to the unquestionably higher level of international diversity on UK boards (compared to US boards) I expect that larger boards of directors have lower meeting frequency simply due to greater travel burdens on directors.

2.2.0. Theoretical Speculation

Mean Reversion (and disconnection with financial theory)

Britain's largest firms operate in a vast range of industries and disparate territories experiencing an immense range of successes and failures. Financial and economic theories suggest that within these parameters are selected factors that influence board of directors' activity, such as boards of directors meetings being correlated with financial challenges. However, the majority of Britain's largest firms have offices within a 15 mile radius of Piccadilly Circus finding it easy to witness other large corporate behavior. I suggest that boards of directors meetings may be influenced by non-financial factors, but observable factors. Most salient among these non-financial factors may be the perception of public acceptability or what is perceived to be normal or beyond criticism. For example, when firms did not disclose the number of board meetings, the number of meetings was *a priori* endogenous. However, when more firms disclose the number of meetings or more attention is focused on the number of meetings and pressure may build for firms to change their number of meeting times to the visible average. Thus, I expect the statistical constant, in regression analyses, to be positively correlated and significant.

Communications (information overload) & Governance Bureaucracy

Prior to my study period, non-executive directors could only have received information by telephone or in hard copy prior to or between meetings. By the time of this study, it was easier and assumable that director briefings were more continual, and perhaps digital. There is no theoretical basis to suggest that such increased communication serves to increase or decrease the required amount of board meetings. Indeed, non-executive directors may perceive such flows of information as requiring additional time commitment and may accordingly resist increased board meetings as a time management tool. The Combined Code (2003) (from Higgs (2003)) provides a non-executive directors' sample commitment letter which explicitly states that non-executive directors receive a contract for services for a specifically indicated number of committed days and expected full board meeting appearances, with the implication that the board commitment is less of a flexible responsive position than a bureaucratic commitment.

2.3.0. Measuring the Value of Monitoring

Whilst the agency framework and the Combined Code suggest various roles of the board, undoubtedly the most difficult to measure is monitoring; inherently, monitoring implies the prevention of problems. Problems that occur generally indicate failures of monitoring but problems that do not occur are not necessarily the result of superior monitoring. Agency and corporate governance suggest that monitoring is necessary and elaborately structure the board of directors to undertake this role for corporations whether on behalf of shareholders or others. Recent UK governance guidelines specifically addressed to the monitoring role of the board includes the requirement for a minimal amount of financial literacy (Combined Code (2003)) following on the earlier requirement for audit committees (Cadbury (1992)) amongst numerous other factors (e.g. split chairman/CEO roles, independence of directors definitions, etc.) that boards of directors must address. Governance thus makes demands of boards of directors to address these monitoring demands at their board meetings, yet regulation does not address the amount of time to be devoted or the frequency of board meetings to address such monitoring. I expect that board meeting frequency is influenced by many factors including firms' characteristics and the structure of boards (Vafeas (1999)), however, I suggest that literature has to date overlooked key human dimensions such as the international composition of the board, gender, and remuneration as determinants of board meeting frequency and monitoring efforts.

3.0.0. Data and Methodology

I construct a balanced panel data sample that covers the largest 150 listed firms on the London Stock Exchange for the years 1998 to 2004 as selected by Spencer Stuart, the executive search firm, and published in their UK Board Indices. There are no investment trusts and virtually all major industrial segments are represented. The Board Indices include board data from annual reports which I have supplemented when missing (rare cases). I have collated and statistically analysed information taken from the board indices independently and have not used any statistical analysis that may have been provided in the board indices unless noted. UK listed firms rarely follow a calendar year reporting cycle, particularly as the UK annual tax cycle is April to March. Therefore, whilst the 1998 selection criteria is market size at July 1998, the annual reports utilised for the year 1998 include firms with year ends from September 1997 through August 1998.[13] All board data was manually entered for quantitative analysis. Corporate, accounting, and market data was downloaded from Thomson Datastream for end July of each year. All information used is publicly available.

I intentionally chose to work with the 150 largest firms and not solely the FTSE 100, the UK's largest 100 listed companies, in order to have a larger amount of data and to observe changing practice at the country's largest firms.[14] The 150 largest firms in the UK include firms with market capitalisations exceeding £100 billion to firms with market capitalisations of slightly less than £1billion[15]. Whilst that gap is vast, prejudice on size in the top 150 is not totally appropriate, for example the four highest paid CEOs in 2004 were not among the mega sized top twenty firms and two of these four were in the smallest third of firms. The top 150 firms are the firms that are the most international, most researched by investment banks, have access to public capital markets, and are advised by domestic and foreign banks. The large majority of these firms have headquarters within the greater London area or have board meeting facilities within central

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[13] There was no board index published for the year ending July 2000. I have created my own index for that year to assess certain variables.

[14] Dependent on the year, the largest 150 firms will represent roughly 85-90% of total market capitalisation in the UK and by definition these firms are included within the FTSE 100 and FTSE 250 (literally the 1st to the 100th and the 101st to the 350th largest listed firms) indices which make up the major components of tracking or index fund investment in the UK and from abroad. Material institutional holdings are represented in both indices based upon the structure of UK pension investment.

[15] By 2004 only 95 of the original 150 firms remain (roughly 40 of the original firms disappeared due to merger, acquisition, or failure), whilst my results could potentially be different if I restricted my analysis to this surviving 95 firms (avg. meetings of 9.22 in 1998 reduce to 8.76 in 2004 are similar to the sample used), my intention is to reveal how the largest 150 firms structure their boards of directors efforts each year as a group and less so the individual board changes that have occurred at each firm. Over 200 different firms were analysed. From findings that non-executive directors' average board tenure is slightly over 4 years survey data over the 7 year period implies that non-executive directors turned over almost two times suggesting data on more than 1200 different non-executive directors participative decisions were assessed (incl. multiple directors).

London, an important dynamic for a diverse board of directors in the UK (and also perhaps allowing the directors to belong to the same social clubs)[16].

Information on non-executive directors and executive directors is relatively clear (though occasionally director changes overlap or leave gaps at reporting periods which may slightly distort my data). No information on board meetings was disclosed by 15% of firms in 1998 declining to 6% of firms in the last two years reducing the sample by 70 firms; oddly, few firms omit the information consistently and some seem to just skip the information periodically. A few firms consistently stated their board meets within a range (e.g. 6-8 times per year) or that the board meets at least a given number of times (in these instances I have used the average of the former and added 1 to the latter consistently over the period in the belief that if a board did meet 4 or 10 times it would be seriously misleading to inform shareholders that it met materially more or less). I have only intentionally omitted the meeting statistics of William Morrison during the first 5 years of data as the company had no non-executive directors and it appeared the reported board of directors bi-weekly meetings may have been staff meetings as well. Missing or inaccurate firm and market information further reduces my sample size to 764 firm years (missing data largely results from market data omissions from Datastream on companies that have been acquired, acquire, demerge, or have dual listings). These omissions do not provide survivorship bias as they are equally distributed among vanished and continuing firms.

To measure firm performance I use the change from the prior year's pre-tax income[17]. I have not used net income due to the distortions that tax provisioning may provide. Performance measures that relied on balance sheet items were unreliable over my study period largely due to the UK's historical accounting regime which wrote off 100% of goodwill on acquisitions reducing both asset and equity measures and the diverse industries included. Extremes are normal during the survey period due to the M&A and dot.com booms in the early years and the subsequent write-offs in the latter years.

[16]An invisible and immoveable line seems to exist in the UK wherein, generally, firms with significantly less than £1 billion market caps will likely have fewer investment banks researching their share performance, fewer international shareholders, less access to public capital markets, be less banked by non-local banks, be less international, and less likely to be in London and, may thus, attract different directors to their boards of directors solely due to size. Broadly speaking, the UK domestic market is relatively small (for non-retailers); firms solely focused domestically will generally be unlikely to achieve the market capital size to be among the 150 largest firms. The Financial Times (2005) noted that UBS, the Swiss Headquartered bank, had estimated that FTSE 100 (non-financial companies) had 51% of their sales in the domestic market in 1999 which had declined to 32% in the UK (28% were in North America) by 2005, if accurate, such figures would surely over represent UK activity through the inclusion of 3 large grocers in the FTSE 100 that have no North American Business.

