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The Impact of the Cadbury Committee Recommendations on Analysts' Earnings Forecasts: UK Evidence

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Abstract

This paper examines the relationship between the board structure of UK firms and the accuracy of individual analysts' earnings forecasts with respect to information asymmetry and agency theory. We hypothesize that managers of firms complying with the recommendations of The Code of Best Practice may have "less to hide" and, subsequently, provide more information to outsiders (including analysts), thus facilitating more accurate analysts' forecasts. We find that analysts are more optimistic, but less accurate, for firms with a greater proportion of non-executive directors. This indicates that non-executive directors are inefficient at addressing the agency disclosure problem (at least in terms of the accuracy of analysts' earnings forecasts).

JEL Classification: G14; G29; G34

Keywords: Financial analysts; Forecast accuracy; Corporate governance; Panel data

1. Introduction

The existence of the agency problem, generated by the separation of ownership and control in the modern corporation, has attracted considerable attention since the first half of the last century (Berle and Means, 1932). However, institutional steps toward developing potential solutions to this problem have only been taken in the UK in the aftermath of the "scandalous" collapse of several prominent companies during the late 1980s and early 1990s. Most notably, financial reporting irregularities in the UK led to the establishment of the 'Financial Aspects of Corporate Governance Committee', chaired by Sir Adrian Cadbury; best known to academics and practitioners as the Cadbury Committee.

In December 1992, the Cadbury Committee issued its first report, The Code of Best Practice (hereafter, The Code). This report consists of a set of recommendations on the structure and responsibilities of corporate boards of directors that ultimately were incorporated into the Listing Rules of the London Stock Exchange. One of the ultimate aims of The Code was to increase the openness and transparency of UK firms.[1] Even if this aim has been achieved, the question still remains as to what governance mechanisms are more effective in accomplishing this objective, and whether indeed the participants of financial markets, including analysts, benefited from these recent changes.

The main purpose of the paper is to test the effectiveness of The Code's recommendations at increasing the openness and transparency of UK firms, using as proxies for the latter the

[1] According to The Code, "The [Cadbury] Committee's objective [was] to help to raise the standards of corporate governance and the level of confidence in financial reporting and auditing". It is argued that "openness on the part of companies, within the limits set by their competitive position, is the basis for the confidence which needs to exist between business and all those who have a stake in its success" (Cadbury, 1992, p. 15). In addition, it is pointed out that the responsibilities of the board of directors are to ensure and present "a balanced and understandable assessment of their company's position ... aim[ing] for the highest level of disclosure" (p. 33).

accuracy of individual analyst forecasts, as measured by forecast error, dispersion and bias.[2] In turn, the effectiveness of these recommendations regarding the composition of board structure is based on four main criteria; viz., the proportion of non-executive directors on the board, the separation of the role of the chief executive and chairman (hereafter, duality), the chairman (executive/non-executive) mix, and the existence of a nomination committee.

We argue that according to the information asymmetry and agency theories, there is a pertinent information gap between the insiders and outsiders of a firm (including analysts) and both parties are aware of this problem (Akerlof, 1972, and Jensen and Meckling, 1976).[3] Consequently, individual analysts in most cases are not fully accurate in forecasting earnings for the firms they follow (i.e., they are biased and inefficient).[4] However, taking into consideration the aims of the

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[2] There are essentially two reasons why we use the accuracy of analysts' earnings forecasts as a proxy for disclosure: (i) the crucial role of financial analysts in financial markets – their impact on the price of securities and investors' perceptions about the future performance of a firm (Frankel, Kothari and Weber, 2006); and (ii) the limitations in the existing measures of the disclosure of a firm. Healy and Palepu (2001), for instance, argue that although there are significant advantages to the existing measures of the disclosure of a firm, such as management forecasts, analysts' rating of disclosure, and self-constructed measures of disclosure, each of these approaches has its limitations. Mainly, management disclosure does not generalize to most forms of disclosure; analysts' ratings of disclosure may be taken as a simple exercise, and the self-constructed measures of disclosures involves judgement on the part of the researcher and may be difficult to replicate. For these reasons, following Thomas (2002), we choose to use an alternative measure of a disclosure of a firm, viz., analysts' earnings forecasts. Although on most of the dimensions the latter is superior to the traditional measure of disclosure, it may depend on analysts' abilities and available resources to perform the task. We overcome these drawbacks by controlling for analysts' specific characteristics and the resources available to the brokerage firm that employs the analyst. Forecast error is measured as the absolute difference between the actual earnings announced by firm j in year t, and the forecast made by analyst i for firm j in year t. The dispersion of forecasts is computed as the standard deviation of individual forecasts made by analysts that follow firm j in year t. Finally, bias is defined as the difference between the actual earnings announced by firm j in year t and the forecast made by analyst i for firm j in year t. All three measures are standardised by the share price 5 days prior to the earnings announcement date and multiplied by 100.

[3] For the purpose of this paper, we base our arguments on agency theory. However, it should be noted that if one adopts the stewardship theory concept (i.e., that the managers are trustworthy and they act in the interests of shareholders) then the managerial control techniques would take the form of motivation mechanisms.

[4] Following the forecast rationality theory, we build our arguments based on two important properties of a forecast error, namely unbiasedness and efficiency of forecasts (see Clements and Hendry, 1998). [It should be noted, that for the purpose of this paper, following the tradition in the field of analyst earnings forecasts, the directional measure of forecast error is called forecast bias, whereas the absolute value of forecast bias represents the forecast error] (see Table A). Let us assume that the forecast error, e_t, for a conditional expectation is $e_t = A_t - E[A_t \mid I_{t-h}]$, where A_t is the actual value known at time t and $E[A_t \mid I_{t-h}]$ is the expectation of A_t conditional upon the available information set I_{t-h}; h is the number of periods ($h \in (1,\ldots, k)$).The forecast error, e_t, has two important properties: (1) Unbiasedness - since the forecast of A_t, made at t-h, is the conditional expectation of A forecasted at t-h, the conditional expectation of e_t should be zero: $E[e_t \mid I_{t-h}] = 0$. [Note: this

Cadbury Committee, this information gap may be partly reduced as a result of the implementation of The Code's recommendations. To examine this issue, with respect to the accuracy of individual earnings forecasts, we control for both firm-specific and analyst-specific characteristics via use of an analyst-firm fixed effects estimator. Such an estimator is necessary because of, at least, two layers of heterogeneity inherent in the data used. First, following the aims of The Code, it may be that the information environment of UK firms that have implemented these recommendations is richer compared to firms that did not do so – a feature that leads to heterogeneous information endowments across firms. And second, the forecasting abilities of analysts may differ from one analyst to another (Clement, 1999, and Bolliger, 2004). While these issues could also be partially 'resolved' by aggregating the data across firms and/or analysts, this would necessarily involve the disposal of potentially important information. Consequently, we maintain use of the richest possible dataset and tailor the estimation methodologies accordingly.

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condition only applies under the assumption of a symmetric loss function. If an asymmetric loss function is employed by the forecaster, than it may be optimal for the forecaster to produce biased forecasts, see, for instance, Lim, 2001]; (2) Efficiency - e_t should be uncorrelated with any information available at the time of forecast, since, if this is not the case, forecasts could be improved by incorporating this correlation: $E[e_t^{\chi} I_{t-h} \mid I_{t-h}] = 0$. Most studies in the field examine the quality of analyst earnings forecasts in terms of the validity of the above conditions, but without specifically pointing this out. For instance, Abarbanell and Bernard (1992) and Hussain (1996), amongst others, explore the over-reaction/under-reaction of financial analysts. In terms of the above conditions, these studies test the zero value condition of the forecast error e_t (i.e., first condition). With regards to the second condition, tests are often conducted by regressing the forecast error upon a set of variables that measure the information environment of a firm (i.e., disclosure score, size of the firm, leverage, etc). Under the null hypothesis of efficient forecasts, there should be no relationship found between the forecast error and any of the information set variables. By contrast, rejection of this null hypothesis implies that forecasts are conditionally inefficient and could be improved by incorporating this information into the forecasts. A similar approach to that described above is taken is this paper. However, we extend the efficiency testing in three important ways. First, in addition to tests of independence between directional measures of forecast error (i.e., the forecast bias) and the information environment of a firm, we consider tests of independence between measures of second moment-based measures of forecast error, such as the absolute forecast error and forecast dispersion. Though rejection of the latter type of independence does not imply forecast inefficiency, an examination of this relationship is important as it sheds light on the likely determinants of forecast accuracy. This represents the second innovation of the paper in terms of the efficiency tests performed. Finally, while previous studies of analyst forecast accuracy have largely relied on a narrow set of testing frameworks, we make use of a set of panel-based regression methodologies. As such, we minimise the chances of incorrectly rejecting null hypotheses due to model misspecification.

