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INDEPENDENT NON-EXECUTIVE DIRECTORS AND EARNINGS MANAGEMENT IN THE UK

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ABSTRACT

This paper examines the association between opportunistic income increasing earnings management and corporate governance in UK firms with a particular focus on the independence of non-executive directors on the board and audit committee. Novel features of our study are the development of a specific accruals methodology to measure opportunistic earnings management based on insights from financial statement analysis and the construction of a comprehensive profile of director independence based on information disclosed in financial statements. Our measure of earnings management is not associated with non-executive director independence or share ownership, but it is significantly associated with the role and equity ownership of the chief executive officer.

INTRODUCTION

A central aim of the Cadbury Report (1992, p. 15) was to enhance those aspects of corporate governance (CG) associated with the reliability of financial statements. In this context Brennan and McDermott (2004, p. 325) highlight the contribution of the Cadbury Report (1992) in identifying the role of independent non-executive directors (NEDs). Peasnell, Pope and Young (2000, p. 419) credit the Cadbury Report (1992) with focusing attention on the extent of earnings management (EM) as a key issue for the protection of investors that impacts adversely on the quality of financial statements. Theory identifies a role for discretionary accruals to reduce information asymmetry by signalling managers' private information (Demski and Sappington, 1990), and the information content of total and discretionary accruals have been confirmed in market-based studies by Wilson (1986) and Subramanyam (1996). However, good CG has a role to play in mitigating opportunistically motivated EM that makes some contracting parties worse off. In this paper we contribute to the literature by examining the relationship between opportunistic income increasing EM and CG, paying particular attention to the independence of NEDs serving on the board and the audit committee.

Recent accounting scandals raised concerns over the adequacy of the Combined Code (London Stock Exchange (1998), hereafter "the Combined Code") definition of NED independence. The Higgs Report (2003) concluded that the

board of directors had excessive discretion in classifying NEDs as independent, and in response the guidance provided in the Combined Code was revised (Combined Code, Financial Reporting Council, revised, 2003, pp. 6–7, hereafter "the revised Combined Code"). The Combined Code was also revised in 2001 and 2006 and for the purposes of this study it is the requirements of the 2001 code, prior to the Higgs Report, that are relevant. In a review of the annual reports of Irish listed firms prior to the Higgs Report (2003), Brennan and McDermott (2004) find a lack of consistency in the interpretation of NED independence. Based on their findings, they support the Higgs recommendations for a more precise definition of NED independence as incorporated in the revised Combined Code. A question remains, however, about the benefit of a tighter definition of NED independence. To examine this issue, and in view of Brennan and McDermott's (2004) findings, we define a construct of NED independence based on information about directors' affiliations disclosed in financial statements for 2001, prior to the revision of the Combined Code. The investigation period is the financial year ended 2001 which pre-dates the Higgs Report (2003) and the revised Combined Code.

The contribution of director independence to financial reporting quality has been the subject of recent research. In a review of the literature, He, Labelle, Piot and Thornton (2005) identify three proxies for poor financial reporting quality, namely, fraudulent financial reporting, Generally Accepted Accounting Principles (GAAP) violations/earnings restatements and EM. For each category, research studies have examined the role of independent NEDs on the board and the audit committee, using US and French data (Xie, Davidson III and DaDalt, 2003; Uzun, Szewczyk and Varma, 2004; Agrawal and Chadha, 2005; Piot and Janin, 2005). However, the findings are mixed. Klein (2002) documents that NED independence is negatively associated with EM, but recent US and French studies do not find that director independence affected EM (Xie et al., 2003; Piot and Janin, 2005).

Previous research examining the association between CG and EM (Dechow, Sloan and Sweeney, 1996; Klein, 2002; Xie et al., 2003; Bradbury, Mak and Tan, 2004; Peasnell, Pope and Young, 2004) employs the aggregate accruals methodology for measuring EM. However, this approach has been challenged for estimating EM with an unacceptably high level of measurement error (McNichols, 2002; Wysocki, 2005). In this paper we follow McNichols and Wilson (1988), Beaver and Engel (1996) and Beneish (1997, 1999b) by exploring and developing further the specific accruals methodology for measuring EM. Our study is informed by insights from financial statement analysis where higher accruals and accounting ratios serve as "red flags" for further investigation by users of financial reports (Dechow et al., 1996; Penman, 2001; Richardson, Tuna and Wu, 2003; Schipper and Vincent, 2003; Dechow and Schrand, 2004). We follow McNichols and Wilson (1988), Beaver and McNichols (1998) and Nelson (2000) by adopting an industry-based approach. Specifically, to identify opportunistic income increasing EM we follow Beneish (1999b) by using the subset of accounting ratios identified as being positively associated with earnings manipulation[1] by US GAAP violators. A novel feature of our research design is the construction of measures of the propensity to

manage earnings for the Beneish ratios in combination and separately for reported values and also for demeaned industry-specific equivalents to control for industry effects. Our findings inform the debate on the reform of CG regulation and are potentially useful for implementing the business-sector approach recently adopted by the Financial Reporting Review Panel (FRRP) in the pro-active enforcement of accounting regulations (Financial Reporting Review Panel Council, 2005, p. 2)[2].

To investigate the significance of industrial characteristics on the relation between EM and CG, the industries we choose differ markedly with regard to their age, size, asset structure and CG characteristics. Prior research has indicated that these characteristics may be associated with EM (Beasley, 1996; Becker, DeFond, Jiambalvo and Subramanyan, 1998). We select the UK software and computer services (hereafter "software") and the engineering and machinery (hereafter "engineering") industries. Firms in the software industry may be seen as being from a "new economy" as they are significantly younger and smaller than firms from the engineering industry, which may be regarded as from the "old economy". We find significant inter-industry differences. Firms in the software industry are found to have a lower proportion of independent NEDs on the board and have a greater propensity towards EM. Their Chief Executive Officers (CEOs) are also more likely to be founders of the firm.

Consistent with Xie et al. (2003) and Piot and Janin (2005), we find little association between NED independence and EM. Our findings are also consistent with those of Uzun et al. (2004) and Agrawal and Chadha (2005) who fail to identify a significant correlation between NED independence and measures of financial reporting quality. Thus, we find little support for the more restrictive definition of independence proposed by the Higgs Report (2003) and incorporated into the revised Combined Code. Further, in the revised Combined Code, it is explicitly assumed that significant shareholdings by NEDs may impede upon their ability to act independently (revised Combined Code, p. 6). However, consistent with prior results (Dechow et al., 1996; Agrawal and Chadha, 2005) and agency-based explanations for EM (Fama, 1980; Fama and Jensen, 1983; Jensen, 1993), we find little evidence that NED shareholdings are associated with the propensity to manage earnings. Firms where the CEO is also the founder have a higher propensity to manage earnings. In contrast, CEO shareholdings are negatively associated with EM. These findings are robust to "demeaning" for industry effects, a process which examines the difference between each ratio and its relevant industry-specific mean. Moreover, findings provide support for the use of the Beneish financial accounting ratios, in combination and separately, for the purposes of financial statement analysis.

Finally, when we apply the more commonly used modified Jones cross-sectional aggregate accruals model for measuring EM to our small sample industry-based data, we find the statistical significance of the model is substantially lower than the best performing specific accruals ratio-based measure of EM. A possible explanation is that the Beneish model, based on a study of GAAP violators, has a comparative advantage over the Jones model in measuring opportunistic income increasing EM. The findings of the paper indicate the benefit

in small industry-based studies of the flexibility offered by a specific accruals approach. Accordingly, our approach to measuring EM is of potential use as a simple scoring model to FRRP regulators and others seeking to screen firms for opportunistic EM in the context of small, industry-based samples.

The remainder of the paper is organised as follows. In the next section we review the literature on NED independence, CG and EM and develop our hypotheses. We then present our research methodology, describe our data and present our empirical findings. We conclude by discussing the policy implications of our results.