[17] Until 1998, UK accounting standards required the 100% write-off of all goodwill at acquisition (changing to a 20 year amortisation post 1998) the effect of which was underrepresented equity values at a substantial number of large firms. In this regard, accounting based return measures such as ROE remained invalid for many years post 1998.

To measure financial stress, for non-financial firms, I use Total Debt to EBITDA and Total Debt to Market Capitalisation. Traditional gearing measures (i.e. leverage) or debt to capitalisation ratios would have been misleading as a measure of stress[18]. Total Debt to EBITDA of 2.9x (μ) and 2.1 (median) indicate an average A to BBB+ credit range is slightly distorted by a strong representation of consumer goods and services firms which support higher gearing ratios (suggesting a somewhat higher or centre investment grade quality and limited average financial stress).

Firm descriptive attributes include the number of employees and market capitalisation (and specific industry segmentation in Panel B). The mean employee number of 35,289 over-represents a small number of the largest firms and a number of domestic retailers and retail focused financial institutions, but is a more stable descriptive factor of the sample firms over time than market capitalisation. Market capitalisation varied widely over the time periods' ballooning and collapsing markets. I have used a logarithmic scale for these variables in my regressions. For my principle regressions I use employees and, in robustness tests, I use market capitalisation. The Correlations Table (see Appendix) indicates a high correlation and possible autocorrelation of market capitalisation and employees (0.41), however, this is somewhat misleading due to the significant presence of retailers and retail banks (only 20% of the top 5% employee firms are amongst the firms within the top 5% market capitalisation and only 5% of the smallest 5% of employee number firms are amongst the smallest 5% market capitalisation firms).

To measure stock market factors that may influence the number of board meetings, I utilize Price to Earnings (PE) and Market Value to Book Value ratios noting that where firms had negatives earnings or equity I substituted the average ratio of the sector in that year. Due to the market balloon and bust, wild and extreme PE swings encouraged the use of a logarithmic scale in my regression analysis. Whilst it may be perceived that PE and Market Value to Book Value are autocorrelated, the Correlations Table provides no indication of correlation most likely due to historical goodwill write-off accounting and the minor representation of traditional tangible asset intensive firms compared to industrial sectors whose earnings generation are based upon non-balance sheet recognised intangible assets. For my principle regressions I use PE, and in robustness tests, I use market value to book value.

To measure remuneration factors that may influence the number of board meetings, I utilise three measures of board pay. I use each firm's average non-executive director fee in my calculations. The mean £37,750 is indicative of the increasing trend of remuneration (*μ= 30k, σ=10.2k* in 1998 and *μ=47k, σ=12.6k* in 2004) and the variance is indicative of the lack of performance effects (absence of non-fee remuneration).

[18] See note 16 above. Also, through the 1990s many firms only provided their 'net debt' on financial statements limiting the relevance of pure balance sheet gearing ratios.

Chairmen's mean remuneration[19] of £359,000 belies the minor volatility exposure of remuneration over the survey period and chairmen's exposure to variable award remuneration from the board (*μ= 361k, σ=351k* in 1998 and *μ=344k, σ=395k* in 2004). CEO mean remuneration of £992,000 belies the general awareness of rapidly increasing executive pay (*μ= 677k, σ=410k* in 1998 and *μ=1258k, σ=853k* in 2004) and various forms of incentives and award remuneration. With the understanding that options, pensions, and other management remuneration may not have been accurately reported for CEOs and a very small group of chairmen during the study period, I used the Board Indices' remuneration statistics for consistency (whilst I used the Board Indices information and my own calculations for non-executive directors remuneration). These simple statistics indicate that only chairmen (mean) faced volatility or downside in pay. Whilst chairmen's mean pay volatility was undoubtedly linked to overall weak market performance in the latter years of this study, corporate governance uniformly assigns the principle role of non-executive chairmen as managing and leading the board which adds the question of whether chairmen's remuneration may have suffered volatility due to their management of the board (and board meeting policy) as opposed to firm performance.

To measure corporate governance as an influence of board meeting frequency, I first use board independence or the ratio of all non-executive directors[20] excluding the chairman to total board directors. The mean figure of 50.9% cannot convey that the 1998 mean was a 48% minority which steadily increased to a mean 53% majority in 2004. I have not utilised the Combined Code (2003) definitions of independence for non-executive directors as these would have been inappropriate for earlier years when a more liberal standard was accepted (Chambers (2005)).

A second metric of corporate governance measures the ages of non-executive directors' influences board meeting frequency. The ages of board members may suggest longer board tenor (and possibly entrenchment) on the board, reduced independence, or reduced interest in the firm potentially influencing the frequency of board meetings and I measure the average age of non-executive directors and executive directors[21]. Interestingly, the means (58 years and 51 years, respectively) did not decline or increase over the study period.[22]

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[19] In each year 5-7 (<5%) chairman are listed as executive, i.e. also CEOs.

[20] I do not include the chairman as a non-executive director following UK corporate governance convention.

[21] I also examined the tenor of non-executive directors, however, this showed autocorrelation with non-executive director age in regressions; these statistics are omitted from this paper.

[22] In unreported results, I found non-executive director age and non-executive director length of service were correlated significantly.

A third metric of corporate governance measures the presence of foreign directors' influence on board meeting frequency. Foreign directors' influence on the frequency of board meetings of the boards of large listed firms is measured as the percentage of foreign non-executive directors (those listed in the annual report as not British) to total non-executive directors. I believe that using total foreign directors as a measure may be misleading as foreign executives would be more likely to be resident in the UK and may have similar attributes to British directors. Foreign non-executive directors increased from a mean 17% to 28% of non-executive directors from 1998 to 2004.

A fourth metric of corporate governance measures the presence of women directors' influence on the board meeting frequency. Women directors' influence on the frequency of board meetings of the boards of large listed firms is the percentage of women non-executive directors to total non-executive directors. The very small minority of women executive directors would challenge the significance of any findings based upon such statistics (of the largest 150 listed firms 89% did not have a woman executive director in 2004, while 51% had at least one woman non-executive director). The average presence of women non-executive directors increased from a mean of 8% to a mean of 12% from 1998 to 2004.

I used Excel for mean, median, and standard deviation (σ), Pearson correlation coefficients[v], and chi-square (X^2)[vi] calculations and Eviews for regression calculations.

4.0.0. Results

4.1.0. Univariate Analysis of Board Meetings

Provided in Table I (and in the Appendix) are descriptive statistics of my sample. Whilst Panel A provides cumulative statistics over the study period, it cannot demonstrate the significant evolution of boards of directors and meetings over the study period (See Panel C). Panel A indicates firms having mean board meetings of 8.81 times per annum over the study period amongst other variables that I have examined for their influence upon the number of board meetings. Included with the univariate analysis are board meeting frequency correlation statistics. Panel B demonstrates the variation that exists amongst various industries. Utilities and Financial Institutions average the most board meetings with strong support from chi-square statistics suggesting that meeting frequency is related to these industries. Whilst in many countries, both of these industries are heavily regulated, the UK's 'light touch' regulation and the likelihood of substantial unregulated activities suggests that these industries may not have more meetings due to their regulatory status but perhaps due to their predominantly domestic activity or board composition. [23] Foreign non-executive directors represent only 14% of non-executive directors at Utilities and 16% of non-executive directors at Financial Institutions, whilst foreign non-executive directors represent over 39% of non-executive directors at more global Consumer Goods firms, the industry with the lowest mean board meetings.

Full Board Meetings are as noted in the annual report as board meetings and strategy sessions. Meetings consistently decline over the study period from a mean 9.39 meetings in 1998 (1997-1998) to a mean of 8.60 meetings in 2004 (2003-2004), with the exception of a minor increase in the mean during the penultimate year. There is the suggestion that the mean frequency has stabilised in the last few years of my data. However, the standardisation process observed in Charts I, II, and III, the reduced standard deviations, and the strong chi-square values for annual statistics add further support to the concept of boards choosing a "market acceptable" number of times to meet.

[23] Anyone visiting the City of London could be excused for believing that the UK's only industry is financial services. Financial services firms represent 25-30% of the market capitalisation of the largest 150 firms and compete with industrial firms for the same pool of non-executive directors.