Our analysis yields several findings. First, we find that although analysts are more optimistic for firms with a greater proportion of non-executive directors on the board, the error and dispersion of forecasts for these firms are higher. Second, the forecasts made for firms with a combined leadership structure are more optimistic, though more dispersed. And finally the chairman (executive/non-executive) mix and the existence of a nomination committee seem to have a negative but unstable effect on the accuracy of analyst forecasts. Overall, these results suggest that in most cases the recommendations of The Code are not effective at mitigating the agency disclosure problem, at least when using the accuracy of analyst forecasts as a proxy for disclosure. By contrast, it seems that these recommendations may actually have an adverse effect on the accuracy of analyst forecasts.

The findings presented in the paper make a contribution to two different streams of literature; namely, the corporate governance and the analyst forecast literature. To the best of our knowledge, the research question posited in the paper has not been previously explored. As such, we make an innovative attempt at investigating whether differences in the quality of corporate governance adopted by UK firms are important to analysts in forecasting earnings. In this way, we address the question of whether the recommendations made by The Code are indeed effective in the context of analyst activity.

The remainder of this paper is organized as follows. Section 2 motivates our hypotheses, and Section 3 explains the statistical models used in the study. Section 4 describes the sample and data, while Section 5 contains the empirical results. In Section 6 we conduct as series of sensitivity analyses and Section 7 concludes the study.

2. Hypotheses development

In this section we discuss the potential associations between board characteristics and the accuracy of analysts' forecasts. For reasons of brevity, we henceforth refer to firms that comply with the recommendations of The Code (i.e., a greater proportion of non-executive directors on the board, separation of the role of the chairman and chief executive, a board chaired by a non-executive director, and the existence of a nomination committee) as firms with a more independent board of directors.

Following Jensen and Meckling (1976) and Fama and Jensen (1983) we argue that board independence may help to reduce the agency disclosure problem through effective monitoring and stronger alignment of the agent and principal interests. In the presence of such monitoring mechanisms, managers' actions are more aligned with shareholders' interests; therefore they may have "less to hide", thus providing more information to outsiders, including analysts. Assuming that the analyst's objective function includes the accuracy of forecasts, then more independent boards may be associated with lower forecast error.[5]

The effect of increased independence of the board on the dispersion of analysts' forecasts may depend on whether the disagreement in forecasts is due to differences in available information or differences in forecasting models.[6] With an increase in the independence of the board, a greater amount of firm-provided disclosure may be available to outsiders, including analysts. If analysts

[5] However, contrary arguments may hold. For instance, recent studies find evidence consistent with managers taking actions to avoid negative "bad news" earning surprises. Matsumoto (2002) argues that managers can use two ways to avoid negative surprises: by managing earnings and/or by guiding forecasts. It may be that stronger governance impedes managers in their attempt to manipulate earnings. In addition, misleading earnings reports are easier to monitor (and prosecute) than misleading communication to analysts. Therefore, firms with a more independent board of directors may be associated with fewer cases of earning management, but greater efforts on the behalf of managers to manipulate analyst forecasts (i.e., higher forecast error).

[6] Lang and Lundholm (1996) use similar arguments in exploring the association between disclosure and the dispersion of analysts' forecasts.

use a common forecasting model and possess the same firm-provided disclosure, but have different private information endowments (Barron *et al.*, 2002), then an increase in the independence of the board may decrease the disagreement between analysts. This is because analysts may place less weight on their private information in the presence of increased firm-provided disclosure. By contrast, if analysts use different forecasting models (Hong, Kubik and Solomon, 2000) and place different weight on components of firm-provided information, then greater board independence may actually increase the dispersion of individual analyst forecasts. In terms of forecast bias, previous findings suggest, although not unanimously, that board independence is positively associated with the value of the firm.[7] Therefore, in the expectation of higher returns, analysts may be more optimistic (i.e., lower forecast bias) in producing forecasts for firms with more independent boards compared to firms with less independent boards. Below we discuss the potential association between the accuracy of analysts' forecasts and board characteristics considered in this study.

2.1. The proportion of non-executive directors on the board

There are a vast number of studies that explore the effectiveness of non-executive directors on the board of directors, yet, their findings are mixed. For instance, Bhagat and Black (2000) find no relation between board independence and four measures of firm performance (Tobin's Q, return-on-assets, market-adjusted stock returns and ratio of sales-to-assets). However, Agrawal and Knoeber (1996), using a simultaneous equation framework, find a significant negative relation between outside membership on the board and firm performance. By contrast, findings presented by Bhojraj and Sengupta (2003) suggest that firms with a higher proportion of non-executive directors enjoy lower bond yields and higher ratings on new bond issues. In addition,

[7] See Hermalin and Weisbach (2003) for a survey of the corporate governance literature.

Anderson, Mansi and Reeb (2004) and Ashbaugh-Skaife, Collins and LaFond (2006) document that firms with a greater proportion of non-executive directors on the board have a lower cost of debt and a higher S&P credit rating, respectively.

Similarly mixed, although much more scant, are the findings of studies that investigate the impact of non-executive directors on a firm's level of disclosure. For instance, Forker (1992) using a sample of 182 UK firms and a self-constructed indicator of disclose during 1987-88, could not find any significant association between the proportion of non-executive directors and a firm's level of disclosure.[8] However, using more recent data and performing the analysis in the context of firms from Hong Kong, Chen and Jaggi (2000) find a significant positive association between the proportion of non-executive directors and disclosure. Based on this evidence, they argue that non-executive directors play *a complementary role* to disclosure.[9] However, the results of another out-of-sample analysis performed by Eng and Mark (2003), suggest that a greater proportion of non-executive directors is associated with less disclosure on the Singaporean market. The authors argue that this may be due to the fact that non-executive directors are elected by block holders to represent their interests. As a result, they may be able to acquire the information directly, rather than through public disclosure. Eng and Mark (2003) conclude that non-executive directors in Singapore play *a substitute-monitoring role* to disclosure.

Thus, the evidence regarding the role of non-executive directors in enhancing the information environment of a firm is mixed with only Forker (1992) addressing the issue in the UK context. Taking into consideration that for the purpose of this paper we use the accuracy of analyst

[8] However, the author acknowledges as a limitation of his study the imprecision of corporate governance data. In particular, Forker (1992) points out that not all the firms in the sample that have non-executive directors disclosed them accurately in the financial statements.

[9] That is, an increase in the proportion of non-executive directors is complemented with an increase in disclosure.

forecasts as proxies for disclosure, the first of the main hypotheses tested in this paper can be formally stated as follows:

H_0^1: There is no relation between the proportion of non-executive directors on the board and the accuracy of individual analysts' forecasts.

2.2. Duality, non-executive chairman and the existence of a nomination committee

As in the case of non-executive directors, there is mixed evidence regarding the effectiveness of separating the role of chairman and chief executive and having a non-executive chairman on the board. Imhoff (2003), for instance, holds that board effectiveness is severely compromised when the same person undertakes the role of the chief executive and chairman; and respectively, the board is chaired by an executive director. This is because the chairman, in most cases, sets the agenda of the board and, therefore, has an impact on the issues discussed at the board meetings. In addition, the chief executive that undertakes the roles of the chairman has a significant influence on the recruitment process of the new members of the board, thereby jeopardising the true independence of newly elected outside members of the board.

Indeed, exploring market reaction to anti-takeover mechanisms, Coles and Hesterly (2000) document a more favourable share price reaction to the introduction of such mechanisms for firms with a dual (i.e., separate) leadership structure. Similarly, Asbaugh-Shaife *et al.* (2006) document that it is costly for firms, in terms of default risk, to cede too much board control to the chief executive. However, Brickley, Cole and Jarrel (1997) support the view that by separating the role of the chief executive and chairman, the company has the potential to reduce the agency cost of controlling the chief executive, but at the expense of adding to the agency costs of

controlling the chairman. They argue that unless the chairman has a significant ownership position, it is easier to control the chief executive whose reputation and financial capital are more at risk. More striking results are presented by Boyd (1995) who shows empirically that duality can actually lead to better performance. The potential advantage of having the same person occupy both positions is that they would exhibit a greater understanding and knowledge of the company's operating environment.