PRIOR LITERATURE AND HYPOTHESES

Non-executive director independence

The academic literature offers various definitions of NED independence and commonly defines NEDs as being either independent or "grey". Lipton and Lorch (1992), Beasley (1996), Klein (2002), Xie et al. (2003) and Bedard, Chtourou and Courteau (2004) define an independent NED as one that has no affiliation with the firm other than being on its board. In regulatory guidance, the Combined Code (p. 15) requires firms to identify NEDs considered to be independent. However, Brennan and McDermott (2004) identify a lack of consistency amongst Irish-listed firms in interpreting the definition of independence.

To obtain a consistent classification of NED independence, we set aside the company's definition by applying our own based on prior literature and informed by disclosures in financial statements. An independent NED is defined as having no known affiliation with the firm other than being on its board, taking into account the business, financial or personal affiliations, disclosed in financial statements, that compromise NED independence. A business affiliation refers to a known relationship the NED has or had with the firm through business transactions. A financial affiliation refers to a known association the NED has or had with the firm due to payment(s) for work undertaken in an executive capacity or to remuneration the NED receives or received that may impair independence. A personal affiliation refers to a known personal relationship the NED has or had with the firm. We construct a checklist for the classification of independence and apply it to NEDs in our sample. The checklist presented in the **Appendix** identifies 16 business, nine financial and three personal affiliations that are viewed as compromising independence. In addition, since the Combined Code explicitly requires firms to identify the independent NEDs in their annual report, those directors not identified by the firm as independent are classified in the paper as grey.

Prior evidence of the association between NED independence and financial reporting quality is varied. In EM studies, for example, Klein (2002) documents a significant negative association between EM and the proportion of independent NEDs on the board of US firms. Bradbury et al. (2004) investigate the association between EM and characteristics of the board in firms from Singapore and Malaysia

and find no association between the proportion of independent NEDs on the board and EM. Moreover, Xie et al. (2003) and Piot and Janin (2005) find no significant association between EM and the proportion of independent NEDs on the board in US and French firms, respectively.

Beasley (1996) and Uzun et al. (2004) examine US firms identified as having been engaged in financial statement fraud. Both report a significant negative association between the proportion of independent NEDs on the board and fraud. However, in contrast, Abbott, Park and Parker (2000) investigate US companies sanctioned by the SEC for aggressive or fraudulent reporting but do not find an association with the proportion of independent NEDs on the board. Peasnell, Pope and Young (2001) report no significant association between the probability of censure by the FRRP in UK firms and the proportion of independent NEDs on the board. Finally, Agrawal and Chadha (2005) find that the probability of financial statement restatement is unrelated to the proportion of independent NEDs on the board. Evidently, the extent to which NED independence is associated with proxies for financial reporting quality is not entirely clear. Thus, we make no prediction regarding the association between *Proportion of Independent NEDs on the Board (PINED)* and EM.

For the audit committee to fulfil its oversight role effectively, its members must also be independent of management (Guy and Zeff, 2002; Bedard et al., 2004). There is US and Asian evidence that a higher proportion of independent NEDs on the audit committee is associated with a lower incidence of EM, financial fraud and GAAP violation/earnings restatements (Wright, 1996; Klein, 2002; Abbott, Parker and Peters, 2004; Bedard et al., 2004; Bradbury et al., 2004). Yet this finding is not universal as US and French studies fail to identify a significant association between audit committee independence and financial reporting quality (Xie et al., 2003; Uzun et al., 2004; Agrawal and Chadha, 2005; Piot and Janin, 2005). In the light of mixed findings in the literature, we make no prediction regarding the association between audit committee independence and EM. The Combined Code (p. 23) requires that at least three NEDs should serve on the audit committee and that a majority of its members should be independent NEDs. Accordingly, we employ the variable *Majority of Independent NEDs on the Audit Committee (MINAC)* to assess the effectiveness of the independence of the audit committee.

Other corporate governance characteristics

Dechow et al. (1996) argue that if the CEO is the founder of the firm, such individuals are more likely to have a strong influence over board decisions and operations, and be less accountable to the board. Consistent with this view, they find that GAAP violators tend to have a CEO who is also a founder. Similarly, Agrawal and Chadha (2005) find that in firms where the CEO belongs to the founding family, there is a higher probability of earnings restatement. Accordingly, *CEO Founder (CEOF)* is expected to be positively associated with EM.

The literature suggests that increased director share ownership provides an incentive for them to monitor management more closely by aligning manager and shareholder interests (Jensen and Meckling, 1976; Jensen, 1993). The limited

evidence on the association between financial reporting quality and independent NED equity ownership is varied. Consistent with the above agency view, Beasley (1996) reports a significantly negative association with financial statement fraud. In contrast, Baber, Kang and Liang (2005) find that share ownership by independent NEDs is positively and significantly associated with accounting restatement. Therefore, we make no prediction regarding the association between *Proportion of Board Shares held by Independent NEDs (PBSIN)* and EM.

Klein (2002) reports a negative and significant association between EM and the proportion of total shares held by the CEO. This suggests increased equity ownership by the CEO helps to align their interests with those of shareholders. Therefore, we predict a negative association between *Proportion of Board Shares held by the CEO (PBSC)* and EM. Note that these constructs of equity ownership are measured in previous studies on the basis of the percentage of issued shares. To obtain a sharper measure of the balance of power in the board of directors, we base our calculations on the proportion of board shares.

Earnings management

The literature identifies various methodologies for the measurement of EM, the most popular being aggregate accruals models, which focus on the manipulation of total accruals as an approximation for EM. The most commonly used aggregate accruals models are the Jones (1991) model and the modified Jones model (Dechow, Sloan and Sweeney, 1995). However, the literature has identified that these models have been subject to increasing criticism concerning their bias, power and specification (Dechow et al., 1995; Bernard and Skinner, 1996; Beneish, 1998; McNichols, 2000, 2002).

Calls in the literature for an alternative approach to measuring EM that can address these issues have recommended focusing on the behaviour of a specific accrual or subset of specific accruals as a measure of EM (Bernard and Skinner, 1996; Healy and Wahlen, 1999; McNichols, 2000, 2002). Advocates of this methodology, such as Penman (2001) and McNichols (2000), recommend the Beneish (1997, 1999b) "M-score" model as it provides considerable insight into the methods and extent by which managerial discretion has been exercised over reported earnings.

Beneish (1997, 1999b) uses a number of financial statement ratios as indicators of earnings manipulation via several specific accruals and applies them to firms from different industries. To obtain a sample of known manipulators and to estimate coefficients to apply to the selected ratios, Beneish (1999b) focuses on US firms that have been identified as GAAP violators by the Securities and Exchange Commission (SEC). Firms identified as having been engaged in earnings manipulation are matched to a sample of non-manipulators. Beneish (1999b) then regresses the dichotomous dependent variable (1 for manipulators; 0 if otherwise) upon the financial statement ratios in the model in an attempt to understand if such ratios can explain earnings manipulation. Certain ratios in the M-score model are found to be significantly correlated with earnings manipulation. For those that

were not, Beneish (1999b) suggests that such firms were perhaps more inclined towards EM than earnings manipulation.

In this paper we examine the association between EM and CG using an industry-based sample compared to the matched sample of GAAP violators and non-violators used by Beneish (1999b). Accordingly, we do not estimate an equivalent UK-based M-score model but, rather, we investigate alternative measures based on the Beneish ratios both in combination and separately to construct different indicators of "Earnings Management Propensity" (EMP). In doing so, we build on insights from financial statement analysis that identify higher accruals and values for accounting ratios as "red flags" for the detection of EM (Dechow et al., 1996; Penman, 2001; Richardson, Tuna and Wu, 2003; Schipper and Vincent, 2003; Dechow and Schrand, 2004). Our primary measure of EM is the average of a firm's ratios to give the EM average (EMAV). However, in sensitivity tests we also control for industry-specific effects by constructing alternative measures of EMP based on ratios measured as differences from the respective industry average. These give demeaned equivalents for EMAV and EMV and these are labeled DEMAV and DEMP respectively.