Table I - Descriptive Statistics Panel A
Cumulative Statistics 1998-2004

	Mean	Median	Minimum	Maximum	Standard Deviation	Correlations w/ Meetings
Full Board Meetings	8.81	9	4	17	2.38	1.000
Board Size (Total Directors)	11.09	11	5	22	2.74	0.059
Market Capitalisation (£millions)	7929	3224	582	128579	15467	0.017
Employees (000)	35289	19441	137	412574	47409	0.065
Change in Pre-Tax Income For the Prior Year	-2.7%	4.9%	-1215.5%	1728.6%	190.4%	-0.061
Market Value / Book Value Ratio	3.65	2.19	-692.17	1418.49	60.48	-0.041
Price Earnings Ratio	20.0	15.7	4.9	374.6	20.3	-0.147
Debt / EBITDA (only Non-FIs)	2.9	2.1	-219.7	302.3	16.6	-0.035
Debt / Market Cap (only Non-FIs)	40.3%	30.2%	0.0%	471.7%	44.9%	0.128
Remuneration of the Chairman (£000)	359	220	0	6175	423	-0.163
Remuneration of the CEO (£000)	992	765	170	6883	764	-0.161
Average Remuneration of Non-Executive Directors (£000)	37.75	35.00	14.50	104.20	12.38	0.027
Board Independence (NEDs/Board Size)	50.9%	50.0%	22.2%	80.0%	10.8%	-0.112
Foreign Non-Executive Directors / Total Non-Executive Directors	25.5%	20.0%	0.0%	100.0%	24.8%	-0.432
Women Non-Executive Directors / Total Non-Executive Directors	10.3%	0.0%	0.0%	66.7%	12.4%	0.219
Average Age of Non-Executive Directors (Years)	58.23	58.00	44.50	70.00	3.29	-0.068
Average Age of Executive Directors (Years)	50.33	51.00	35.00	60.00	3.67	0.008
Number of Firm Years	**764**					
Number of Firms	**203**					

*Only 31 companies or firm years had market capitalisations below £1bn and 3 companies had market capitalisations below £600million

**Debt/EBITDA and Debt/Market Cap were only utilised for non-financial institutions calculations
*** Extremes of Market to Book and PE occurred due to negative equity situations (prior to 1998 UK GAAP required the 100% of goodwill on acquisition) these occurrences are more pronounced in early years.
Employees vary immensely from large property firms that own dozens of London buildings but have only hundreds of employees to global retailers with hundreds of thousands of employees.

Table I Panel B

Cumulative Descriptive Statistics by Industry

Full Board Meetings	Average (μ)	*Chi-Sq. (X^2)*	Median	Maximum	Minimum	Standard Deviation	% Foreign Non-Executive Directors	Firm Years (Obs)
Utilities	10.03	80.431**	10	15	5	1.98	13.5%	59
Financial Institutions	9.49	128.299**	10	16	4	2.79	16.2%	156
Industrials	8.85	94.487	9	12	4	1.99	20.7%	136
Consumer Services	8.81	83.030	9	15	4	2.14	24.3%	176
Basic Industries	8.60	68.687	9	17	4	2.27	42.4%	65
Tech & Telecom	8.02	60.168	8	14	4	2.42	31.5%	55
Consumer Goods	7.68	123.028*	7	16	5	2.26	39.1%	117

Panel C

Annual Statistics

Full Board Meetings	Average (μ)	*Chi-Sq. (X^2)*	Median	Maximum	Minimum	Standard Deviation	% Foreign Non-Executive Directors	Firm Years (Obs)
1998	9.39	284.922***	10	16	4	2.70	16.9%	107
1999	9.15	281.074***	9	16	4	2.56	22.3%	122
2001	8.59	268.888***	8	15	4	2.58	27.2%	133
2002	8.59	203.018***	9	13	4	2.15	28.5%	135
2003	8.76	201.836***	9	16	5	2.14	28.5%	136
2004	8.60	224.605***	9	17	4	2.13	27.5%	131

I initially use the largest 150 listed firms in the UK as selected in Spencer Stuart's UK Board Indices for years 1988, 1999, 2000/2001, 2002, 2003, 2004, which excludes investment trusts, finally reducing the sample size where missing data occurs, for example there are over 70 instances where firms fail to provide the number of board meetings in their annual reports. Chi-Square (X^2) values exceed (0.01)***, (0.05)**, and (0.10)* critical values.

Panel B provides an indication of the variation in meeting frequency by industry. Remarkably, industries experiencing some of the most volatility, technology and telecommunications, have some of the lowest mean board meetings frequencies (the sample is small). Also of note, utilities and financial institutions, which are largely domestic and the least internationally diversified, have the most meetings. These industries have the lowest mean foreign non-executive directors. While not provided in the chart, utilities and financial institutions have the highest and third highest mean percentages of women non-executive directors, respectively. Basic industries has the largest mean board (12.01 members) and utilities has the smallest mean board 10.03 members), though it must be noted that mean market capitalisation and the mean number of employees of basic industries are 3x and 4x the mean market capitalisation and the mean number of employees of utilities.

Panel C demonstrates part of the board meeting frequency evolutionary process. The mean board is meeting less with less variation (σ drops from 2.70 to 2.13). Whilst most corporate officers and employees are contractually obligated to be present at a work location a specified amount, boards choose when they meet and, indeed, along with choosing to meet less, boards are independently choosing to meet at similar intervals. This is somewhat surprising as over the study period, corporate governance requirements increased significantly, market turmoil reigned as the FTSE 100 fell over 40% which also had the dual effects of lower corporate valuations but also creating massive deficits in corporate pension assets, and corporate scandals, board litigation and new accounting standards weighed heavily on boards. Following are three charts which graphically illustrate the standardisation of board meeting frequency. Chart I provides the range of board meetings in 1998 with perhaps the most peculiar aspect being that boards preferred to have even numbers of meetings over the year. Chart II provides evidence of boards moving toward a common number of meetings whilst Chart III virtually demonstrates the standardisation having occurred.