The director selection process has long been subject of criticisms as powerful chief executives, rather than shareholders, select directors. Such criticism has led to proposals that boards should choose directors through nominating committees composed only of independent members of the board. Indeed, The Code stresses the importance of transparency in the appointment procedure. Although obviously important, the adoption of a formal nomination committee on the boards of the UK firms has been much slower than other committees such as the audit and remuneration committees.[10] Nevertheless, considering the aims of The Code, the existence of a nomination committee should increase the independence of the board by ensuring the appointment of directors whose interests are aligned with those of shareholders. In turn, this should contribute to an increase in the transparency and openness of the firms. Indeed, Shivdasani and Yermack (1999) document that when no nominating committee exists firms tend to appoint fewer independent outside directors on the board and more grey outsiders with conflict of interest. Similarly, Vafeas (1999) finds that the likelihood of using a nominating committee is positively (weakly) related to the independence of non-executive directors on the board. However, as argued earlier, duality may enable chief executives to exert a strong influence on all aspects of board work, including the nomination process.

[10] In this study we concentrate on the nomination committee. This is because all firms in the sample had established audit and remuneration committees.

Thus, the recommendations of The Code may have, in practice, an opposite effect from that expected. In terms of our paper, this means that to the extent that the above discussed governance devices create pressure for better disclosure, it may be that analysts that follow firms that comply with the recommendations of The Code may produce more accurate forecasts compared to firms that do not comply with such recommendations. Nonetheless, taking into consideration the mixture of evidence regarding the effectiveness of these mechanisms, we do not exclude an insignificant or a negative effect of these governance mechanisms on the accuracy of analyst forecasts. Based on the above arguments, the next three main hypotheses tested in the paper can be formally stated as follows:

H_0^2: There is no relation between duality and the accuracy of individual analysts' forecasts.

H_0^3: There is no relation between the chairman mix (i.e., executive/non-executive) and the accuracy of individual analysts' forecasts.

H_0^4: There is no relation between having a nomination committee on the board and the accuracy of individual analysts' forecasts.

3. Research Design

3.1. Evaluating the accuracy of analysts' earnings forecasts

For the purpose of this paper, we use three different proxies to evaluate the accuracy of individual analysts' forecasts: (i) forecast error, measured as the absolute difference between the actual earnings announced by firm *j* in year *t*, and the forecast made by analyst *i* for firm *j* in year

t; [11] (ii) forecast dispersion, computed as the standard deviation of individual forecasts made by analysts that follow firm *j* in year *t*; and (iii) forecast bias, defined as the difference between the actual earnings forecast announced by firm *j* in year *t* and the forecast made by analyst *i* for firm *j* in year *t* (i.e., optimistic versus pessimistic forecasts). In all three cases, in order to avoid any effects of information leakage, and following Thomas (2002), the measures of forecast accuracy are standardised by the share price five days prior to the earnings announcement date and multiplied by 100.[12] Although bias is a sign version of error, it addresses the question of whether analysts are optimistic or pessimistic versus the magnitude of the error in the case of the forecast error.

3.2. The models

Because of the potential collinearity problem between the proportion of non-executive directors, duality and the executive/non-executive chairman mix (see Table 4), we explore the impact of board related variables on the accuracy of analyst forecasts in distinct groups: (i) the proportion of non-executive directors and duality, and (ii) the executive/non-executive chairman mix and the existence of a nomination committee. Specifically, we consider the following models:

Model 1: $AF_{ijt} = a_0 + a_1 NED_{jt} + a_2 DUALITY_{jt} + a_3 HORIZON_{ijt} + a_4 LNMRKCAP_{jt} + a_5 GROWTH_{jt} + a_6 LOSS_{jt} + a_7 LEVERAGE_{jt} + n_{ijt}$.

Model 2: $AF_{ijt} = a_0 + a_1 EXCHAIR_{jt} + a_2 NOMCOM_{jt} + a_3 HORIZON_{ijt} + a_4 LNMRKCAP_{jt} + a_5 GROWTH_{jt} + a_6 LOSS_{jt} + a_7 LEVERAGE_{jt} + n_{ijt}$.

Model 3: $AF_{ijt} = a_0 + a_1 NED_{jt} + a_2 DUALITY_{jt} + a_3 NOREVIEW_{ijt} + a_4 LNMRKCAP_{jt} + a_5 ROASD_{jt} + a_6 EXP_{ijt} + a_7 EFF_{ijt} + a_8 BRKSIZE_{ijt} + n_{ijt}$.

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[11] The absolute forecast error is chosen, as opposed to the squared error, as the former may be more representative of the loss function employed by analysts (see, for instance, Basu and Markov, 2004).

[12] The share price on the announcement day would be influenced by the earning surprise expectation, while the share price at the beginning of the year may be too removed from the event.

Model 4: $AF_{ijt} = \alpha_0 + \alpha_1 EXCHAIR_{jt} + \alpha_2 NOMCOM_{jt} + \alpha_3 NOREVIEW_{ijt} + \alpha_4 LNMRKCAP_{jt} + \alpha_5 ROASD_{jt} + \alpha_6 EXP_{ijt} + \alpha_7 EFF_{ijt} + \alpha_8 BRKSIZE_{ijt} + \eta_{ijt}$.

Models 1 and 2 explore the association between board variables and the accuracy of analyst forecasts in the presence of firm-related variables; while Models 3 and 4 explore the association in the presence of both firm and analyst-specific variables.

A description of the variables used in the models is given below:

(i) Variables used to evaluate the accuracy of analyst earnings forecasts

AF_{ijt} – accuracy of individual forecasts made by analyst *i* for firm *j* in year *t* measured as:

$ERROR_{ijt}$ = $|A_{jt} - F_{ijt}|/SP_{jt}*100$, where A_{jt} is the actual earnings reported by firm *j* in year *t*; F_{ijt} is the earnings forecast made by analyst *i* that follows firm *j* in year *t*; and SP_{jt} is the share price of firm *j* for year *t* five days prior to the earnings announcement date.

$DISPERSION_{jt}$ - dispersion of forecasts, calculated as the standard deviation of individual earnings forecasts divided by share price five days prior to the earnings announcement date for firm *j* in year *t*.

$BIAS_{ijt}$= $(A_{jt} - F_{ijt})/SP_{jt}*100$, – similar to FE_{ijt}, but not in the absolute value. A negative *BIAS* indicates optimism, while a positive *BIAS* indicates pessimism

(ii) Variables used to evaluate the independence of the board of directors

NED_{jt} - the proportion of non-executive directors on the board of firm *j* in year *t*.

$DUALITY_{jt}$ - a dummy variable that takes a value of unity when the same person undertakes the role of chief executive and chairman on the board of firm *j* in year *t*, and zero otherwise.

$EXCHAIR_{jt}$ - executive chairman - a dummy variable that takes a value of unity when the board of firm *j* in year *t* is chaired by an executive chairman, and zero otherwise.

$NOMCOM_{jt}$ - a dummy variable that takes a value of unity when there is a nomination committee, and zero otherwise.

(iii) Firm-specific control variables

$LNMRKCAP_{jt}$ - the natural logarithm of market capitalization of firm *j* in year *t*.

$ROASD_{jt}$ - the standard deviation of the return on assets over the last five years for firm *j* in year *t*.

$GROWTH_{jt}$ - a measure of the growth of firm *j* in year *t* ($MRKCAP_{jt}/MRKCAP_{jt-1}$).

$LOSS_{jt}$ - a dummy variable that takes a value of unity when a firm's earnings before interest and tax are negative, and zero otherwise for firm *j* in year *t*.

$LEVERAGE_{jt}$ - the proportion of total debts against total assets for firm *j* in year *t*.

(iv) Analyst-specific control variables

EFF_{ijt} - the effort put in by analyst *i* in following firm *j* in year *t*, calculated as the inverse proportion of the number of firms followed by analyst *i* in year *t*.

EXP_{ijt} - years of experience of individual analyst *i* that follow firm *j* in year *t*, based on the assumption that 1990 (the start year in our initial sample) is the year one of experience.

$BRKSIZE_{ijt}$ - the number of analysts that work for the brokerage houses that employ analyst *i* that follows firm *j* in year *t*.

(v) Forecast-specific control variables

$HORIZON_{ijt}$ - the average number of trading days between analyst's *i* earnings forecasts announcement date and the reported date for firm *j* in year *t*.

$NOREVIEW_{ijt}$ - the average number of times the forecasts made by analyst *i* for firm *j* in year *t* is reviewed.

η_{ijt} - disturbance term.

In order to address our research question, we adopt the following approach. First, a univariate analysis is performed aimed at comparing the differences in the mean (median) accuracy of

forecasts above and below the median of the independent variables.[13] Then, given the nature of the research question (i.e., the estimation of the individual analyst's forecast accuracy variables as functions of the relevant firm *and* analyst specific characteristics) and the complexity of the data employed, we use an analyst-firm fixed effects estimator.[14] The variables, in this case, are adjusted, respectively, by analyst-firm specific means.[15] Finally, following Clement (1999) and Bolliger (2004), we check the robustness of our findings using pooled and Fama-MacBeth regressions estimators.[16] The approach used in this paper offers several benefits compared to using an aggregated forecast sample: (i) it offers the opportunity to test the hypotheses on a large sample of forecasts; (ii) it allows use of individual analysts' characteristics without averaging across individuals; (iii) it explores the determinants of forecast accuracy across individual analysts in the presence of both firm and analyst-specific characteristics;[17] and (iv) it avoids use of potentially inappropriate econometric techniques.[18]

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[13] A *t*-test is used to explore the differences in the mean accuracy of forecasts, and a Wilcoxon rank-sum test to evaluate the median differences.