Table 1 defines and describes the seven financial statement ratios used to measure EM via the Beneish (1999b) series of specific accruals. Beneish (1999b) reports that each of the variables has a predicted positive association with EM. Accordingly, a higher EMAV implies higher propensity towards EM. The EMAVs for all firms are ranked from lowest to highest and the sample divided into three parts. Firms in the lower (upper) third are regarded as having a low (high) propensity to engage in EM and are assigned a value of 0 (1) for EMP. Using a discrete approach to measure EM maximises the difference between those firms with a low and high propensity to engage in EM, which may enhance the statistical power of tests (Bartov, Gul and Tsui, 2001). Firms in the remaining middle third are defined as "unknown" as their propensity towards EM is unclear. Accordingly, they are excluded from the primary model. This avoids misclassifying a firm as an earnings manager when it is an earnings non-manager, and vice versa.

TABLE 1: DEFINITION OF VARIABLES USED TO DETECT EARNINGS MANAGEMENT *

Sales Growth Index (SGI)

$SGI = Sales_t\,[1070+1071]/Sales_{t-1}$

While sales growth does not imply EM, rapidly growing firms are more likely to commit financial statement fraud (Beneish, 1999b, p. 27). If such firms face sizeable share price losses at the first sign of a market slowdown, they have an incentive to engage in positive EM to dispel the perception of declining growth.

Debtors Index (DBTI)

$DBTI = (Debtors_t\,[370–291]/Sales_t\,[1070+1071])/(Debtors_{t-1}/Sales_{t-1})$

If management recognise additional revenue by increasing their debtors to manage earnings, then one would expect to see a disproportionate increase in debtors relative to sales.

Leverage Index (LEVI)

$$LEVI = \frac{(\text{Long term debt}_t\,[321]+\text{ Current liabilities}_t\,[389–280]/\text{Total assets}_t\,[392])}{(\text{Long term debt}_{t-1}+\text{ Current liabilities}_{t-1}/\text{Total assets}_{t-1})}$$

LEVI measures management's incentive to manipulate earnings upwards in order to reduce the ratio of total debt to total assets and thus avoid costs associated with violating its debt covenants.

Selling, Distribution and Administration (SDA) expenses Index (SDAI)

$SDAI = (SDA^a\ expense_t\,[130+131]/Sales_t\,[104])/(SDA\ expense_{t-1}/Sales_{t-1})$

Financial analysts interpret disproportionate increases in SDA expenses as a negative signal to investors about a firm's future prospects (Lev and Thiagarajan, 1993). Large increases in SDAI raises the likelihood that earnings have been overstated through the management of SDA expenses and sales.

Total Accruals to Total Assets (TATA)

$$TATA = \frac{[\Delta\text{Current assets}_t\,[376–291]-\Delta\text{Cash}_t\,[375]]-[\Delta\text{Current liabilities}_t\,[389–280]-\Delta\text{Current maturities of long term debt}_t\,[309]-\Delta\text{Income tax payable}_t\,[381+394]]-\text{Depreciation and Amortisation}_t\,[136+562]}{\text{Total assets}_t\,[392]}$$

Prior research commonly focuses on the level of total accruals within the firm as a proxy for EM (Jones, 1991). EM will increase discretionary accruals leading to an overall increase in total accruals.

Gross Margin Index (GMI)

$GMI = (Sales_{t-1}\,[104]-COS^b_{t-1}\,[129]/\,Sales_{t-1}\,[104])/(Sales_t - COS_t/\,Sales_t)$

"COS" refers to cost of sales. Should a firm be experiencing decreasing gross profit margins, it may have an increased incentive to engage in positive EM to dispel the perception investors may hold that the firm is in decline.

Depreciation Index (DEPI)

$DEPI = (Depreciation_{t-1}\,[136]/Depreciation_{t-1}\,[136]+ PPE^c_{t-1}[339]\ )/(Depreciation_t/Depreciation_t + PPE_t)$

"PPE" refers to plant, property and equipment. By adopting a new depreciation policy, firms can boost current period earnings.

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* *All variables are taken from Beneish (1999b). All data required to compute these variables are taken from Datastream.*

The Datastream item number appears in brackets after each extracted variable.

METHODOLOGY

Model specification

To examine the associations between EM and certain aspects of the sample firm's CG, the following logit model is used:

$$EMP_t = \beta_0 + \beta_1 PINED_t + \beta_2 CEOF_t + \beta_3 PBSIN_t + \beta_4 PBSC_t + \beta_5 MINAC_t + \sum_{k=1}^{K} \beta_k \, Controls_t + \varepsilon_t$$

Where:

EMP	=	Earnings Management Propensity. EMP = 1 if a firm has a high propensity to engage in EM, and 0 if a firm has a low propensity to engage in EM
PINED	=	Number of independent NEDs/board size
CEOF	=	1 if the CEO is the founder of the firm; 0 if otherwise
PBSIN	=	Number of beneficial ordinary shares held by independent NEDs / Total number of ordinary shares held by directors
PBSC	=	Number of beneficial ordinary shares held by the CEO / Total number of ordinary shares held by directors
MINAC	=	1 if the majority of NEDs on the audit committee are independent; 0 if otherwise
Controls	=	control variables.

The control variables included are "Firm Size" (SIZE) and "Age" (AGE). SIZE is calculated as the natural logarithm of the total assets of the firm. Firm size is controlled for as it may affect board and audit committee characteristics, the level of EM (Becker et al., 1998) and managerial incentives towards EM[3]. AGE may affect a firm's tendency towards EM (Beasley, 1996; Beneish, 1999a) and is calculated (in years) from the date from which the firm's ordinary shares were first admitted to the official stock market lists to the date of the accounts. When the model is estimated for the whole sample, both SIZE and AGE are replaced by "Industry (IND)" which equals 1 if the firm is from the software industry and 0 if it is from the engineering industry.

Data

We apply the model to two distinctly different industries. We choose the UK software and engineering industries. Firms in the former may be seen as coming from a "new economy" as they are significantly younger and smaller than firms in the latter industry, which may be regarded as the "old economy". Further, the asset structure for firms in the software industry consists mainly of intangible fixed assets (e.g. intellectual property) compared to the engineering industry where fixed assets mainly comprise plant, property and equipment. Thus, our paper

provides insight into the tendency towards EM and the quality of CG of firms from two distinctly different industries.

The data required to measure EM is extracted from Datastream. The data for each CG characteristic is manually collected from the sample firms' annual report and accounts. Our investigation period is the financial year ended 2001 which pre-dates the Higgs Report (2003) and the revised Combined Code and provides the opportunity to investigate the effect of a less restrictive definition of NED independence under the operation of the Combined Code.

An initial Datastream (level four) search for firms for the 2001 financial year yields an initial sample of 245 firms. Firms with only one period of accounting data (either for 2000 or 2001) are excluded from the sample (n = 40). Firms with an accounting period in 2000 or 2001 that is less than 12 months are also excluded (n = 5). Finally firms whose annual reports are unavailable are excluded from the sample (n = 8). Thus, the final sample consists of 192 firms, comprised of 125 from the software industry and 67 from the engineering industry. There are two data collection issues of note: first, the data for firms that report an accounting year end date change are annualised, and secondly, rather than exclude any statistical outliers, each variable used to measure EM is winsorized[4].

Measuring earnings management

We adjust our measure of EM to accommodate differences in the fixed asset structure of our two industries. The Depreciation Index (DEPI) is designed to detect EM via depreciation on tangible fixed assets. For the majority of software firms, fixed assets largely consist of intangibles (e.g. intellectual property). Therefore, DEPI is applied only to engineering firms and is not used to measure EM in software firms or the whole sample[5].