Chart I

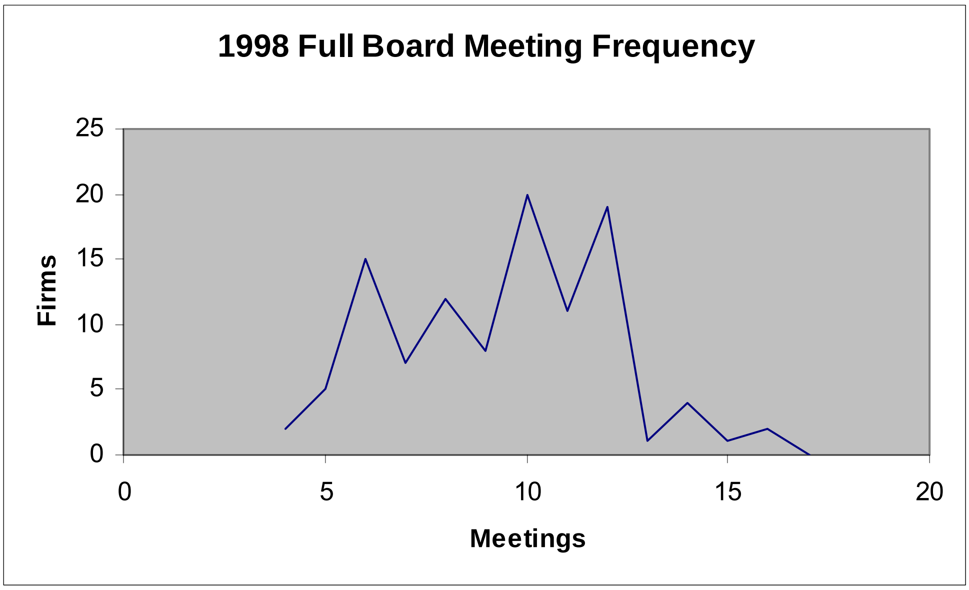


Chart II

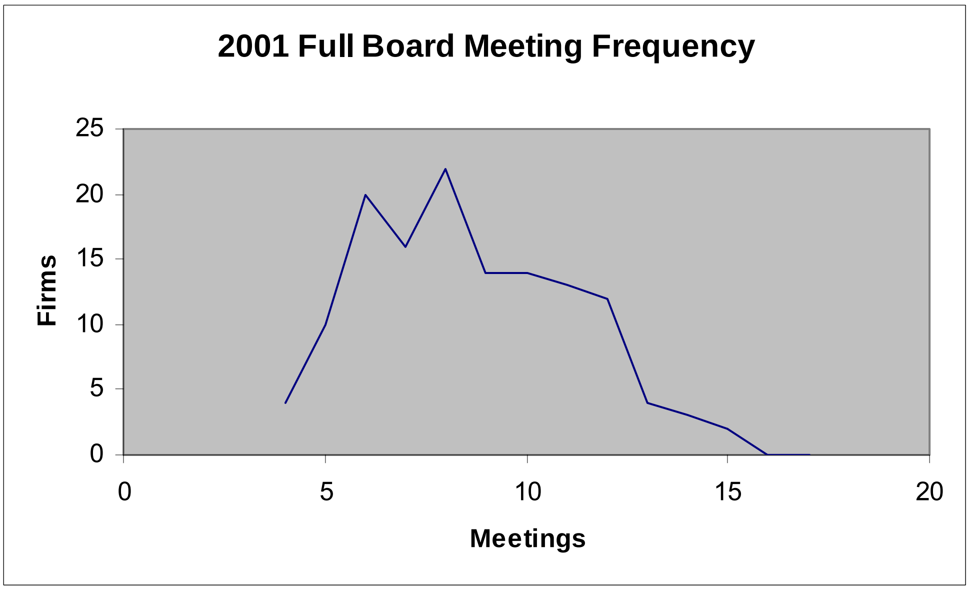
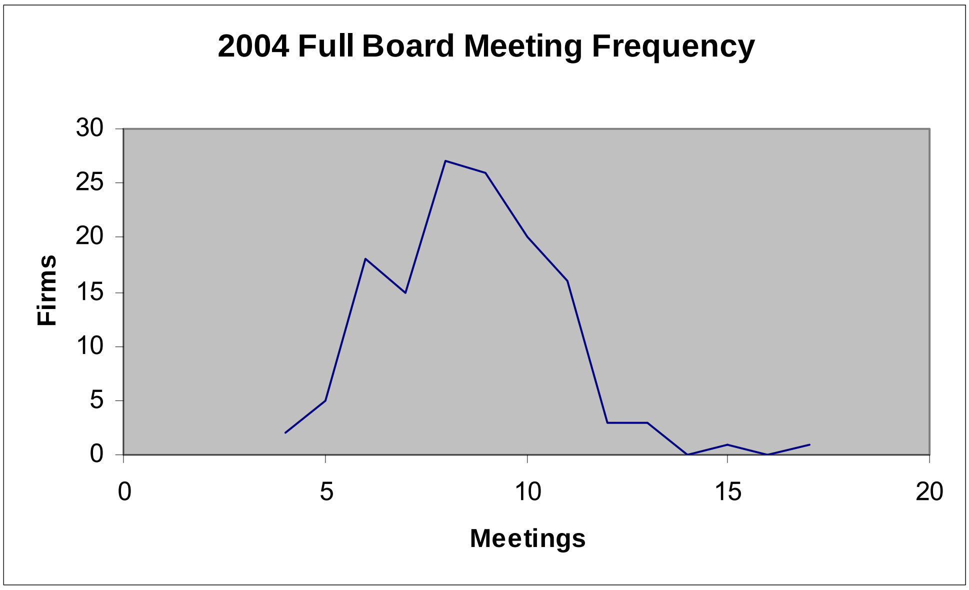


Chart III



Further supporting evidence of standardization of board meeting frequency around the mean is demonstrated in Table II indicating that 42% of firms held between 7 and 10 meetings in 1998 increasing to more than 60% by 2004. Whilst not shown in the table, only 47% of firms had 9 meetings or less in 1998 climbing to over 66% of firms by 2004. The distribution also notes a lack of firms experiencing extreme needs for full board meetings with less than 5% of firms needing more than an average monthly meeting in each of the last three years. Whilst this may suggest that urgent meetings and information may be communicated electronically, it also suggests that boards of directors today may be less able to adjust their meeting schedules in times of dire need.

TABLE II – Board Meetings Move to the Mean
(or The Changing Distribution of Board Meetings)

	Up to 6 Meetings	7 or 8 Meetings	9 or 10 Meetings	11 or 12 Meetings	13 or More Meetings
1998	23%	17%	25%	26%	9%
1999	22%	25%	24%	25%	6%
2001	25%	29%	22%	18%	6%
2002	23%	28%	28%	21%	1%
2003	18%	29%	32%	17%	3%
2004	19%	27%	33%	15%	4%

*Percentages may not equal 100 due to rounding. Data is from the same sample selected for TABLE I above. To be read as 25% of firms had fewer than 7 full board meetings in 2001 and 29% of firms had 7 or 8 meetings in 2001.

4.2.0. Multivariate Analysis of Board Meetings

Table III provides evidence from testing the theoretical bases discussed above. My regression formula is

$$\text{Full Board Meetings} = \alpha_0 + \alpha_1 \text{board independence} + \alpha_2 \text{board size} + \alpha_3 \text{change in prior year pre-tax income} + \alpha_4 \text{industry dummies……} + \alpha_9 \text{executive director age} + \alpha_{10} \text{Log(market capitalization)} + \alpha_{11} \text{foreign non-executive directors} + \alpha_{12} \text{women non-executive directors} + \alpha_{13} \text{non-executive director age} + \alpha_{14} \text{Log(PE)} + \alpha_{15} \text{CEO remuneration} + \alpha_{16} \text{Chairman remuneration} + \alpha_{17} \text{Non-executive remuneration} + \alpha_{18...23} \text{year dummies} + \varepsilon$$

The agency framework and managerial power find strong support in the results of this regression. Within the agency framework, and as expected, changes in pre-tax income in the prior year were negatively correlated *(p=0.0205)* to board meeting frequency suggesting that non-executive directors may exert more pressure to meet when the firm's prospects decline and do so in a timely matter. In a further, not included, regression where I eliminated 5% of extreme earnings changes (+ and -) significance increased. Considering that boards may have extra meetings to approve the largest of write-downs of assets or sales of undervalued subsidiaries which both affect reported income, this increased correlation does not support agency. The agency framework is supported by PE(log) having a negative correlation with meeting frequency *(0.0007)* suggesting that firms with high relative share performance experience less board activity and that boards react to market performance. However, in a further regression that is not provided, I used total shareholder return (TSR) as an independent variable and noted no correlation suggesting that the board may be reactive to market performance rather than firm managed performance. This conclusion suggests that boards act upon market decisions and not fundamentals.

Table III

Cumulative Regression Statistics (for Full Board Meetings)

Variable	Coefficient	t-Statistic	*p-Value*
C	8.1258	4.465	*0.0000*
Board Independence	0.4530	0.603	*0.5468*
Board Size	0.0411	1.221	*0.2223*
Change in Pre-Tax Income During Year	-0.0886	-2.322	*0.0205*
Exec. Director Age	0.0123	0.550	*0.5827*
Employees (log)	0.7369	4.560	*0.0000*

Foreign NEDs	-3.5711	-9.662	*0.0000*
Non-Exec. Dir. Age	-0.0217	-0.925	*0.3552*
PE (log)	-1.3935	-3.417	*0.0007*
CEO Pay	-0.0001	-1.125	*0.2610*
Chair Pay	-0.0008	-3.668	*0.0003*
Non-Exec. Dir. Pay	0.0131	1.665	*0.0963*
Women NEDs	2.6675	3.921	*0.0001*
Industry Dummies*		-	*0.00-0.92*
Year Dummies*		-	*0.01-0.57*
Sample Size	764		
Adjusted R-squared	31.5%		
F-statistic	16.08		

The sample is derived from the 150 largest listed firms as detailed in Table I above. Missing from this table are year dummies (not significant) and industry dummy variables (Basic Industries, Consumer Goods, Consumer Services, Industrials, Technology and Telecoms, Financial Services, and Utilities); only Financial Services was significant at the 90% level.

The concept that boards of directors meeting frequency may be determined by non-financial factors and is mean reverting finds strong support in the positive correlation of the constant and board meeting frequency *(0.0000)*. This suggests that the agency framework may be less in contrast to managerial power in setting meeting frequency than in conflict with more bureaucratic factors or directors time constraints which may be driving the standardization of board meeting frequency across firms. In regressions where the constant is removed, industry dummies gain significance, but other explanatory variables do not.