[14] Due to the fact that each analyst in the sample may cover a (possibly time-varying) number of firms in any given year, and each firm may be covered by multiple (and a time-varying number of) analysts in any given year, the residual terms in a simple pooled regression may not be identically and independently distributed. Therefore, an analyst-firm fixed effects estimator is more appropriate.

[15] For example, the analyst-firm fixed effects estimator associated with Model 3 would take the following form: $ERROR_{ijt}=f(NED¢_{jt}, DUALITY¢_{jt}, \ldots, EFF¢_{ijt}, BRKSIZE¢_{ijt})$, where $NED¢_{jt}= NED_{jt} - \overline{NED_{ij}}$, $DUALITY¢_{jt}= DUALITY_{jt} - \overline{DUALITY_{ij}}$, $EFF¢_{ijt}= EFF_{ijt} - \overline{EFF_{ij}}$, $BRKSIZE¢_{ijt} = BRKSIZE_{ijt} - \overline{BRKSIZE_{ij}}$ (Greene, 1997). Moreover, in order to address the potential autocorrelation and heteroskedasticity problems that may be inherent in the nature of the data used (Cohen and Lys, 2003), the *t(z)*-values are calculated using the White-estimator of the variance-covariance matrix (White, 1980).

[16] The advantage of this approach is two-fold. Firstly, estimating the regression equation on an annual basis addresses the potential serial correlation problem in the data. Secondly, the time-series pattern of the coefficients may be informative (see Clement, 1999, and Bolliger, 2004).

[17] Some of the firm-specific characteristics employed in the research are dummy variables (e.g., duality, executive/non-executive chairman, the presence of a nomination committee). This feature is not unique to our research. For instance, Clement (1999) and Bolliger (2004) also employ dummy variables to measure the status of the brokerage house an analyst works for in their research. The variability across years within the firm dimension of these variables should ensure the sensitivity of the fixed-effects estimator to these changes. In the case of our research, there are 2488 individual forecasts when the nomination committee for firm *j* switches from 0 to 1, 1978 forecasts for executive/non-executive chairman, and 579 forecasts for duality. The variability of these variables would ensure the sensitivity of the analyst-firm fixed effects estimator to these variables.

[18] Exploring the impact of analyst-specific characteristics *only* on individual analysts' forecast errors, Clement (1999) and Bolliger (2004) employ a *firm-year* fixed effects estimator. However, a distinctive characteristic of our research is that unlike the above studies, we explore the impact of both firm *and* analyst-specific characteristics on the accuracy of individual analyst forecasts. De-meaning the variables by the firm-year values would remove the impact of firm-specific variables. Therefore, a combined *analyst-firm* fixed effects estimator is used.

4. Sample Data

The initial sample of one year ahead individual analysts' earnings forecasts is drawn from the *I/B/E/S UK Detailed File*. It consists of 263,350 earnings forecasts made from January 1990 through December 2002. Despite its overall quality, the *I/B/E/S* database does contain a number of omissions and inconsistencies. Therefore, to proceed further, we eliminate observations with unidentified analyst codes, missing reported dates and actual earning per share values (see details in Table 1, Panel A). Previous evidence suggests that the information environment of a firm is richer closer to the announcement date of annual earnings and that the most recent forecasts are the most accurate ones.[19] For these reasons, forecasts very near the end of the forecasting period are attractive measures for assessing differences in the accuracy of forecasts across firms. After selecting the most recent forecasts made by a particular analyst for a particular firm, the size of the sample is reduced to 59,410 forecasts (Table 1, Panel B).[20]

The firm-specific financial information was mainly collected from Datastream and supplemented with information regarding board characteristics from Annual Reports. After eliminating the observations not available in Datastream, forecasts made for financial firms, and forecasts qualified as outliers, the dataset contains 27,350 individual analyst forecasts.[21] In addition, due to the specific nature of the analyst-firm fixed effects estimator, we require that each analyst in the sample should follow a firm for at least three years.[22] The final sample is comprised of 11,659 forecasts made for 532 firms by 488 analysts over a 6 year period. The three dimensional

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19 See, for instance, Clement (1999).

20 Although we restrict our sample to the most recent forecasts, we take into consideration the total number of forecasts by using the number of reviews of a particular forecast as a control variable (*NOREVIEW*).

21 Following Thomas (2002), observations that have a forecast error greater than the associated share price and dispersion of forecasts greater than twenty percent are treated as outliers. There are 45 forecast error-related outliers and 99 dispersion-related outliers.

22 This requirement is imposed for two main reasons. First, to exclude the forecasts made by non-active analysts. And second, to allow the calculation of meaningful analyst-firm means for analyst and firm-specific variables (see, for instance, Himmerberg, Hubbard and Palia, 1999).

variation of the dependent variables (i.e., analyst, firm and time) requires use of appropriate econometric techniques. However, the rigorous selection criteria used to shape the sample and the elimination of forecast data due to missing values in the initial dataset, does create the potential for selection bias. Using Verbeek and Nijman's (1992) methodology, however, the existence of a selection bias problem is rejected.[23]

5. Empirical Results

5.1. Descriptive statistics

Table 2 exhibits the descriptive statistics of the variables used in the study. The mean (median) market capitalisation of firms included in the sample is £4.81 billion (£978 million), with a maximum of £172 billion and a minimum of £2.79 million. The average firm in the sample has 24.5 pence worth of total debts per pound of total assets, and a growth rate of 10.4 percent over the period 1996 to 2002.

The board of directors of an average firm in the sample is comprised of 9 members. Non-executive directors remain in the minority on UK boards, with the average representation in our sample being 48.7%. The incidence of duality is relatively low, with 8% of the forecasts in the sample being made for firms that have a combined role of chairman and chief executive. The results indicate that the majority of forecasts included in the sample (78%) are made for firms

[23] Following Verbeek and Nijman (1992), we create a dummy variable r_{ijt} that denotes whether or not observations for y_{ijt} are available. In other words, $r_{ijt}=1$ if y_{ijt} is observed, and $r_{ijt}=0$ otherwise. The condition of consistency is that the error term should not depend on r_{ijt}. More formally, $E[\tilde{e}_{ijt} \mid r_{ijt}]=0$, where $i=1\ldots N$, $j=1\ldots M$, $t=1\ldots T$, and $\tilde{e}_{ijt}$ is the residual. The authors argue that one could create functions of r_{ijt}, like r_{ijt-1}, $c_{ij}=\prod_{s=1}^{T} r_{ijs}$ or $T_{ij}=\sum_{s=1}^{T} r_{ijs}$, indicating whether j was observed by i in the previous year, over all the periods, and the total number of periods j is observed by i, respectively. In order to check for selection bias, Verbeek and Nijman (1992) suggest to include these function of r_{ijt} in the model and to check their significance. The results of this study (available upon request) indicate that the sample used in the research does not suffer from selection bias.

that have established a nomination committee. At the same time, in 39% of the cases, the board is chaired by an executive chairman. UK analysts appear to be reasonably accurate at forecasting short-term earnings, as reflected in a median forecast error and dispersion of forecasts of 0.467% and 0.400%, respectively. An average analyst in the sample has 4.42 years of experience, following an average of 11.63 firms per year.[24] Moreover, analysts in our sample review a forecast 2.82 times, and the average age of a forecast in the sample is 152 trading days.

5.2. Univariate analysis

Table 3 reports the differences in the mean/median of the accuracy of analyst forecasts for observations above and below the median of the independent variables.[25] The results suggest that contrary to the recommendations of The Code, analysts are less accurate for firms with a greater proportion of non-executive directors. For instance, the mean forecast error of firms with a small proportion of non-executive directors is 1.386%, compared to 2.403% of firms with a higher proportion of non-executive directors, with the difference being significant at the 1% level.

Also contrary to the recommendations of The Code, the univariate analysis indicates that firms with a combined leadership structure and firms chaired by an executive chairman have a lower forecast error and dispersion. Thus, the preliminary evidence does not provide any support for the recommendations of The Code.

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[24] Analyst effort is measured as the inverse of the number of firms followed by analyst *i* for firm *j* in year *t* (Table A). This means in this particular case: 1/0.086=11.63 firms.