The variables defined in **Table 1** have a predicted positive association with the probability of EM. If a negative value for any variable is included in the computation of EMAV, potentially misleading results regarding the firm's propensity towards EM may be obtained. In our sample, negative values are reported for Gross Margin Index (GMI) and Total Accruals to Total Assets (TATA). We take the view that GMI only has an economically meaningful interpretation for the propensity to engage in EM for positive values. In the sample, there are 12 (6.25 per cent) firms that report a negative GMI. We set these values to "Not Available". Additionally, 157 firms (81.8 per cent) report a negative TATA. This is because most firms report an increase (decrease) in current liabilities (assets) from 2000 to 2001 and usually incur large depreciation and/or amortisation charges on their tangible and intangible fixed assets. To avoid losing this considerable portion of data, a transformation on TATA is conducted. Beneish (1999b, p. 28) expects higher positive values of TATA to be associated with a higher likelihood of earnings manipulation. Accordingly, an average for TATA is calculated for each industry and the whole sample. If a firm's TATA is below the respective average, it is assigned a value of 0. If it lies above the average, it is set equal to its actual positive deviation from the respective average. Tests using the original values of TATA are also conducted but our findings remain substantially unchanged.

RESULTS

Table 2 presents the descriptive statistics for the whole sample. Panel A of **Table 3** presents those for the software industry while Panel B of **Table 3** presents those for the engineering industry. The dispersion of Sales Growth Index (SGI), Leverage Index (LEVI), Selling, Distribution and Administration (SDA) expenses Index (SDAI), Gross Margin Index (GMI) and the Earnings Management Average (EMAV) is higher in the software industry compared to the engineering industry which identifies the former as a more likely case of EM. Comparisons of variables common to the model when applied to each industry are presented in **Table 4** and show that: (i) firms in the engineering industry are significantly larger ($p = 0.006$) and older ($p = 0.000$) than firms in the software industry; (ii) firms in the software industry have a significantly higher average propensity towards EM than firms in the engineering industry, as indicated by EMAV ($p = 0.000$); (iii) firms in the software industry have a significantly higher average propensity towards EM via sales (SGI, $p = 0.000$), leverage (LEVI, $p = 0.046$), SDA expenses (SDAI, $p = 0.023$) and total accruals (TATA, $p = 0.000$), while firms in the engineering industry have a significantly higher average propensity towards EM via debtors, as shown by the Debtors Index (DBTI) ($p = 0.002$); (iv) there is a significantly higher average proportion of independent NEDs[6] on the boards in engineering firms ($p = 0.002$); (v) independent NEDs in engineering firms hold a significantly higher average proportion of board shares ($p = 0.001$); (vi) there is a significantly greater number of firms in the software industry with a CEO that is also a founder ($p = 0.000$). Results show that for both industries, the proportion of board shares held by the CEO (PBSC) exceeds 30 per cent. However, in the software industry, CEOF is 36 per cent compared to only 12 per cent in the engineering industry. Taken together, these findings indicate a concentration of power in the hands of CEOs in the software industry. The differences in CG between industries indicate that firms in the software industry have greater opportunities for EM compared to those in the engineering industry.

To test for multicollinearity between the continuous variables included in the model, Pearson correlation coefficients for the whole sample are presented in **Table 5**. The statistically significant findings indicate that: (i) an inverse correlation exists between PBSC and PBSIN showing that the stronger the NED independence, the weaker the equity interest of the CEO in the firm; (ii) the higher the PINED, the higher their shareholder stake in the firm (PBSIN); (iii) there is a strong positive association between proportion of independent NEDs on the board (PINED) and the size of the firm and its age; (iv) larger firms in the sample are significantly older. These associations provide evidence of substitution effects in the balance of power on corporate boards. However, none are strong enough to cause multicollinearity problems in the model.

In **Tables 2–5** below, the following variable definitions are used:

Variable definitions:

SGI = $sales_t / sales_{t-1}$

DBTI = $(debtors_t/sales_t)/(debtors_{t-1}/sales_{t-1})$

LEVI = $(long\ term\ debt_t + current\ liabilities_t/total\ assets_t)/(long\ term\ debt_{t-1} + current\ liabilities_{t-1}/total\ assets_{t-1})$

SDAI = $(Selling, distribution\ and\ administration\ expense_t/sales_t)/(Selling, distribution\ and\ administration\ expense_{t-1}/sales_{t-1})$

TATA = $\frac{[\Delta current\ assets_t - \Delta cash_t] - [\Delta current\ liabilities_t - \Delta current\ maturities\ of\ long\ term\ debt_t - \underline{\Delta income\ tax\ payable_t]\ - depreciation\ and\ amortisation_t}}{Total\ assets_t}$

GMI = $(sales_{t-1} - cost\ of\ sales_{t-1} / sales_{t-1})/(sales_t - cost\ of\ sales_t / sales_t)$

DEPI$_t$ = $\frac{(depreciation_{t-1}/depreciation_{t-1} + plant,\ property\ \&\ equipment_{t-1})}{(depreciation_t/depreciation_t + plant,\ property\ \&\ equipment_t)}$

EMAV$_t$ = *Average of the subset of ratios used to detect EM*

PINED$_t$ = *Number of independent non-executive directors (NEDs)/board size*

PBSIN$_t$ = *Number of beneficial ordinary shares held by independent NEDs/Total number of ordinary shares held by directors*

PBSC$_t$ = *Number of beneficial ordinary shares held by the CEO/Total number of ordinary shares held by directors*

SIZE$_t$ = *Firm size measured as ln (Total Assets*$_t$*)*

AGE$_t$ = *Firm age measured as number of years from when firm's ordinary shares were first listed on UK stock markets to the firm's accounting year end date for 2001*

CEOF$_t$ = *1 if the CEO is also the founder of the firm; 0 if otherwise*

MINAC$_t$ = *1 if the majority of NEDs on the audit committee are independent; 0 if otherwise*

IND$_t$ = *1 if the firm is from the software and computer services industry; 0 if it is from the engineering and machinery industry.*

TABLE 2: DESCRIPTIVE STATISTICS: WHOLE SAMPLE

Earnings management variables

Variables	**SGI**	**DBTI**	**LEVI**	**SDAI**	**TATA**	**GMI**	**EMAV$_t$**
No. of firms	184	188	192	189	192	176	192
Mean	1.236	0.917	1.254	1.364	0.200	1.119	1.008
Median	1.075	0.901	1.030	1.082	0.227	1.026	0.913
Std. dev.	0.635	0.332	0.758	1.014	0.105	0.533	0.279

Corporate governance variables and control variables

Variables	**PINED$_t$**	**PBSIN$_t$**	**PBSC$_t$**	**SIZE$_t$**	**AGE$_t$**		**CEOF$_t$**	**MINAC$_t$**
No. of firms	192	189	192	192	192	No. of firms	190	182
Mean	0.255	0.103	0.340	10.590	13.177	No%	72.6	45.6
Median	0.250	0.007	0.251	10.443	5.500	Yes%	27.4	54.4
Std. dev.	0.195	0.214	0.325	1.644	16.686			

TABLE 3: DESCRIPTIVE STATISTICS BY INDUSTRY

Software and Computer Services

Earnings management variables

Variables	SGI	DBTI	LEVI	SDAI	TATA	GMI	$EMAV_t$
No. of firms	121	121	125	122	125	111	125
Mean	1.613	0.868	1.406	1.531	0.291	1.214	1.144
Median	1.159	0.854	1.098	1.140	0.324	1.008	0.999
Std. dev.	1.380	0.361	0.979	1.331	0.140	0.807	0.458

Corporate governance variables and control variables

Variables	$PINED_t$	$PBSIN_t$	$PBSC_t$	$SIZE_t$	AGE_t		$CEOF_t$	$MINAC_t$
No. of firms	125	123	125	125	125	No. of firms	123	118
Mean	0.222	0.076	0.351	10.322	4.743	No %	64.2	50.0
Median	0.250	0.004	0.281	10.255	4.000	Yes %	35.8	50.0
Std. dev.	0.190	0.198	0.330	1.530	3.970			

Engineering and machinery industry

Earnings management variables

Variables	SGI	DBTI	LEVI	SDAI	TATA	GMI	DEPI	$EMAV_t$
No. of firms	67	67	67	67	67	66	67	125
Mean	1.006	1.000	1.011	1.100	0.023	1.066	0.964	0.881
Median	1.008	0.945	1.000	1.021	0.010	1.050	0.944	0.860
Std. dev.	0.283	0.236	0.178	0.386	0.028	0.353	0.238	0.087

Corporate governance variables and control variables

Variables	$PINED_t$	$PBSIN_t$	$PBSC_t$	$SIZE_t$	AGE_t		$CEOF_t$	$MINAC_t$
No. of firms	67	66	67	67	67	No. of firms	67	64
Mean	0.317	0.155	0.319	11.092	28.911	No %	88.1	37.5
Median	0.333	0.054	0.241	11.066	29.080	Yes %	11.9	62.5
Std. dev.	0.191	0.235	0.319	1.741	19.752			

TABLE 4: INDUSTRY COMPARISONS

Presented below are comparisons of the EM, CG and control variables between the two industries in the sample. A Mann-Whitney U^a test is used to test the statistical significance of the difference in these variables between the two industries. A Chi-Square test[b] is used to test the statistical significance of the difference in the discrete variables between the two industries.