Employees(log) are highly correlated *(0.0000)* with meeting frequency; this supports the agency framework if increasing employee numbers are a proxy for firm complexity and higher monitoring needs. In separate regressions, I also tested market capitalization(log) and found that market capitalization, whilst correlated with meeting frequency, provided less explanatory significance than employees(log). This comparison may suggest that employee numbers are a better proxy for firm complexity or that boards are preoccupied with larger employee firms amongst other non-financial factors. Of course, market values varied significantly over the study period.

The Combined Code specifically suggests[24], and agency theory may suggest, that longer serving non-executive directors (non-executive director age as proxy) are less desirable monitors. This was supported by the model (coefficient negative, but not significant). Opposite to expectation, longer serving management (executive director age as proxy) had a positive coefficient but this also was not significant. Univariate analysis and chi-square results also support the concept that age is not a factor influencing board meeting frequency.

[24] The Combined Code on Corporate Governance, 2003 revision, instructs that non-executive directors with nine years of service not be included as an independent director for the calculation of majority board independence, strongly suggesting that longer serving non-executive directors have interests aligned with management.

The strongest statistical influence on board meeting frequency, beyond the constant, is the presence of foreign non-executive directors which is negatively correlated *(0.0000).* Simply, foreign non-executive directors by definition are likely to have increased travel time requirements which may exert downward pressure on their desired frequency of board meetings. Foreign non-executive directors increased as a presence on largest 150 firms' boards from 50% to 67% of firms between 1998 and 2004, and the mean firm in my sample has 25% foreign non-executive directors. Agency framework supports the consideration that foreign non-executive directors are recruited to provide a broader range of skills to the non-executive director group to best manage the agency conflict. However, prior US research shows that the selection of new board members is strongly influenced by management and management may utilize the selection of foreign directors as a means to reduce the frequency of board meetings, thus supporting the managerial power theory (for discussion on management influence on director selection see Lorsch and MacIver (1989), Shivdasani and Yermack (1999), Kaufman, Englander and Tucci (2005)). The Combined Code on Corporate Governance requires non-executive directors to commit to an indicative amount of time upon becoming a non-executive director supporting the notion that it is not foreign non-executive directors on boards that influence reduced board meeting frequency but it is incumbent boards of directors that have reduced meeting frequency potentially to attract foreign non-executive directors and/or for other purposes.

The presence of women non-executive directors is positively correlated with board meeting frequency *(0.0001)*. Whilst popular perception might support the concept that women are more likely to be selected or offered non-executive positions with less desirable or troubled firms that may have more meetings (Ryan and Haslam (2005)), my sample suggests that women are more likely to be selected as board members by more domestic and regulated firms (women as a percentage of non-executive directors are 16% at utilities, 12% at financial institutions whilst only 10% of the entire sample). Agency and contracting theories suggest that classes of directors are selected by regulated industries for a variety of advisory roles (Agrawal and Knoeber (2001), Helland and Sykuta (2004)).

Executive's and chairmen's remuneration are consistently negatively correlated or uncorrelated with board meeting frequency. The agency framework would explain CEO remuneration to be negatively correlated to meeting frequency with the suggestion that positive performance entails both higher CEO reward and less required monitoring and I have found evidence of board meeting frequency influenced by performance. However, this same finding may also support the managerial power theory that CEOs limit board meeting frequency to reduce monitoring of their remuneration (my Correlations Table below does not support a link between CEO remuneration and the change in pre-tax income). Chi-square results strongly support the correlations that higher chairmen's and CEO pay is associated with fewer meetings. Brick, Palmon, and Wald (2002) studied US firms and noted the number of board meetings was negatively correlated to CEO cash remuneration and positively correlated to the proportion of non-cash remuneration suggesting board meeting frequency and remuneration are linked.

UK corporate governance strongly encourages non-executive chairmen, thus without an executive role the agency framework suggests a positive relationship amongst chairmen's remuneration and board activity (as the chairman's primary responsibility). However, the negative correlation *(0.0003)* strongly suggests the managerial power theory that highly paid chairmen discourage full board scrutiny of their remuneration. Greenbury's guidance for non-executive directors to be paid for their time would have been expected to provide positively correlated factors; however, I found no correlation amongst non-executive directors' remuneration and meeting frequency.

Industry Tests

The majority of board of directors research is US based and generally excludes examination of financial institutions and utilities due to regulation. UK regulation is generally viewed as less restrictive, in many aspects is self-regulatory, and it is also common that listed UK firms participating in regulated industries have substantial non-regulated activities. To assess whether there were any underlying differences between financial institutions and other industries I used the following two models:

$$\text{Full Board Meetings}_{\text{Financial Institutions}} = \alpha_0 + \alpha_1 \text{board size} + \alpha_2 \text{ executive director age} + \alpha_3 \text{ Log(employees)} + \alpha_4 \text{ foreign non-executive directors} + \alpha_5 \text{ non-executive director age} + \alpha_6 \text{ Log(PE)} + \alpha_7 \text{ CEO remuneration} + \alpha_8 \text{ Chairman remuneration} + \alpha_9 \text{ Non-executive remuneration} + \alpha_{10} \text{ women non-executive directors} + \alpha_{11} \text{ change in pre-tax} + \varepsilon$$

$$\text{Full Board Meetings}_{\text{Non-Financial Institutions}} = \alpha_0 + \alpha_1 \text{ board size} + \alpha_2 \text{ executive director age} + \alpha_3 \text{ Log(employees)} + \alpha_4 \text{ foreign non-executive directors} + \alpha_5 \text{ non-executive director age} + \alpha_6 \text{ Log(PE)} + \alpha_7 \text{ CEO remuneration} + \alpha_8 \text{ Chairman remuneration} + \alpha_9 \text{ Non-executive remuneration} + \alpha_{10} \text{ women non-executive directors} + \alpha_{11} \text{ change in pre-tax} + \alpha_{12} \text{ Debt to Market Capitalisation} + \varepsilon$$

I used various models for financial institutions board meeting frequency with the above demonstrating the highest explanatory power (adj. R^2 = 30.8%, 156 obs). Notably, no performance or remuneration measures of any kind were explanatory in all models, however, employees(log) *(0.0000)* was positively correlated whilst consistent with the all industry model and foreign non-executive directors were negatively correlated *(0.0001)*. Weak evidence suggests a positive relationship amongst non-executive director age and board meeting frequency. Interpreting this data suggests that financial institutions' board meeting frequency is increased by firm size (employees) and to a much lesser extent by longer serving non-executive directors whilst attracting foreign non-executive directors exerts pressure for the board to meet less does provide some support to the agency framework. Noting that the statistical evidence is weak, a suggestion is that longer serving directors at financial institutions may be desirable as monitors in contrast to the Combined Code's suggestion that longer serving non-executive directors are not independent.

In the full sample (all industry) regression model industry dummies proved inconclusive (all negatively correlated and with one exception not significant). Examining the determinants for non-financial institutions permitted the inclusion of financial stress variables (due to their regulatory constraints, financial institutions have more relatively uniform financial stress). I used various models with the model above providing the most explanatory power (adj. R^2 = 27.86%, 608 obs). Notable among positive correlations with board meeting frequency were the constant *(0.0002)*, board size *(0.0257)*, debt to market capitalization or financial stress *(0.0634)*, employees(log) *(0.0089)*, and women non-executive directors *(0.0002)*, whilst remuneration for CEOs *(0.0221)* and Chairmen *(0.0123)* and the presence of foreign non-executive directors *(0.0000)* exert pressure for the board to meet less seemingly supporting both the agency framework and the managerial power theory of executive control.

Robustness

Board meeting frequency and positive correlations with firm complexity and negative correlations with performance (and financial stress in certain models) supports the agency framework. However, the negative correlations of chairmen's remuneration and the lack of any correlation with non-executive director remuneration do not. Perhaps, most incongruous is my finding that UK corporate governance guidelines, in principle, suggest that non-executive remuneration be linked with 'time' and board meeting frequency is a strong proxy for time. The latter mentioned correlations equally support the managerial power theory. All models that I developed and examined strongly demonstrated the influence of foreign non-executive directors on reducing the frequency of board meetings which may be supported by agency theory in adding diversity to the board of directors or perhaps 'conspiratorially' being implanted by CEOs on the board to reduce monitoring. This paper does not review the determinants of board remuneration, however, my Correlations Coefficients Table's positive correlations for foreign non-executive directors and Chairmen (.202) and CEO (.323) remuneration may provide further support of managerial power theory[25], suggesting that managers select foreign non-executive directors as a means of to increase their own remuneration (a subject for further research).