[25] For the dummy variables used in the model, such as duality, executive/non-executive chairman, the existence of a nomination committee and loss firms, instead of using the median as the cut off point, we group them based on the value of dummies (i.e., 0 or 1).

5.3. Multivariate analysis

In this section we discuss the results of the analysis as hypothesised in Section 2, with the results pertaining to forecast error given in Table 5, dispersion in Table 6, and forecast bias in Table 7. Each of these tables contains the results of the three estimation techniques described earlier, namely the analyst-firm fixed effects, pooled and Fama-MacBeth regressions estimators. For reasons of brevity, we mainly focus on the results obtained from the analyst-firm fixed effects estimator.

Hypothesis 1: Non-executive directors. Contrary to the recommendations of The Code, the results in Table 5 suggest that with an increase in the proportion of non-executive directors, analyst forecast error increases. In particular, in the context of Model 1, a one unit increase in the proportion of non-executive directors, *ceteris paribus*, increases the forecast error by 2.977%. A qualitatively similar conclusion can be drawn using the pooled and Fama-MacBeth regressions estimators across all the models (Table 5). Moreover, firms with a greater proportion of non-executive directors not only have a greater forecast error, but their forecast dispersion is also greater. The results in Table 6 suggest that the proportion of non-executive directors is positively (but not across all the models significantly) associated with dispersion. For instance, using Model 1 and the analyst-firm fixed effects estimator, we find that a unit increase in the proportion of non-executive directors, *ceteris paribus*, is associated with 1.035% greater dispersion of forecasts. Thus, with an increase in the proportion of non-executive directors, the level of disagreement between the analysts regarding the future prospects of a firm increases. Some analysts, following the recommendations of The Code, may have higher expectations regarding the future earnings of the firms with a greater proportion of non-executive directors.

Others, however, who take into consideration the critical views regarding the effectiveness of non-executive directors, may be less so inclined.

Thus, in line with the information asymmetry and agency theories, the above evidence suggests that there is an agency information problem between the insiders and outsiders of a firm. However, contrary to the expectations and recommendations of The Code, an increase in the proportion of non-executive directors seems to be an inefficient method of addressing the agency disclosure problem, at least in terms of the accuracy of analyst earnings forecasts. Indeed, increasing the proportion of non-executive directors actually seems to accentuate the problem. These findings are in direct contrast to the *complementary role* to disclosure attributed to non-executive directors in Hong Kong by Chen and Jaggi (2000). However, our findings support Eng and Mark's (2003) *substitute-monitoring role* to disclosure of non-executive directors. A possible explanation may be that the non-executive directors are elected by institutional investors or block holders to represent their interests. As a result, non-executive directors may obtain the necessary information directly, rather than through public disclosure. The bottom line is that, contrary to the expectation of The Code, the non-executive directors seem not to fulfil their role of increasing the openness and transparency of UK firms. As a result of lower disclosure for firms with a greater proportion of non-executive directors, individual analysts make forecasts that suffer from higher forecast error and dispersion.

Despite the substitute-monitoring role of non-executive directors, the results presented in Table 7 suggest that analysts are more optimistic for firms with a greater proportion of non-executive directors. In the context of the analyst-firm fixed effects estimator and Model 1, a one unit increase in the proportion of non-executive directors, *ceteris paribus*, is associated with 3.876% lower forecast bias (i.e., greater optimism). A possible explanation for these results may be that

analysts expect non-executive directors to perform effectively their monitoring activities (i.e., greater expected returns for firms with more independent boards). Alternatively, this may be because of the greater level of uncertainty associated with these firms (i.e., lower disclosure, as argued earlier, may be associated with higher uncertainty and, thus, greater optimism; see Scherbina, 2004). In terms of forecasting theory, the findings suggest that UK analysts are biased and inefficient at producing earnings forecasts. In particular, the forecast bias of UK analysts is different from zero (i.e., the condition of forecast unbiasedness is not met) and the forecast bias depends on firm-specific characteristics (i.e., the efficiency condition is violated).

Hypothesis 2: Duality. The results suggest that a combined leadership structure does not affect analyst forecast error, but it has a weak impact on the dispersion and bias of the forecasts. For instance, the results in Table 6 and 7 (Model 1) suggest, *ceteris paribus*, that analysts are on average 0.303% more optimistic and the forecasts are 0.221% less dispersed for firms with a combined leadership structure compared to firms with no duality. This evidence does not support the recommendations of The Code, which suggests that duality is not a recommended practice. By contrast, our results seem to suggest that analysts take Boyd's (1995) point of view that duality may have a positive effect on the performance of the firm. In addition, it seems that firms with a combined leadership structure provide more information to outsiders – a feature that results in less dispersed forecasts.

Hypotheses 3 and 4: Executive/non-executive chairman and a nomination committee. Further results (Model 3 and 4) suggest that the role of a chairman and the existence of a nomination committee seem to have an insignificant impact on the forecast error and bias (Table 5 and 7). However, there is a weak indication (Table 6) that the role of chairman and the existence of a nomination committee affect the level of disagreement between analysts. Specifically, as based

on Model 3, the forecasts made for firms with a non-executive chairman and/or a nomination committee, *ceteris paribus*, are, on average, 0.216% and 0.125%, respectively, more dispersed compared to forecasts made for firms with an executive chairman and/or a nomination committee. However, in both cases the results are not robust across the Fama-MacBeth regressions estimator.

Thus, contrary to the recommendations of The Code, the evidence suggests that a non-executive chairman and the existence of a nomination committee seem to have a very weak (or no) impact on the level of disagreement between analysts. It may be that, similar to the non-executive directors, the non-executive chairman acts as a substitute-mechanism to disclosure. The rationale of forming a nomination committee is to ensure a formal and transparent procedure for the appointment of new directors on the board. However, because of the lack of robustness of the results, the evidence should be treated with some caution.

In terms of the control variables, the results presented in this paper support previous evidence that, nearer to the earnings announcement date, forecast errors and the analysts' level of optimism decrease. In addition, more experienced analysts are found to make more optimistic, but less accurate forecasters.

6. Sensitivity tests

The main aim of this paper is to test whether the openness and transparency of a firm improves with an increase in the independence of the board, using the accuracy of analysts' forecasts as a proxy for disclosure. In this section, we further examine this association by considering its relationship with the ownership structure of a firm and research and development expenditures.

Fama and Jensen (1983) suggest, and The Code reinforces the view, that non-executive directors strengthen the extent to which a board is independent of company management and so improve the degree of board monitoring. However, there are concerns that under concentrated director ownership, the controlling owners may have significant voting power and influence to determine the composition of the board and the appointment of non-executive directors (see, for instance, Shleifer and Vishny, 1997). Therefore, it may be that non-executive directors of high-insider ownership firms may be less effective at addressing the agency disclosure problem compared to non-executive directors of firms with less concentrated insider ownership. Indeed, Leung and Horwitz (2004) find that non-executive directors in Hong Kong are more effective at enhancing voluntary disclosure for firms with low insider ownership structure only. In order to check this possibility we proceed as follows. We create an interaction term between the proportion of non-executive directors on the board (*NED*) and a dummy variable that takes a value of unity if the proportion of shares held by insider members of the board as a proportion of outstanding shares is greater than the median, and zero otherwise (*DINSOW*). Then we include the interaction term in Model 1 and use an analyst-firm fixed effects estimator. Upon doing this (Table 8), we confirm our previous results that analysts are more optimistic, but less accurate, for firms with a higher proportion of non-executive directors, this holding true for both low and high insider ownership firms. Although analysts that follow high insider ownership firms are more accurate and but less optimistic with an increase in the proportion of non-executive directors compared to low insider ownership firms, the sum of the coefficients on *NED* and *NEDxDINSOW* is positive for forecast error and dispersion, and negative for bias (i.e., more optimistic forecasts). Thus, contrary to the evidence presented by Leung and Horwitz (2004), our results suggest that high insider ownership does not reduce the information environment of a firm, as measured by the accuracy of analysts' forecasts.