Earnings management variables

Variables	**SGI**	**DBTI**	**LEVI**	**SDAI**	**TATA**	**GMI**	**EMAV$_t$**
Mann-Whitney *U*	2628	2927	3456	3268	747.5	3540	2216
Z	–3.989	–3.153	–1.993	–2.277	–9.410	–0.373	–5.372
(p-value)	(0.000)***	(0.002)***	(0.046)**	(0.023)**	(0.000)***	(0.709)	(0.000)***

Corporate governance variables and control variables

Variables	**PINED$_t$**	**PBSIN$_t$**	**PBSC$_t$**	**SIZE$_t$**	**AGE$_t$**	**CEOF$_t$**	**MINAC$_t$**
Mann-Whitney *U*	3049.5	2942	3923	3169	979.5	–	–
Z	–3.138	–3.181	–0.721	–2.775	–8.741	–	–
(p-value)	(0.002)***	(0.001)***	(0.471)	(0.006)***	(0.000)***		
χ^2	–	–	–	–	–	12.393	2.614
(p-value)						(0.000)***	(0.106)

****Significant at the 1 per cent level; **Significant at the 5 per cent level; *Significant at the 10 per cent level*

[a]The Mann-Whitney U test is a non-parametric test for assessing whether the difference in medians between two observed distributions is statistically significant. U is calculated as $n_1n_2 + n_1(n_1 + 1)/2 - R_1$ where n_1 and n_2 refers to the size of samples 1 and 2, respectively and R_1 the sum of the ranks in sample 1. The statistical significance of U is calculated by Z which is computed as U minus its mean and divided by its standard deviation.

[b]The Chi-Square test examines for statistically significance differences in dichotomous variables between two groups by testing for a statistically significant difference between the observed value for a variable and its expected value. Thus, the Chi-square statistic is calculated as the sum of the squared difference between the observed and expected values of the variables divided by their expected values.

TABLE 5: CORRELATION ANALYSIS

Pearson correlation coefficients are used to examine correlations between the continuous CG and control variables. Results from this analysis for the whole sample are presented below.

Variables	**PINED$_t$**	**PBSIN$_t$**	**PBSC$_t$**	**SIZE$_t$**	**AGE$_t$**
PINED$_t$	1				
PBSIN$_t$	0.441***	1			
PBSC$_t$	0.054	–0.214***	1		
SIZE$_t$	0.359***	0.074	–0.173**	1	
AGE$_t$	0.273***	0.131*	–0.048	0.254***	1

***Significant at the 1 per cent level; **Significant at the 5 per cent level; *Significant at the 10 per cent level

Estimation results

The estimation results for our primary model of the average of the Beneish financial ratios based on the sample of the top and bottom thirds of EMAV are presented in **Table 6**. Panel A presents those for the whole sample. As predicted, a positive and significant association (at 1 per cent) between CEOF and EMP is reported, indicating that EM is more likely in firms where the CEO is the founder. The odds ratio[7] for CEOF indicates that EM is over five times as likely in the sample firms if the CEO is also the founder. This result confirms that of Dechow et al. (1996). A predicted negative and significant association (at 1 per cent) between the percentage of board shares held by the CEO (PBSC) and EMP exists, indicating that in the sample firms, the likelihood of EM decreases as the proportion of board shares held by the CEO increases. This new finding is potentially explained by our investigation of opportunistic income-increasing EM that aims to exclude a signalling motivation and is consistent with the view that providing directors with more of the firm's equity will align their interests with those of the shareholders (Mace, 1986; Patton and Baker, 1987). An alternative explanation, however, is that entrenched CEOs enjoy greater scope for opportunism and have less need to resort to EM. Consistent with expectations, a positive and significant association between IND and EMP is reported, indicating that there is a higher likelihood of EM in the software industry. The odds ratio for IND shows that EM is over three times more likely in the software industry than in the engineering industry. These findings are consistent with the inter-industry differences identified in the univariate analysis. The marginal effects for each explanatory variable in the model are presented in **Table 6**. Consistent with the above findings, they show that in the model, CEOF, PBSC and IND are highly influential on the probability of EM.

Panel B of **Table 6** presents the results for the software industry. As predicted, a positive and significant association (at 1 per cent) between CEOF and EMP is observed. Further, a negative and significant correlation (at 1 per cent) between PBSC and EMP is again reported. The estimation results also show that EMP is negatively and significantly associated with AGE, indicating that younger firms in the computers industry have a significantly greater propensity towards EM. A potential explanation for this finding is that, in 2001, many of these software firms were only recently listed and typically provided in their prospectuses one year earnings and dividend forecasts and their history for the minimum three year trading period required to be fully listed. The market will pay close attention to such newly listed firms to ascertain whether or not they are meeting their own forecasts, thus providing these younger firms with a greater incentive towards EM. The marginal effects show that PINED, CEOF and PBSC have a greater influence on the probability of EM.

Panel C of **Table 6** presents the estimation results for the engineering industry. A negative and significant association (at 1 per cent) between shares held by the CEO (PBSC) and EMP is once again identified. Further, a negative and significant association (at 10 per cent) between EMP and PBSIN is reported. Consistent with the agency view of equity ownership, this indicates that increased share ownership by independent NEDs helps to align the interests of management with those of

shareholders. EMP is also found to be negatively and significantly associated (at 10 per cent) with SIZE, indicating that larger firms in the engineering industry have a lower propensity towards EM. Finally, the marginal effects show that all variables (particularly PBSC), with the exception of SIZE and AGE have considerable influence on the probability of EM in the engineering industry.

TABLE 6: LOGIT REGRESSION OF EARNINGS MANAGEMENT PROPENSITY ON CORPORATE GOVERNANCE VARIABLES.

Presented below are the estimation results of the logit regression of Earnings Management Propensity (EMP) upon the selected CG and control variables. Panel A presents those for the whole sample. Panel B presents those for the software and computer services industry. Panel C presents those for the engineering and machinery industry. Firms with a low (high) propensity towards EM are assigned a value of 0 (1) for EMP. t-values appear in brackets while marginal effects[a] for each variable appear in italics.