[25] See Appendix for Correlations Coefficients Table.

To further examine the validity of my regressions and better explain the theoretical conflicts, I developed an annual model. Table IV shows that model's reliability declined from 1998 to 2004 (adj. R^2 declining from 35% to 26%). This is unsurprising as the univariate analysis demonstrated that board meeting frequency overall is becoming more standardized and less effected by any variables perhaps other than the Chairman's and CEO's schedule, in effect there are fewer financial, economic, or demographic factors that determine board meetings. This is underlined with the constant becoming significant (.003).

Table IV

Regression Years 1998 v. 2004

	1998			2004		
Variable	Coefficient	t-Statistic	p-Value	Coefficient	t-Statistic	p-Value
Constant	+	0.776	0.440	+	3.008	0.003
Board Independence	+	0.070	0.944	-	-0.655	0.514
Board Size	+	1.669	0.098	-	-1.056	0.293
Pre-Tax Change	-	-0.849	0.398	-	-1.609	0.110
Ex.Director Age	+	2.082	0.040	-	-2.081	0.040
Log(employees)	-	-0.210	0.834	+	3.029	0.003
Foreign Non-Executives	-	-4.885	0.000	-	-2.572	0.011
Non-Exec.Dir. Age	-	-0.578	0.564	-	-0.271	0.787
Log(PE)	-	-1.240	0.218	-	-1.147	0.254
CEO Remuneration	+	1.053	0.295	-	-2.810	0.006
Chair Remuneration	-	-2.539	0.013	+	0.748	0.456
Non-Exec.Dir. Remun.	+	2.176	0.032	+	1.444	0.151
Women Non-Executives	+	1.524	0.131	+	2.352	0.020
R-squared		*42.4%*			*32.9%*	
Adjusted R-squared		*35.0%*			*26.0%*	
F-statistic		*5.760*			*4.770*	
Observations		107			131	

Verifying the significance of the constant, I did not use the constant and tested the model utilising only industry dummies which then became significant (without substantial reduction in explanatory power). Similarly, replacing employees (log) with market capitalization (log) and, for non-financial services, replacing debt to market capitalization with debt to ebitda all supported the models suggestions.

Table V further illustrates some of the mean reversion and standardization processes on the firm level. This table is divided into three groups: 1) Standardised, 2) Standardising from above the mean, and 3) Standardising from below the mean. The table implies no statistical significance but is meant to illustrate board meeting trends over the study period. Whilst it is somewhat difficult to appreciate that no event(s) occurred that may have demanded one meeting more or less of the Standardised group over the study period, the significant reductions of meetings for those Standardising from Above the Mean imply strategic decisions to meet less frequently (the length of the survey period insures that all of the firms illustrated in this section encountered major strategic events). It was unintentional, but of interest to note that all of the firms Standardising from Below the Mean have overseas activities that exceed the scale of their domestic activities. That boards of directors evolve and that trends emerge are part of the literature (Yang et al. (2004) and Chhaochharia and Grinstein (2004)), however, I am not aware of literature suggesting that boards of directors endogenously standardize.

Table V

Selected Meeting Frequencies 1998- 2004*+

	Firm	**Number of Board Meetings**					
Standardised							
	British American Tobacco	6	6	6	6	6	6
	BSkyB	6	6	6	6	6	6
	Carlton	8	8	8	8	8	8
	EMAP	11	11	11	11	11	11
	Rank	8	8	8	8	8	8
	Standard Chartered	8	8	8	8	8	8
	United Utilities	10	10	10	10	10	10
Standardising From Above the Mean							
	Allied Domecq	12	12	7	7	6	6
	AstraZeneca	10	10	6	6	6	6
	BPB	10	9	7	7	8	7
	Intercontinental Hotels**	14	11	11	11	8	8
	LloydsTSB	16	16	15	11	9	11
	Scottish & Newcastle	12	10	7	7	7	7
Standardising From Below the Mean							
	Diageo	8	8	7	7	7	7
	Hanson	5	5	5	6	6	6
	Pearson	8	8	6	6	6	6
	Reed Elsevier	7	6	6	6	6	5
	Reuters	6	7	8	8	8	9

*This table is intended to illustrate various types of board meeting frequency evolution over time and is not intended as a statistically accurate sample. Meetings noted are for the firm years ending 1998, 1999, 2001, 2002, 2003, 2004. Selected firms in this table, by definition, include only firms that remained in the top 150 firms during the entire sample period.

**During the study period Bass Group became Six Continents when shedding its brewing business, then became Intercontinental after shedding its pub business to becoming a focused hotel group.

5.0.0 Conclusions

Boards of directors are most often forgotten in good times and quickly rise to prominence in times of firm turmoil. The popular explanation is that boards of directors do not matter (or no one cares) when all is working well and boards are there to grasp control when management is failing. Inevitably, the directors must monitor in order to know when to exert control. By this assumption, board of directors meetings remain the apex of control at firms and seemingly are the only venue where non-executive directors can monitor and exert control. The agency framework, corporate governance guidelines, and contracting theory suggest that firms self determine their meeting frequency to the needs of the firm. However, my results find that most firms need a similar amount of full board meetings whilst it is difficult to conceive that most firms have similar needs based upon the challenges they face. It is not inconceivable that most firms face similar public scrutiny of their visible activity and determine the number of full board meetings in light of what is acceptable to public scrutiny.

The largest listed firms' boards of directors met an average of 9.39 times in 1998 and 8.60 times in 2004, whilst the standard deviation dropped from 2.70 to 2.13 over the same period. The latter figure confirms that boards of directors were becoming more uniform in their number of full board meetings (median declined from 10 to 9); Spencer Stuart's (1998) Board Index commented that in 1996 the FTSE 100 median board of directors met 12 times confirming a long term trend of declining full board meetings. With the publicized greater demands on boards of directors, this is indeed surprising. Sporadic anecdotal and annual report evidence implies that there are substantially more committee meetings, but the decline in the number of full board meetings indicates that there may be less time at full board meetings for non-committee members to review committees' work while the empirical evidence clearly demonstrates that the interval of time when full board meetings review committee work has increased. On a broad level, this result confirms with Vafeas (1999) who found among large US firms increasing board size correlated with increased meetings, though in the UK it is the reverse that average board size is shrinking and average meeting numbers are shrinking. However, I found no correlation between UK boards with fewer directors and fewer meetings. This paper adds to the literature by suggesting that the decline in full board meetings may lie in the increased representation of foreign non-executive directors who may only agree to serve dependent on the number of board meetings (less being preferable to minimise travel). Over the study period foreign directors increased in absolute numbers per board, but most visibly increased from 16.9% of non-executive directors in 1998 to 27.5% of the non-executive directors in 2004. For further explanation of the correlation, I contacted a few Boards of Directors amongst the sample group of larger listed firms. Peter Kennerley, Company Secretary & General Counsel of Scottish & Newcastle Plc, noted that fewer board meetings made it possible to attract "the right calibre of international participants" who were focused on more strategic and international concerns noting that these were fewer but bigger issues than were discussed in the past, and Graeme Musker, Secretary and Solicitor of AstraZeneca PLC, noted that fewer meetings reduced the travel burden on international directors, and added that in moving to bi-monthly meetings from monthly meetings, meeting time increased from one-half to full day meetings.

Gender provided a curious explanatory variable as the percentage of women non-executive directors was correlated with full board meetings; however, further investigation suggests that it is sectors that have higher board meeting frequencies that more often select women as non-executive directors. The univariate analysis showed that some sectors with higher women non-executive directors selected the least foreign non-executive directors (utilities and financial institutions), which potentially suggests a trading off of foreign directors for women directors, but the evidence is more suggestive of women having greater opportunities to be non-executive directors in more domestic focused firms (women non-executive directors were also more represented among the largely domestic consumer services and consumer goods sectors).