As argued earlier in the paper, previous evidence suggests that firms with more independent boards of directors are more likely to enjoy superior performance and firm value. As such, the latter firms may be in a better position to "afford" higher research and development expenditures. As documented by Kothari, Laguerre and Leone (2002) and Amir, Guan and Livne (2007), research and development expenditures are associated with higher future uncertainty. Consequently, it may be that although firms with more independent boards of directors are more transparent, this effect may be crowded out by the greater uncertainty related to these financial items. As a result, financial analysts may be less accurate for firms with high research and development expenditures compared to firms with less such expenditures. To address the issue, we create two dummy variables for firms with high and low research and development expenditures (*DR&DH* and *DR&DL*). If the amount of research and development expenditures as a proportion of sales is higher (lower) than the median, *DR&DH (DR&DL*) takes a value of unity, and zero otherwise.[26] Then we include the interactive terms of these variables with the proportion of non-executive directors in Model 1. The results presented in Table 8 support our previous findings that a greater proportion of non-executive directors is indeed associated with more optimistic, but less accurate forecasts, for both high and low research and development firms.[27] Nonetheless, analysts seem to be less optimistic and make a lower forecast error, for firms with lower research and development expenditures that increase the proportion of non-executive directors compared to high research and development firms. However, the sum of the coefficients, in both cases, confirm our initial findings that analysts are more optimistic, but less accurate, for firms with a higher proportion of non-executive directors on the board. These

[26] It should be noted that firms that report zero research and development expenditures, or do not report any such expenditures, are not included in the low research and development category.

[27] The results hold true in the presence of both ownership and research and development expenditures in the same model.

results hold true for firms with different levels of insider ownership and research and development expenditures.

7. Summary and conclusions

The evidence presented in this paper suggests that as predicted by the information asymmetry and agency theories, there is an agency disclosure problem between the insiders and outsiders of a firm. Despite The Code recommending a set of governance mechanisms aimed at addressing this issue, the findings in this paper suggest that in most cases these recommendations are not effective at mitigating the agency disclosure problem, at least when using the accuracy of analyst earnings forecasts as a proxy for the disclosure of a firm. The above findings, in the context of standard forecasting theory, suggest that analysts are biased and inefficient at forecasting earnings.

Moreover, the results suggest that, in some instances, the recommendations of The Code may actually have an adverse effect on disclosure. For instance, we find that although analysts' are more optimistic for firms with a greater proportion of non-executive directors on the board, the forecast error and dispersion for these firms is higher, this holding true at different levels of insider ownership and research and development expenditures. Thus, although analysts view non-executive directors as a desirable characteristic of a board (i.e., analysts are optimistic), in reality non-executive directors seem to be ineffective at increasing the transparency of the firm. In line with Eng and Mark (2003), we argue that non-executive directors play *a substitute-monitoring role* to disclosure. It is possible that non-executive directors have been elected on the board by the major institutional shareholders or other block holders. As a result, they obtain their information directly and not from public disclosure.

Duality is found to have an insignificant influence on forecast error, though the forecasts made for firms with a combined leadership structure are more optimistic and dispersed. This evidence suggests that duality may foster stronger leadership, rather than a situation where the chief executive/chairman acts to the detriment of shareholders. In addition, the chairman (executive/non-executive) mix and the existence of a nomination committee do not seem to affect the forecast error and bias. However, the forecasts made for these firms are found to be more dispersed. It may be that some analysts view non-executive chairmen to be too busy to perform effectively their duties, furthermore that they could use their strong external connections to the detriment of shareholders' interests. Others, however, who take into consideration the recommendations of The Code, may take a positive view regarding the role of the non-executive chairmen – a view that results in higher disagreement between individual analysts' regarding future earnings.

In summary, the evidence presented in this paper indicates that the recommended governance practices, as in The Code, seem to be ineffective at addressing the agency disclosure problem, at least when using the accuracy of analyst forecasts as a proxy for disclosure. Indeed, in some cases they actually have the opposite effect from that intended. These results compound previous suggestions that question the effectiveness of the recommended governance practices. However, the current research approaches the issue from a different perspective (i.e., analyst perspective), using panel data techniques and a UK sample. To the best of our knowledge these are innovative insights into analysts' forecasting activity from a corporate governance perspective.

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Table 1. Sample selection.

Panel A. We start with a total of 263,350 one-year ahead earning forecasts available in the *I/B/E/S UK Detailed File* made by the financial analysts during the 1990-2002 period. The observations that have missing *I/B/E/S*-specific characteristics, such as reported date, analyst code and actual earning per share, are eliminated from the sample. After eliminating these forecasts, the sample is comprised of 151,212 individual forecasts, but which also include the revised forecasts. For instance, if analyst *i* follows firm *j* in year *t* and the forecast has been reviewed five times since it has been initially made to the announcement date, then all five forecasts would be included in the sample.

	Individual forecasts	Firm-year forecasts	Firms	Brokerage houses	Analysts
UK EPS forecasts	263,350	14,634	1,869	179	1,813
After eliminating observations with missing					
Reported date	207,770	11,703	1,773	160	1,730
Analyst code	161,982	10,532	1,704	138	1,729
Actual EPS	155,346	8,936	1,596	130	1,718
Different year-firm actual EPS value	151,212	8,775	1,585	128	1,713

Panel B. For the purpose of this paper, from the 151,212 forecasts we select the most recent forecasts made by analyst *i* for firm *j* in year *t*. This yields a sample of 59,410 individual forecasts. Then we eliminate forecasts made for firms not available in Datastream, financial firms and firms with no found annual reports. In addition, because of the small number of forecasts in the sample made during 1990-1995&2002 we also eliminate these forecasts. Due to the specific nature of the employed methodology to explore the individual analysts forecasts, we require that forecasts included in the sample should be made by analysts that follow a particular firm for at least three years. This requirement yields a sample of 11,659 individual analyst forecasts.

	Individual forecasts	Firm-year forecasts	Firms	Brokerage houses	Analysts
The most recent forecasts	59,410	8,775	1,585	128	1,713
Available in DataStream	46,838	5,456	1,072	102	1,646
Financial firms and 1990-1995&2002	27,580	3,183	844	84	1,299
Annual Reports found	27,494	3,151	840	84	1,299
Outliers	27,350	3,109	834	84	1,297
Analyst *i* follows firm *j* at least for 3 years	11,659	2,480	532	53	488

Table 2. Descriptive statistics.

This table exhibits the descriptive statistics for variables used in the study. See the description of the variables in Table A (N=11,659).

Variables	Min	Max	Mean	Median	St. Dev.
Panel A: Forecast-specific characteristics					
ERROR, %	0.000	89.760	1.736	0.467	5.333
DISPERSION, %	0.000	18.980	0.919	0.400	1.818
BIAS, %	-89.760	57.110	-0.321	0.044	5.599
HORIZON	6.00	249.000	152.00	144.00	102.726
NOREVIEW	1.000	19.000	2.820	2.000	1.785
EXP	1.000	11.000	4.420	4.000	2.145
EFF	0.010	1.000	0.086	0.043	0.141
BRKSIZE	1.000	79.000	30.030	28.000	18.402
Panel B: Firm-specific characteristics					
MRKCAP, (£M)	2,798	172,248	4,813	978	13,701
ROASD	0.000	0.960	0.044	0.028	0.051
GROWTH	0.000	31.620	1.104	1.035	0.739
LOSS	0.000	1.000	0.051	0.000	0.220
LEVERAGE	0.000	1.830	0.245	0.225	0.172
Panel C: Board-specific characteristics					
SIZE OF THE BOARD	3.000	25.000	9.430	9.000	2.805
NED	0.000	0.880	0.487	0.500	0.135
DUALITY	0.000	1.000	0.080	0.001	0.264
EXCHAIR	0.000	1.000	0.390	0.001	0.488
NOMCOM	0.000	1.000	0.780	1.000	0.417

Table 3. The accuracy of analyst forecasts and board structure.

This table compares the accuracy of individual analysts' forecasts below and above the median value of the independent variables. For instance, the mean value of forecast error for firms with a proportion of non-executive directors below the median value (i.e., a low proportion of non-executive directors) is 1.386% compared to 2.043% for firms with a proportion of non-executive directors above the median (i.e., a high proportion of non-executive directors). For binary variables used in the study (duality, chairman mix and the existence of a nomination committee) the groups are formed based on the zero and unity values. Differences in mean are assessed using a *t*-test, while differences in median are evaluated using a Wilcoxon rank-sum test (N=11,659).

	NED		DUALITY		EXCHAIR		NOMCOM	
Variables	Mean	Median	Mean	Median	Mean	Median	Mean	Median
ERROR								
Below the median or 0	1.386	0.430	1.774	0.473	2.015	0.465	1.413	0.483
Above the median or 1	2.043	0.491	1.267	0.412	1.303	0.471	1.829	0.463
Differences	-0.657***	-0.061***	0.508***	0.061***	0.712***	-0.006	-0.416***	0.020
DISPERSION								
Below the median or 0	0.864	0.345	0.925	0.402	0.982	0.415	0.877	0.313
Above the median or 1	0.967	0.447	0.848	0.354	0.821	0.361	0.931	0.413
Differences	-0.102***	-0.102***	0.076	0.048***	0.161***	0.054***	-0.054	-0.100***
BIAS								
Below the median or 0	-0.387	0.052	-0.330	0.037	-0.192	0.068	-0.454	0.068
Above the median or 1	-0.263	0.034	-0.200	0.114	-0.521	0.009	0.282	0.037
Differences	-0.124	0.018	-0.130	-0.077***	0.329***	0.059***	-0.172	0.031**

**** denotes significance at the 0.01 level (2-tailed), ** denotes significance at the 0.05 level (2-tailed),* denotes significance at the 0.1 level (2-tailed)*

Table 4. Correlation table: ownership structure and the accuracy of analysts' forecasts.