Panel A: Whole Sample (n = 128)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	IND_t
–0.423	0.224	1.627	–0.210	–2.606	–0.089	1.224
(–0.729)	(0.111)	(2.65)***	(–0.194)	(–2.98)***	(–0.128)	(2.57)**
–0.106	*0.056*	*0.377*	*–0.052*	*–0.652*	*–0.022*	*0.293*

Likelihood Ratio[b]	McFadden R^2 (%)[c]	% Correct[d]
24.524***	14.87	70.59

Panel B: Software and Computer Services Industry (n = 83)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
1.266	2.030	3.126	0.714	–5.371	–0.356	0.009	–0.283
(0.565)	(0.669)	(2.80)*	(0.438)	(–3.18)***	(–0.336)	(0.043)	(–2.31)**
0.310	*0.498*	*0.650*	*0.175*	*–1.317*	*–0.087*	*0.002*	*–0.069*

Likelihood Ratio[b]	McFadden R^2 (%)[c]	% Correct[d]
29.167***	27.33	75.33

Panel C: Engineering and Machinery Industry (n = 45)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
9.540	2.884	1.811	–4.078	–6.737	1.958	–0.696	–0.036
(2.28)**	(0.634)	(1.02)	(–1.97)*	(–3.10)***	(1.23)	(–1.90)*	(–1.56)
2.381	*0.720*	*0.366*	*–1.018*	*–1.682*	*0.454*	*–0.174*	*–0.009*

Likelihood Ratio[b]	McFadden R^2 (%)[c]	% Correct[d]
20.025***	33.61	74.42

****Significant at the 1 per cent level; **Significant at the 5 per cent level; *Significant at the 10 per cent level*

Variable definitions:

$PINED_t$ = *Number of Independent Non-Executive Directors (NEDs)/board size*

$PBSIN_t$ = *Number of beneficial ordinary shares held by independent NEDs/Total number of ordinary shares held by directors*

$PBSC_t$ = *Number of beneficial ordinary shares held by the CEO/Total number of ordinary shares held by directors*

$SIZE_t$ = *Firm size measured as ln (Total Assets$_t$)*

AGE_t = *Firm age measured as number of years from when firm's ordinary shares were first listed on UK stock markets to the firm's accounting year end date for 2001*

$CEOF_t$ = *1 if the CEO is also the founder of the firm; 0 if otherwise*

$MINAC_t$ = *1 if the majority of NEDs on the audit committee are independent; 0 if otherwise*

IND_t = *1 if the firm is from the software and computer services industry; 0 if it is from the engineering and machinery industry.*

[a] The marginal effect of the regressors on the probability of EM, $\rho(i)$, are calculated as follows: $\rho(i)*[1-\rho(i)]$ where $\rho(i) = 1/(1 + exp^{-(x'\beta)})$ and ß is the appropriate coefficient estimate.

[b] The Likelihood Ratio is calculated as 2(log-likelihood at convergence – log-likelihood at zero). The ratio is used to test the null hypothesis that all the parameters in the model are simultaneously equal to zero. Under this null hypothesis, the statistic has an asymptotic distribution, which is a chi-square with degrees of freedom equalling the number of parameters in the model.*

[c] The McFadden R^2 is calculated as 1 – (log-likelihood at convergence/log-likelihood at zero). It provides a measure of the explanatory power of the logit model and is similar to the R^2 statistic in OLS regressions.

[d] The % Correct measures the percentage of actual values for EMP correctly predicted by the model. The statistic measures the goodness of fit of the model estimations.

Sensitivity checks

EMAV is calculated by taking a simple average of the variables defined in **Table 1** for each firm[8]. However, this applies an equal weighting for each ratio in the measurement of EM. To investigate the robustness of our findings we also estimate weights to apply to each ratio for both industries and the whole sample. In this procedure, we first obtain weights for each EM ratio included in the computation of EMAV. We do this by estimating each ratio upon the same model of CG and control variables as before. The coefficient of determination (R^2) for each regression is divided by the total R^2 for the relevant subset of ratios for each sample to provide a weight to be attached to each ratio. The weighted ratios are then added together and the resulting metric is referred to as each firm's "Weighted EM Measure" (WEMM). Using this approach allows ratios with the greater goodness of fit to have a greater weight in the computation of the firm's propensity towards EM. We substitute WEMM for EMAV in the computation of EMP and find that although the untabulated results are slightly less significant, they confirm our findings for our primary model using the simple average-based approach.

As a further refinement to our measure of EM propensity we demean each ratio by its industry-specific mean and obtain the demeaned earnings management average (DEMAV). Firms with a positive difference are coded 1, otherwise 0, to give the demeaned earnings management propensity (DEMP2) for all firms in the sample. To provide a direct comparison with the findings from our primary model we also construct a sample comprising the top and bottom thirds of the distribution of DEMAV. This variable is labelled DEMP3. The results for the models using DEMP2 as the *dependent variable are reported in* ***Table 7****. The* combination of demeaning and the selection of the top and bottom halves of the distribution of DEMAV as the indicator variable causes the model to become statistically insignificant. However, the previous finding of a significant negative relation between EM and shares held by the CEO is confirmed for the full sample and for the engineering industry. To allow a direct assessment of the impact of demeaning we repeat the analysis for the top and bottom thirds of the industry specific ranking of DEMAV. The results for DEMP3 are reported in **Table 8**. The finding of a significant positive relation between EM and CEOF reported in **Table 7** for EMP is confirmed, as is the significant negative relationship between EM and the proportion of board shares held by the CEO. The demeaned models reported in **Table 8** have similar levels of statistical significance to the EMP models reported in

Table 6. Thus, the results reported for the primary model based on the unadjusted accounting ratios are not sensitive to the impact of controlling for industry effects, provided that firms are sorted into EM classes within industries.

To further assess the significance of our findings for the use of accounting ratios on an individual basis in financial statement analysis, we replicate the tests in **Table 7** using dependent variables for EM based on the demeaned values of the individual ratios where positive values are coded 1, 0 otherwise. In untabulated findings we identify a statistically significant association in the predicted direction between EM and CEOF for the gross margin index (GMI), sales growth index (SGI) and leverage (LEVI). The predicted negative relation between EM and shares held by the CEO (SHCEB) is also identified by GMI and the selling, distribution and administration cost index (SDAI). A significant positive relation between EM and the proportion of independent directors on the board (PINED) is identified by SGI and confirmed by SDAI. Significant negative relationships are also identified for majority of independent directors in the board (MJIAC) by SGI and for proportion of board shares held by independent directors (PBSIN). With the exception of the positive association between PINED and EM, these findings generally support expected relationships and warrant further consideration of the analysis of these ratios on an individual basis as "red flags" by investment analysts and others seeking to use financial statements to identify firms engaged in EM.

We also compare our findings to those using the modified Jones cross-sectional aggregate accruals model (Defond and Jiambalvo, 1994; Becker et al., 1998) where EM is identified by measuring a firm's Discretionary Accruals (DA). We derive the modified Jones cross-sectional aggregate accruals model and regress DA upon the same vector of CG variables as before. Following Defond and Jiambalvo (1994), parameter estimates for the cross-sectional modified Jones model are industry and year specific rather than firm specific. Consequently, the model is estimated cross-sectionally for each separate industry in the sample. Estimation results from this analysis appear in **Table 9**. Panel A presents those for the whole sample while Panels B and C present those for the software and engineering industries respectively. Except for PINED, which is found to be significantly negatively associated (at 10 per cent) with DA for the whole sample, no variables attain statistical significance. For the whole sample and both industries, the F-stat reported in **Table 9** shows that the explanatory power of the models is not significantly different from zero. A potential explanation for the relatively weak performance of the modified Jones model is that the accounting ratios identified by Beneish to discriminate between GAAP violators and GAAP non-violators provide more accurate measures of opportunistic income increasing EM. Signalling motivations are less likely to be reflected in our measures and the associated reduction in measurement error may provide a better explanation of the role of CG in mitigating the adverse consequences of EM.

TABLE 7: LOGIT REGRESSION OF DEMEANED EARNINGS MANAGEMENT PROPENSITY ON CORPORATE GOVERNANCE VARIABLES.

Presented below are the estimation results of the logit regression of Demeaned Earnings Management Propensity (DEMP2) upon the selected CG and control variables. Panel A presents those for the whole sample. Panel B presents those for the software and computer services industry. Panel C presents those for the engineering and machinery industry. Firms with a low propensity towards EM (DEMAV is below the industry mean) are assigned a value of 0, otherwise 1, for DEMP2. t-values appear in brackets while marginal effects[a] for each variable appear in italics.