The consistent negative correlation of chairmen's remuneration and board meeting frequency in my models does not support the agency framework and indeed supports managerial power in an extension to non-executive chairmen. Since the days of Robert Maxwell and Cadbury (1992) the linchpin of UK corporate governance has been the separation of chairmen from executive responsibility with the chairmen's focus on "the running of the board". Running of the board gives the chairman a significant say in determining board meeting frequency yet fewer board meetings provide fewer opportunities to review remuneration. I am unaware of research on non-executive chairmen's remuneration, but with key responsibility for running of the board and explicitly without management responsibility it would seem that board activity should be a major determinant of remuneration (a subject for further research).

Supporting the agency framework and good corporate governance, my results suggest that non-executive directors and boards of directors monitor for shareholders. However, the evidence strongly suggests that idiosyncratic firm characteristics have less influence on the frequency of board meetings than the idiosyncratic characteristics of directors. The standardization of board meeting frequency can only occur with the compliance of board directors. Whilst I have found strong evidence to link the standardization of board meeting frequency to increased numbers of foreign non-executive directors, boards of directors must have reduced their number of meetings to attract these directors. Further anecdotal evidence comes from executive search firms mentioning that non-executive directors have heightened up-front awareness of board time commitments and, finally, the Combined Code requires new non-executives to commit to an indicative number of days perhaps further adding pressure to standardize meeting frequency.

My results do not support popular theory and corporate governance guidelines that older boards (executive or non-executive) shirk responsibilities and promote fewer board meetings, or that large boards ('unwieldiness') may be unable to meet more frequently, or that increased board independence leads to increased meeting frequency. My results suggest that boards of directors now have more bureaucratic meeting schedules that may be less responsive to corporate challenges and indeed show less connection to greater monitoring needs and or performance (fundamental or market). This raises the key question that if board meeting frequency becomes more standardized and fixed to schedules, will future boards be unable to adjust to an urgent need of the firm? "What, we're ready to buy who, sales have dropped, the share price has fallen, accounting scandal, hostile bid for us, the CEO has lost the plot…..? So sorry, but I've already got something booked for next month and don't have any open dates before the next board meeting."

The unintended consequences of corporate governance efforts?

Exogenous rules, regulations, and codes are largely the result of market failings and exist to improve practice. Our corporate governance movement over the past 15 years has provided several conditions that were intended to positively affect the board of directors' contribution but some of these conditions may have unintentionally had negative effects on the board's contribution. This research suggests reconsideration and improvement of factors such as (1) Director remuneration that is not related to either meeting commitments, attendance, or firm performance, (2) Director commitment processes that may suggest or have created meeting inflexibility and the bureaucratization of board meetings, and (3) Director board meeting attendance reporting that may discourage the changing of board meeting schedules to meet corporate needs. The author does not disagree with either the current board remuneration structure or detailed reporting of the board's activities, but suggests that both these efforts may have produced undesired effects that merit attention and perhaps modification of current governance provisions.

Appendix

Coefficients Correlations Table (cumulative data 1998-2004)

	Board Meetings	Board Size	Non-Exec. Age	Exec.Dir. Age	Market Cap.	Employ-ees	Board Indep.	Foreign NEDs	Women NEDs	Chair's Rem.	CEO Rem.	NED Rem.	DT/EBITDA	DT/MCAP	Pre-Tax Change	MK/BK	PE
Board Meetings	1																
Board Size	0.059	1															
Non-Exec. Age	-0.067	0.162	1														
Exec.Dir. Age	0.007	0.184	0.182	1													
Market Cap.	0.014	0.471	0.066	0.166	1												
Employees	0.064	0.381	0.059	0.222	0.418	1											
Board Indep.	-0.118	0.153	0.035	-0.010	0.256	0.115	1										
Foreign NEDs	-0.428	0.207	0.078	0.099	0.216	0.155	0.358	1									
Women NEDs	0.212	0.063	-0.250	-0.007	0.169	0.166	0.036	-0.062	1								
Chairman's Rem.	-0.160	0.279	0.125	0.275	0.181	0.300	0.064	0.202	-0.050	1							
CEO Rem.	-0.166	0.223	0.037	0.096	0.359	0.244	0.202	0.323	0.117	0.441	1						
NED Rem.	0.025	0.317	0.040	0.032	0.409	0.216	0.252	0.195	0.143	0.197	0.427	1					
DT/EBITDA	-0.053	-0.034	0.017	0.043	0.004	0.008	0.034	-0.040	0.039	-0.005	-0.027	-0.057	1				
DT/MCAP	0.229	0.191	-0.072	-0.001	0.059	0.010	0.116	-0.138	0.066	0.034	-0.004	0.225	-0.240	1			
Pre-Tax Change	0.010	0.038	-0.040	-0.010	-0.003	0.019	-0.022	0.013	-0.034	-0.012	-0.049	-0.008	0.003	-0.004	1		
MK/BK	-0.042	-0.037	-0.012	0.051	0.038	0.047	0.012	0.020	-0.043	0.026	-0.010	0.006	0.001	-0.011	-0.014	1	
PE	-0.099	-0.053	-0.020	-0.076	0.072	-0.062	0.047	0.071	-0.056	-0.012	-0.043	-0.090	-0.011	-0.092	-0.205	0.007	1

Descriptive Statistics Sorted by Board Meetings (1998-2004)

Firms are sorted by the number of full board meetings. Data Description may be found in Table I above. Chi-square statistics (X^2) critical values are 13.4 (0.1), 15.5 (0.05), and 20.3 (0.01). *t-diff* is the T-test for two samples with unequal variances. ***exceeds .01 critical value, **exceeds .05 critical value, *exceeds .1 critical value.

Meetings	Obs.	% of Foreign NEDs μ	Median	σ	% Women NEDs μ	Median	σ	Board Size μ	Median	σ
4 to 5	54	39.7%	39%	24%	4.2%	0%	10%	10.93	10	2.81
6	101	44.5%	50%	30%	8.0%	0%	12%	11.19	11	3.10
7	73	35.8%	38%	25%	9.6%	0%	12%	11.25	11	2.66
8	135	29.1%	25%	24%	9.0%	0%	12%	11.21	10	2.83
9	98	23.5%	20%	22%	8.5%	0%	13%	10.30	10	2.34
10	118	15.7%	17%	17%	12.5%	14%	12%	10.97	10	2.46
11	80	10.1%	0%	15%	13.9%	14%	14%	10.75	11	2.72
12	72	12.2%	0%	15%	14.7%	15%	13%	11.60	12	2.48
13 to 17	33	13.1%	13%	14%	14.7%	13%	10%	12.70	12	3.22
X^2 (8)		69.296***			9.304			1.258		
t-diff (6 & 12)		9.350***			-3.483***			-0.963		

Meetings	Obs.	Change in Pre-Tax Earnings μ	Median	σ	PE Ratio μ	Median	σ	Employees μ	Median	σ
4 to 5	54	31%	9%	113%	29.7	22.5	24.9	17737	7689	37697
6	101	13%	7%	223%	24.5	19.3	19.4	40148	19749	54033
7	73	-33%	6%	188%	16.7	14.8	6.3	28497	13674	40482
8	135	10%	-3%	249%	18.9	16.0	11.5	34106	23196	36557
9	98	6%	6%	133%	16.4	15.0	5.8	35774	20858	41989
10	118	-10%	0%	199%	18.5	14.3	17.8	45655	22434	71131
11	80	-12%	9%	162%	15.6	13.7	7.8	30622	12388	34968
12	72	-23%	3%	173%	18.4	16.1	9.8	35058	22596	38915
13 to 17	33	-22%	8%	95%	21.1	15.8	32.8	42316	30570	37430
X^2 (8)		14.797*			11.727			13246.***		
t-diff (6 & 12)		1.198			2.73***			0.720		

Meetings	Obs.	Market Capitalisation (£MM) μ	Median	σ	NED Age (Avg.) μ	Median	σ	ED Age (Avg.) μ	Median	σ
4 to 5	54	3632	2702	3111	59.07	58.8	3.96	49.96	50.0	4.71
6	101	10810	3689	20131	58.51	58.6	3.14	50.48	51.0	4.28
7	73	6760	3570	13548	58.51	58.5	3.09	50.21	50.0	2.91
8	135	10479	3503	22329	58.11	58.0	3.08	50.75	51.0	3.23
9	98	5870	2792	10918	58.09	58.2	3.41	50.32	51.0	4.21
10	118	6633	2730	13019	58.03	59.0	3.49	50.10	50.0	3.37
11	80	6304	2524	10872	58.00	58.2	3.24	49.65	49.8	3.54
12	72	8291	4920	11878	57.91	58.0	3.57	50.34	51.0	3.32
13 to 17	33	12193	7772	14223	58.30	59.0	2.03	51.41	52.0	3.19
X^2 (8)		3010824.***			0.036			0.605		
t-diff (6 & 12)		1.031			1.142			0.243		