	ERROR	DISPER	BIAS	NED	DUALITY	EXCHAIR	NOMCOM	HORIZON	NOREV	LNMRK	ROASD	GROWTH	LOSS	LEVER	EXP	EFF
ERROR	1															
DISPER	0.369(**)	1														
	0.000															
BIAS	-0.092(**)	-0.265(**)	1													
	0.000	0.000	.													
NED	0.053(**)	0.055(**)	-0.001	1												
	0.000	0.000	0.875													
DUALITY	-0.025(**)	-0.011	0.006	-0.089(**)	1											
	0.007	0.231	0.508	0.000												
EXCHAIR	-0.065(**)	-0.043(**)	-0.029(**)	-0.241(**)	0.355(**)	1										
	0.000	0.000	0.002	0.000	0.000											
NOMCOM	0.032(**)	0.012	0.013	0.168(**)	-0.077(**)	-0.100(**)	1									
	0.000	0.184	0.166	0.000	0.000	0.000										
HORIZON	0.048(**)	-0.012	-0.075(**)	-0.026(**)	-0.006	-0.001	0.005	1								
	0.000	0.194	0.000	0.004	0.487	0.943	0.581									
NOREV	0.003	0.071(**)	0.021(*)	0.096(**)	-0.032(**)	-0.017	0.095(**)	-0.368(**)	1							
	0.787	0.000	0.027	0.000	0.001	0.065	0.000	0.000								
LNMRK	-0.086(**)	-0.162(**)	0.024(*)	0.175(**)	-0.081(**)	0.087(**)	0.315(**)	-0.076(**)	0.160(**)	1						
	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	.						
ROASD	0.132(**)	0.179(**)	-0.069(**)	0.150(**)	-0.027(**)	-0.081(**)	-0.070(**)	0.009	0.011	-0.109(**)	1					
	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.344	0.255	0.000						
GROWTH	0.098(**)	-0.050(**)	0.130(**)	-0.003	0.009	0.009	-0.034(**)	-0.023(*)	-0.028(**)	0.089(**)	0.027(**)	1				
	0.000	0.000	0.000	0.738	0.324	0.308	0.000	0.011	0.003	0.000	0.003					
LOSS	0.303(**)	0.227(**)	-0.082(**)	0.102(**)	0.043(**)	-0.033(**)	-0.005	0.005	-0.006	-0.142(**)	0.382(**)	-0.018(*)	1			
	0.000	0.000	0.000	0.000	0.000	0.000	0.559	0.606	0.538	0.000	0.000	0.047				
LEVER	-0.027(**)	0.044(**)	-0.035(**)	0.189(**)	-0.053(**)	-0.034(**)	0.101(**)	0.025(**)	0.061(**)	0.126(**)	0.109(**)	-0.025(**)	0.047(**)	1		
	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.006	0.000			
EXP	0.016	0.044(**)	-0.029(**)	0.035(**)	0.005	-0.030(**)	0.080(**)	0.189(**)	0.078(**)	-0.082(**)	0.038(**)	-0.021(*)	0.043(**)	0.042(**)	1	
	0.075	0.000	0.002	0.000	0.609	0.001	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000		
EFF	0.003	0.016	-0.034(**)	0.114(**)	-0.044(**)	-0.015	0.071(**)	0.010	-0.050(**)	0.157(**)	0.028(**)	-0.002	0.009	0.073(**)	-0.086(**)	1
	0.720	0.076	0.000	0.000	0.000	0.105	0.000	0.260	0.000	0.000	0.003	0.838	0.327	0.000	0.000	
BRKSIZE	-0.007	-0.022(*)	0.012	0.046(**)	0.000	0.008	0.071(**)	0.045(**)	0.102(**)	0.131(**)	-0.033(**)	-0.013	-0.023(*)	0.061(**)	-0.048(**)	0.037(**)
	0.462	0.018	0.192	0.000	0.993	0.399	0.000	0.000	0.000	0.000	0.000	0.159	0.013	0.000	0.000	0.000

*** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).*

Table 5. Forecast error and board structure.

The regression results for the pooled and Fama-MacBeth regressions presented in Table 5-7 are obtained by demeaning the independent variables by their respective analyst-firm means. The *t*-statistics for analyst-firm fixed effects and pooled regressions (given in the second entry of each cell) are based on White's (1980) estimator of the variance-covariance matrix. The *t*-statistics for Fama-MacBeth regressions are calculated as $\bar{x}/(s_x/\sqrt{n})$ where the x's are the regression coefficients for the individual year, s_x is the standard deviation of the regression coefficients across the years, and n is the number of years (N=11,659).

		Model 1			Model 2			Model 3			Model 4		
	Expected	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth
NED	-	2.977***	2.977***	3.120*	3.030***	3.030***	3.171	-	-	-	-	-	-
		3.65	3.37	1.68	3.50	3.17	1.57						
DUALITY	+	0.191	0.191	-0.101	0.351**	0.351**	0.320	-	-	-	-	-	-
		1.32	1.12	-0.25	2.29	2.06	0.90						
EXCHAIR	+	-	-	-	-	-	-	-0.038	-0.038	-0.156	0.054	0.054	0.111
								-0.29	-0.27	-0.52	0.39	0.37	0.44
NOMCOM	-	-	-	-	-	-	-	0.068	0.068	0.213	0.056	0.056	0.165
								0.52	0.49	0.40	0.38	0.35	0.37
LNMRKCAP	-	-1.462***	-1.462***	-1.972***	-1.224***	-1.224***	-1.671**	-1.498***	-1.498***	-2.037***	-1.247***	-1.247***	-1.491*
		-8.34	-6.79	-2.77	-8.18	-5.49	-2.47	-8.45	-6.89	-2.85	-8.24	-5.54	-1.91
GROWTH	+	0.566***	0.566***	0.504	-	-	-	0.577***	0.577***	0.535	-	-	-
		5.54	1.98	0.62				5.58	2.02	0.65			
LOSS	+	4.774***	4.774***	4.759*	-	-	-	4.809***	4.809***	4.778*	-	-	-
		7.32	5.37	1.84				7.36	5.40	1.83			
LEVERAGE	-	-1.470***	-1.470***	-0.907	-	-	-	-1.425***	-1.425***	-1.963	-	-	-
		-2.97	-2.53	-0.44				-2.89	-2.47	-1.01			
ROASD	+	-	-	-	14.186***	14.186***	9.066	-	-	-	14.458***	14.458***	9.804
					4.46	4.00	1.31				4.52	4.06	1.41
HORIZON	+	0.003***	0.003***	0.004***	-	-	-	0.004***	0.004***	0.004***	-	-	-
		7.52	5.93	4.39				7.71	6.07	3.66			
NOREVIEW	-	-	-	-	-0.033	-0.033	-0.032	-	-	-	-0.032	-0.032	-0.033
					-1.17	-0.93	-0.84				-1.13	-0.89	-0.78
EXP	-	-	-	-	0.081***	0.081***	0.332**	-	-	-	0.115***	0.115***	0.358***
					2.76	2.10	2.67				3.49	2.78	3.22
EFF	-	-	-	-	0.840	0.840	1.162*	-	-	-	0.808	0.808	1.031
					1.21	1.10	1.68				1.16	1.06	1.47
BRKSIZE	-	-	-	-	0.003	0.003	0.002	-	-	-	0.003	0.003	0.002
					0.79	0.55	0.326				0.80	0.55	0.23
R-Sq.,%		62.07	3.87		59.82	1.63		61.97	3.77		59.72	1.52	

**** denotes significance at the 0.01 level (2-tailed), ** denotes significance at the 0.05 level (2-tailed),* denotes significance at the 0.1 level (2-tailed)*

Table 6. Dispersion and board structure.