Panel A: Whole Sample (n = 180)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	IND_t
0.289	–0.411	0.786	0.388	–1.511	0.292	–0.145
0.740	–0.270	1.760*	0.460	–2.420**	0.560	–0.420
	–0.103	*0.192*	*0.097*	*–0.378*	*0.073*	*–0.036*

Likelihood Ratio[b] 8.29 — McFadden R^2 (%)[c] 3.32

Panel B: Software and Computer Services Industry (n = 116)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
0.535	–1.074	0.871	0.675	–1.530	0.270	–0.004	–0.048
0.350	–0.550	1.530	0.610	–1.790*	0.400	–0.030	–0.880
	–0.269	*0.214*	*0.169*	*–0.383*	*0.067*	*–0.001*	*–0.012*

Likelihood Ratio[b] 8.23 — McFadden R^2 (%)[c] 5.11

Panel C: Engineering and Machinery Industry (n = 64)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
3.886	4.159	–0.618	–1.331	–2.417	0.581	–0.318	–0.035
1.710*	1.310	–0.580	–0.890	–2.090**	0.570	–1.500	–2.140**
	1.039	*–0.152*	*–0.333*	*–0.604*	*0.144*	*–0.079*	*–0.009*

Likelihood Ratio[b] 11.19 — McFadden R^2 (%)[c] 12.61

****Significant at the 1 per cent level; **Significant at the 5 per cent level; *Significant at the 10 per cent level*

Variable definitions:

- $PINED_t$ = *Number of Independent non-executive directors (NEDs)/board size*
- $PBSIN_t$ = *Number of beneficial ordinary shares held by independent NEDs/Total number of ordinary shares held by directors*
- $PBSC_t$ = *Number of beneficial ordinary shares held by the CEO/Total number of ordinary shares held by directors*
- $SIZE_t$ = *Firm size measured as ln (Total Assets$_t$)*
- AGE_t = *Firm age measured as number of years from when firm's ordinary shares were first listed on UK stock markets to the firm's accounting year end date for 2001*
- $CEOF_t$ = *1 if the CEO is also the founder of the firm; 0 if otherwise*
- $MINAC_t$ = *1 if the majority of NEDs on the audit committee are independent; 0 if otherwise*
- IND_t = *1 if the firm is from the software and computer services industry; 0 if it is from the engineering and machinery industry.*

[a] The marginal effect of the regressors on the probability of EM, $\rho(i)$, are calculated as follows: $\rho(i)*[1-\rho(i)]$ where $\rho(i) = 1/(1 + exp^{-(x'\beta)})$ and ß is the appropriate coefficient estimate.

[b] The Likelihood Ratio is calculated as 2(log-likelihood at convergence – log-likelihood at zero). The ratio is used to test the null hypothesis that all the parameters in the model are simultaneously equal to zero. Under this null hypothesis, the statistic has an asymptotic distribution, which is a chi-square with degrees of freedom equalling the number of parameters in the model.*

[c] The McFadden R^2 is calculated as 1 – (log-likelihood at convergence/log-likelihood at zero). It provides a measure of the explanatory power of the logit model and is similar to the R^2 statistic in OLS regressions.

TABLE 8: LOGIT REGRESSION OF DEMEANED EARNINGS MANAGEMENT PROPENSITY ON CORPORATE GOVERNANCE VARIABLES.

Presented below are the estimation results of the logit regression of Demeaned Earnings Management Propensity (DEMP3) upon the selected CG and control variables. Panel A presents those for the whole sample. Panel B presents those for the software and computer services industry. Panel C presents those for the engineering and machinery industry. Firms with a low propensity towards EM (DEMAV is in the bottom one-third of the industry ranking) are assigned a value of 0, otherwise 1, for DEMP3. t-values appear in brackets while marginal effects[a] for each variable appear in italics.

Panel A: Whole Sample

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	IND_t
0.814	–1.279	2.457	0.031	–3.934	0.805	–0.465
1.530	–0.630	3.420***	0.030	–4.000***	1.130	–1.010
	–0.319	*0.524*	*0.008*	*–0.980*	*0.198*	*–0.116*

Likelihood Ratio[b]: 26.63*** — McFadden R^2 (%)[c]: 15.88

Panel B: Software and Computer Services Industry

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
0.909	–0.372	2.885	1.623	–4.337	0.423	–0.007	–0.157
0.420	–0.130	2.800***	0.910	–2.890***	0.410	–0.040	–1.560
	–0.092	*0.609*	*0.403*	*–1.077*	*0.104*	*–0.002*	*–0.039*

Likelihood Ratio[b]: 25.15*** — McFadden R^2 (%)[c]: 23.56

Panel C: Engineering and Machinery Industry

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
8.694	0.912	–0.270	–3.277	–5.475	2.351	–0.654	–0.027
2.250**	0.220	–0.170	–1.710*	–2.990***	1.510	–1.910*	–1.300
	0.228	*–0.067*	*–0.819*	*–1.369*	*0.527*	*–0.163*	*–0.007*

Likelihood Ratio[b]: 17.73** — McFadden R^2 (%)[c]: 29.11

****Significant at the 1 per cent level; **Significant at the 5 per cent level; *Significant at the 10 per cent level*

Variable definitions:

$PINED_t$ = *Number of Independent non-executive directors (NEDs)/board size*

$PBSIN_t$ = *Number of beneficial ordinary shares held by independent NEDs/Total number of ordinary shares held by directors*

$PBSC_t$ = *Number of beneficial ordinary shares held by the CEO/Total number of ordinary shares held by directors*

$SIZE_t$ = *Firm size measured as ln (Total Assets$_t$)*

AGE_t = *Firm age measured as number of years from when firm's ordinary shares were first listed on UK stock markets to the firm's accounting year end date for 2001*

$CEOF_t$ = *1 if the CEO is also the founder of the firm; 0 if otherwise*

$MINAC_t$ = *1 if the majority of NEDs on the audit committee are independent; 0 if otherwise*

IND_t = *1 if the firm is from the software and computer services industry; 0 if it is from the engineering and machinery industry.*

[a] *The marginal effect of the regressors on the probability of EM, $\rho(i)$, are calculated as follows: $\rho(i)*[1-\rho(i)]$ where $\rho(i) = 1/(1 + \exp^{-(x'\beta)})$ and ß is the appropriate coefficient estimate.*

[b] *The Likelihood Ratio is calculated as 2*(log-likelihood at convergence – log-likelihood at zero). The ratio is used to test the null hypothesis that all the parameters in the model are simultaneously equal to zero. Under this null hypothesis, the statistic has an asymptotic distribution, which is a chi-square with degrees of freedom equalling the number of parameters in the model.*

[c] *The McFadden R^2 is calculated as 1 – (log-likelihood at convergence/log-likelihood at zero). It provides a measure of the explanatory power of the logit model and is similar to the R^2 statistic in OLS regressions.*

TABLE 9: SENSITIVITY ANALYSIS: USING THE MODIFIED JONES CROSS-SECTIONAL MODEL TO MEASURE EARNINGS MANAGEMENT.

Presented below are the estimation results of the OLS regression of Discretionary Accruals (DA) upon the selected CG and control variables. Panel A presents those for the whole sample. Panel B presents those for the software and computer services industry. Panel C presents those for the engineering and machinery industry. t-values appear in brackets while the partial coefficient of determination (R^2) for each variable appears in italics. Variable definitions are provided in **Tables 1** and **2**.