Meetings	Obs.	Chairman's Pay (£000) μ	Median	σ	NED Pay (Avg.) (£000) μ	Median	σ	CEO Pay (£000) μ	Median	σ
4 to 5	54	410	239	486	34.53	33.63	10.64	1117	796	926
6	101	571	261	808	37.50	35.00	12.62	1182	898	886
7	73	316	200	334	36.14	34.00	10.75	1144	842	791
8	135	372	240	378	40.99	37.00	15.87	1145	848	1022
9	98	367	251	313	37.95	36.30	10.89	928	726	655
10	118	291	200	257	36.90	34.17	12.25	834	733	501
11	80	270	175	240	35.95	33.77	9.04	795	706	422
12	72	282	210	184	38.45	34.50	12.22	771	620	531
13 to 17	33	267	249	142	39.24	36.00	11.65	958	774	623
X^2 (8)		208.074***			2.528			350.084***		
t-diff (6 & 12)		3.480***			-0.496			3.797***		

For Non-Financial Institutions Only

Meetings	Obs.	Debt to EBITDA (multiple) μ	Median	σ	Debt to Market Cap (%) μ	Median	σ
4 to 5	43	1.89	1.80	1.39	30.7%	20.8%	28.4%
6	85	1.37	1.37	4.46	32.4%	22.7%	37.9%
7	64	4.53	2.48	10.08	41.1%	31.5%	34.4%
8	108	3.17	2.18	6.58	35.8%	30.1%	23.0%
9	87	4.23	1.93	8.31	40.9%	30.2%	55.8%
10	96	1.77	1.89	3.00	46.7%	32.6%	48.1%
11	61	2.45	2.03	2.04	38.9%	31.5%	30.9%
12	47	2.37	2.30	3.03	55.2%	29.2%	84.2%
13 to 17	17	2.71	1.88	1.96	55.4%	35.9%	49.0%
X^2 (8)		1.975			13.994*		
t-diff (6 & 12)		-1.534*			-1.758**		

5.0.0. References

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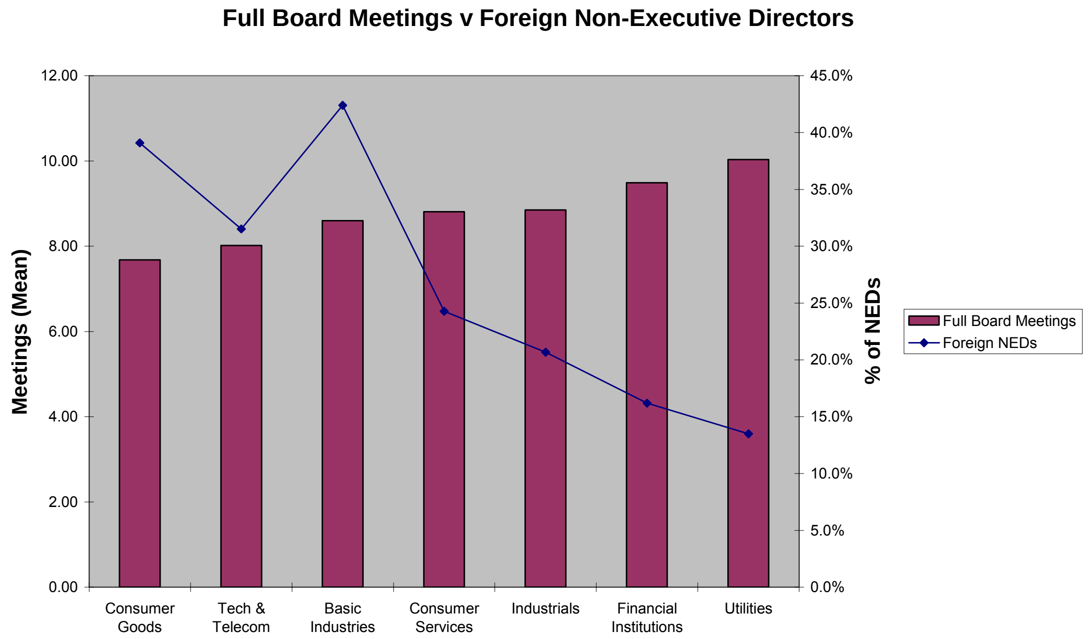
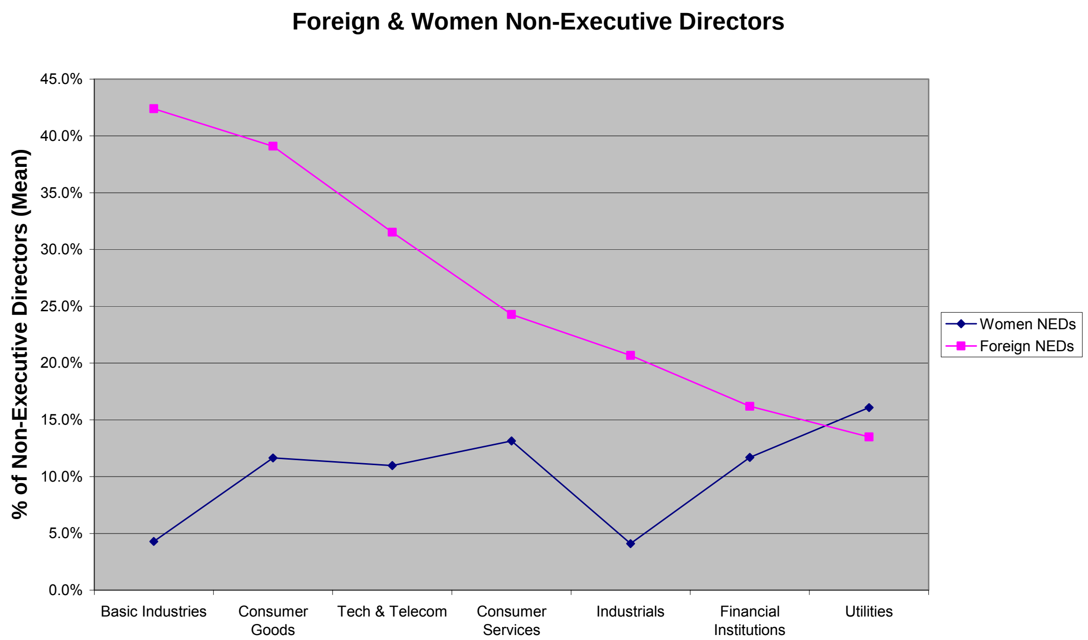
Additional Tables



See Table I for data description.



See Table I for data description.

[i] Marconi Annual Report 1999, June, p. 35.
[ii] Marconi Annual Report 2000, May, p. 36.
[iii] Companies Act, Part 10, Chapter 2, paragraph 170.
[iv] Companies Act, Part 10, Chapter 2, paragraph 172. General duties of directors:

> **"Duty to promote the success of the company**
> (1) A director of a company must act in the way he considers, in good faith, would be most likely to promote the success of the company for the benefit of its members as a whole, and in doing so have regard (amongst other matters) to—
> (a) the likely consequences of any decision in the long term,
> (b) the interests of the company's employees,
> (c) the need to foster the company's business relationships with suppliers, customers and others,
> (d) the impact of the company's operations on the community and the environment,
> (e) the desirability of the company maintaining a reputation for high standards of business conduct, and
> (f) the need to act fairly as between members of the company."

[v] Pearson's correlation coefficient (from Curwin, Jon and Roger Slater, 2002, Quantitative Methods for Business Decisions, Thomson Learning, London.

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}}$$

[vi] Chi-Square calculations from Curwin and Slater and Amir Alizadeh, 2004, Quantitative Methods, Cass Business School, London.

$$\mathrm{X}^2 = \sum\left[\frac{(O-E)^2}{E}\right]$$ or

$$\mathrm{X}^2 = \sum\frac{(f_o - f_e)^2}{f_e}$$ with d.f. = rows (-1) x columns (-1)