	Expected	Model 1			Model 2			Model 3			Model 4		
		Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth
NED	-	1.035***	1.035***	0.599	0.513	0.513	0.565	-	-	-	-	-	-
		2.81	2.57	1.06	1.31	1.19	1.08						
DUALITY	+	-0.221**	-0.221**	-0.270	-0.147	-0.147	-0.224	-	-	-	-	-	-
		-2.23	-2.02	-0.91	-1.47	-1.34	-0.77						
EXCHAIR	+	-	-	-	-	-		-0.216***	-0.216***	-0.156	-0.134*	-0.134*	-0.137
								-2.91	-2.82	-0.68	-1.71	-1.68	-0.60
NOMCOM	-	-	-	-	-	-		0.125**	0.125**	-0.064	-0.042	-0.042	-0.097
								2.38	2.09	-0.39	-0.76	-0.69	-0.73
LNMRKCAP	-	-0.942***	-0.942***	-1.067***	-0.787***	-0.787***	-0.863***	-0.952***	-0.952***	-1.073***	-0.788***	-0.788***	-0.860***
		-11.10	-11.11	3.64	-11.54	-11.04	-4.38	-11.13	-11.12	-3.65	-11.49	-10.96	4.40
GROWTH	+	0.209***	0.209***	0.324***	-	-		0.214***	0.214***	0.331**	-	-	-
		5.55	5.79	1.89				5.60	5.85	1.94			
LOSS	+	0.686***	0.686***	0.750	-	-		0.867***	0.867***	0.756	-	-	-
		5.16	4.49	1.51				5.10	4.44	1.51			
LEVERAGE	+	0.682***	0.682***	0.011	-	-		0.666***	0.666***	0.067	-	-	-
		3.62	2.89	0.02				3.47	2.78	0.12			
ROASD	+	-	-	-	6.721***	6.721***	5.685***	-	-	-	6.807***	6.807***	5.686**
					7.83	6.30	2.47				7.85	6.34	2.40
HORIZON	+	-0.001	-0.001	-0.001	-	-		-0.001	-0.001	-0.001	-	-	-
		-0.24	-0.21	-0.79				-0.21	-0.19	0.79			
NOREVIEW	-	-	-	-	0.060***	0.060***	0.054***	-	-	-	0.060***	0.060***	0.052***
					4.92	4.41	4.92				4.92	4.41	4.90
EXP	?	-	-	-	0.076***	0.076***	0.019	-	-	-	0.081***	0.081***	0.032
					5.93	5.55	1.20				5.99	5.98	1.50
EFF	-	-	-	-	0.189	0.189	0.293	-	-	-	0.180	0.180	0.269
					0.97	0.88	1.11				0.92	0.84	1.02
BRKSIZE	?	-	-	-	-0.001	-0.001	0.001	-	-	-	-0.001	-0.001	0.001
					-0.37	-0.33	0.67				-0.37	-0.33	0.77
R-Sq.,%		40.86	4.60		41.09	4.84		40.83	4.57		41.09	4.83	

**** denotes significance at the 0.01 level (2-tailed), ** denotes significance at the 0.05 level (2-tailed),* denotes significance at the 0.1 level (2-tailed)*

Table 7. Forecast bias and board structure.

	Expected	Model 1			Model 2			Model 3			Model 4		
		Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth	Analyst-firm FE	Pooled regressions	Fama-MacBeth
NED	-	-3.876***	-3.876***	-3.126	-3.832***	-3.832***	-3.900**	-	-		-	-	-
		-4.40	-4.07	-1.88	-4.16	-3.79	-2.29						
DUALITY	+	-0.303*	-0.303*	-0.311	-0.386**	-0.386**	-0.399	-	-		-	-	-
		-1.69	-1.73	-0.54	-2.07	-2.19	-1.12						
EXCHAIR	+	-	-	-	-	-		0.272*	0.272*	0.223	0.189	0.189	0.242
								1.87	1.77	0.59	1.21	1.16	0.60
NOMCOM	-	-	-	-	-	-		-0.011	-0.011	0.394	0.006	0.006	-0.119
								-0.07	-0.07	0.83	0.04	0.04	-0.30
LNMRKCAP	+	0.998***	0.998***	1.418**	0.995***	0.995***	1.133	1.043***	1.043***	0.969	1.019***	1.019***	
		6.48	4.72	1.68	6.89	4.42	1.03	6.65	4.87	0.99	6.97	4.49	
GROWTH	-	-0.181**	-0.181**	-0.724	-	-		-0.196**	-0.196**	-0.768	-	-	1.137
		-2.09	-0.56	-0.98				-2.22	-0.60	-1.04			1.02
LOSS	-	-3.493***	-3.493***	-2.551	-	-		-3.547***	-3.547***	-2.14			
		-5.12	-3.77	-0.77				-5.17	-3.82	-0.79			
LEVERAGE	?	1.785***	1.785***	2.625**	-	-		1.747***	1.747***	2.699*	-	-	
		3.38	2.87	1.63				3.32	2.82	1.63			
ROASD	-	-	-	-	-9.964***	-9.964***	-7.121	-	-	-	-10.431***	-10.431***	-7.467
					-3.01	-2.66	-1.13				-3.13	-3.13	-1.18
HORIZON	-	-0.004***	-0.004***	-0.003***	-	-		-0.004***	-0.004***	-0.001***	-	-	
		-8.35	-6.56	-2.53				-8.56	-6.72	-2.71			
NOREVIEW	+	-	-	-	0.071**	0.071**	0.042	-	-	-	0.070**	0.070**	0.033
					2.43	1.90	1.42				2.38	1.86	1.12
EXP	-	-	-	-	-0.091***	-0.091***	0.374***	-	-	-	-0.128***	-0.128***	0.334*
					-2.86	-2.22	3.16				-3.63	-2.93	2.76
EFF	-	-	-	-	-0.399	-0.399	-0.360	-	-	-	-0.349	-0.349	-0.228
					-0.55	-0.50	-0.43				-0.48	-0.43	-0.27
BRKSIZE	?	-	-	-	-0.009*	-0.009*	-0.003	-	-	-	-0.009*	-0.009	-0.003
					-1.88	-1.30	-0.52				-1.87	-1.30	-0.62
R-Sq.,%		61.06	2.27		59.89	1.11		60.92	2.12		59.75	0.96	

**** denotes significance at the 0.01 level (2-tailed), ** denotes significance at the 0.05 level (2-tailed),* denotes significance at the 0.1 level (2-tailed)*

Table 8. Sensitivity tests.

This table exhibits the results of sensitivity tests in relation to the ownership of insider members of the board and research and development expenditures using Model 1 and an analyst-firm fixed effects estimator. *DINSOW* represents a dummy variable that takes a value of unity if the proportion of shares held by insider members of the board as a proportion of outstanding shares for firm *j* in year *t* is greater than the median in the sample, and zero otherwise. *DR&DH* is a dummy variable that takes a value of unity if the proportion of research and development expenditures in total sales of firm *j* in year *t* is greater than the median, and zero otherwise. *DR&DL* is a dummy variable that takes a value of unity if the proportion of research and development expenditures in total sales of firm *j* in year *t* is lower than the median, and zero otherwise. In both cases, the median of research and development expenditures as a proportion of total sales is calculated using the sample of firms that report positive (non-zero) research and development expenditures. See Table A for a description of the remaining variables (N=11,659).

	Insider Ownership			Research and Development Expenditures		
	Error	Dispersion	Bias	Error	Dispersion	Bias
NED	3.436***	1.301***	-4.199***	2.818***	0.300	-4.230***
	4.09	3.44	-4.64	2.98	0.67	-4.14
NED*DINSOW	-1.320***	-0.763***	0.928*	-	-	-
	-2.91	-5.32	1.94			
NED*DR&DH	-	-	-	2.853**	3.001***	-1.154
				2.22	4.52	-0.86
NED*DR&DL	-	-	-	-1.401*	1.243***	2.564***
				-1.81	3.05	3.12
DUALITY	0.264*	-0.178*	-0.354**	0.165	-0.211**	-0.264
	1.81	-1.78	-1.96	1.15	-2.17	-1.47
HORIZON	0.003***	-0.001	-0.004***	0.003***	-0.001	-0.004***
	7.53	-0.23	-8.35	7.52	-0.51	-8.42
LNMRKCAP	-1.451***	-0.935***	0.991***	-1.436***	-0.923***	0.982***
	-8.34	-11.11	6.46	-8.30	-10.85	6.48
GROWTH	0.565***	0.209***	-0.180**	0.552***	0.203***	-0.169**
	5.56	5.57	-2.08	5.51	5.49	-1.99
LOSS	4.810***	0.889***	-3.518***	4.803***	0.866***	-3.529***
	7.36	5.30	-5.12	7.37	5.11	-5.16
LEVERAGE	-1.556***	0.632***	1.846***	-1.435***	0.620***	1.698***
	-3.12	3.34	3.47	-2.94	3.25	3.24
R-Sq.,%	62.14	41.07	61.10	62.25	41.41	61.20

**** denotes significance at the 0.01 level (2-tailed), ** denotes significance at the 0.05 level (2-tailed),* denotes significance at the 0.1 level (2-tailed)*