Panel A: Whole Sample (n = 128)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	IND_t
0.722	–3.036	–0.754	0.921	0.029	0.452	–0.342
(1.61)	(–1.74)*	(–1.52)	(0.967)	(0.042)	(0.759)	(–0.878)
0.015	*0.017*	*0.013*	*0.005*	*0.000*	*0.003*	*0.004*

Likelihood Ratio[b]	McFadden R^2 (%)[c]	% Correct[d]
4.5	2.04	1.363

Panel B: Software and Computer Services Industry (n =83)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
0.282	–4.397	–0.818	1.544	–0.017	0.626	0.029	0.020
(0.131)	(–1.590)	(–1.050)	(0.980)	(–0.015)	(0.663)	(0.144)	(0.270)
0.000	*0.023*	*0.010*	*0.009*	*0.000*	*0.004*	*0.000*	*0.001*

Likelihood Ratio[b]	*McFadden R^2 (%)[c]*	*% Correct[d]*
5.33	2.04	0.8693

Panel C: Engineering and Machinery Industry (n=45)

Constant	$PINED_t$	$CEOF_t$	$PBSIN_t$	$PBSC_t$	$MINAC_t$	$SIZE_t$	AGE_t
0.013	–0.035	0.008	–0.058	0.018	–0.009	–0.000	0.000
(0.244)	(–0.461)	(0.290)	(–1.550)	(0.650)	(–0.338)	(–0.069)	(0.374)
0.001	*0.004*	*0.002*	*0.041*	*0.008*	*0.002*	*0.000*	*0.003*

Likelihood Ratio[b]	McFadden R^2 (%)[c]	% Correct[d]
13.93	2.20	1.295

****Significant at the 1 per cent level; **Significant at the 5 per cent level; *Significant at the 10 per cent level*

Variable definitions:

$PINED_t$ = *Number of Independent non-executive directors (NEDs)/board size*

$PBSIN_t$ = *Number of beneficial ordinary shares held by independent NEDs/Total number of ordinary shares held by directors*

$PBSC_t$ = *Number of beneficial ordinary shares held by the CEO/Total number of ordinary shares held by directors*

$SIZE_t$ = *Firm size measured as ln (Total Assets$_t$)*

AGE_t = *Firm age measured as number of years from when firm's ordinary shares were first listed on UK stock markets to the firm's accounting year end date for 2001*

$CEOF_t$ = *1 if the CEO is also the founder of the firm; 0 if otherwise*

$MINAC_t$ = *1 if the majority of NEDs on the audit committee are independent; 0 if otherwise*

IND_t = *1 if the firm is from the software and computer services industry; 0 if it is from the engineering and machinery industry.*

[a] *The marginal effect of the regressors on the probability of EM, $\rho(i)$, are calculated as follows: $\rho(i)*[1-\rho(i)]$ where $\rho(i) = 1/(1 + exp^{-(x'\beta)})$ and ß is the appropriate coefficient estimate.*

[b] *The Likelihood Ratio is calculated as 2*(log-likelihood at convergence – log-likelihood at zero). The ratio is used to test the null hypothesis that all the parameters in the model are simultaneously equal to zero. Under this null hypothesis, the statistic has an asymptotic distribution, which is a chi-square with degrees of freedom equalling the number of parameters in the model.*

[c] *The McFadden R^2 is calculated as 1 – (log-likelihood at convergence/log-likelihood at zero). It provides a measure of the explanatory power of the logit model and is similar to the R^2 statistic in OLS regressions.*

[d] *The % Correct measures the percentage of actual values for EMP correctly predicted by the model. The statistic measures the goodness of fit of the model estimations.*

CONCLUSIONS AND POLICY IMPLICATIONS

We investigate the relationship between CG and EM and focus particularly on the role of independent NEDs. Our study differs from previous research in two respects. Firstly, we follow Beneish (1999b) and adopt a specific accruals approach based on financial statement analysis of accounting ratios to develop a simple heuristic for the measurement of EM. Our scoring approach has the advantage of being simple and easy to apply. Further, the Beneish (1999b) approach discriminates between GAAP violators and GAAP non-violators and is well-suited to detecting opportunistic income increasing EM that is appropriate in a study of the association between EM and CG. The results indicate the potential to improve the explanatory power of the model by excluding those firms in the middle third of the sample with an indeterminate propensity to manage earnings. Our Beneish-based specific ratio methodology approach provides higher levels of statistical significance than the modified Jones aggregate accruals methodology and warrants further investigation as a potentially useful approach for regulators such as the FRRP and others seeking to screen firms for EM behaviour in the context of small, industry-based samples. Secondly, in the light of previous findings of a lack of consistency in the application of the Combined Code's definition of NED independence, we construct a checklist for the classification of business, financial and personal affiliations, based on disclosures in financial statements, which may impair NED independence.

Using our definition, we identify significant inter-industry differences and a notable shortfall in board independence in software firms and a significantly higher concentration of power in the hands of the CEO. In our best performing models and consistent with prior research, we find no significant association between EM and measures of NED independence on the board or on the audit committee. In contrast, our evidence suggests that the role and equity ownership of the CEO is more influential. Consistent with Dechow et al. (1996), we find that EM is more likely in firms in which the CEO is also the founder. However, we also find that CEO equity ownership is negatively associated with EM. These findings highlight the potential significance of the role and equity ownership of CEOs as factors that warrant the attention of regulators and analysts investigating financial reporting quality in the form of EM. We also find that EM is more likely in firms in the software industry, which is consistent with our finding of a lower quality of CG in this industry. Our results are robust whether we use reported values or industry-specific demeaned equivalents of the Beneish ratios. We also find that analysis of the ratios on an individual demeaned basis provides results that generally support our findings for the ratios used in combination.

We present our results as a contribution to the development of the specific accruals methodology for measuring and detecting opportunistic income increasing EM. Our research, however, identifies several avenues for further research. First, the use of a specific accruals methodology to detect EM reduces the generalisability of results; thus the implications for policy inferences may be somewhat limited. This can be overcome by applying the model to several industries and a longer time period. Secondly, previous research has reported that measures of financial reporting quality are positively associated with the financial expertise and experience of NEDs on the board and audit committee (Xie et al., 2003; Bedard et al., 2004; Song and Windram, 2004; Farber, 2005; Agrawal and Chadha, 2005). Under the Combined Code (2001), which applied during the period of this study, there is no requirement for financial expertise. Therefore, this characteristic is not examined in this paper. However, the revised Combined Code now recommends that at least one independent NED on the audit committee should have recent and relevant financial experience. Consequently, future research could consider financial expertise and experience as an additional explanatory variable in the model.

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NOTES

1 EM is not the same as earnings manipulation. EM refers to the exercise of managerial discretion over earnings *within* the confines of GAAP. In contrast, earnings

manipulation is defined as managerial *violation* of GAAP to represent the firm's financial performance favourably (Beneish, 1999b).

2 In December 2004, following advice by the Standing Group on Pro-activity, the FRRP announced it would be applying selection criteria based on industry sectors to examine the financial statements of firms from the UK automobile, pharmaceutical, retail, transport and utility sectors.

3 Larger firms usually receive greater attention from financial/market analysts (Francis, LaFond and Schipper, 2004), which may put added pressure on the management of such firms to meet or just beat earnings targets, thus providing a motive for EM.

4 The winsorization approach used by Biddle, Bowen and Wallace (1997) is adopted, whereby the median is first calculated for each EM variable for all firms. Any variable over eight standard deviations from the median is then excluded, while any variable between four and eight standard deviations from the median is winsorized to a value that lies four standard deviations from the median. Using this approach, less than one per cent of observations are excluded.

5 We find that the estimation results are unchanged if DEPI is included as part of the computation of EMAV for the whole sample and the software industry.

6 We find a significant difference ($p = 0.000$) between our classification of PINED (25.52 per cent) and that provided by the firms (35.07 per cent).

7 The odds ratio compares whether the probability of a certain event is the same for two groups. In this case, whether is firm is engaged in EM (1) or not (0). An odds ratio of one implies that the event is equally likely in both groups. An odds ratio greater than one implies that the event is more likely in the first group. An odds ratio less than one implies that the event is less likely in the first group. The odds ratio is computed as $\rho(i)/(1-\rho(i))$, where $\rho(i)$ is the implied probability of EM.

8 We find that the estimation results are largely robust if the full data set are included in the analysis and EMAV is the dependent variable.

APPENDIX

Framework Appraising Non-Executive Director Independence

An independent non-executive director (NED) is defined as having no business, financial or personal affiliations with the firm other than being on its board. Presented below are a series of checks used to establish whether a NED is affiliated with the firm. If a NED is found to be affiliated with the firm, he/she is classified as "grey" (non-independent).

Business Affiliation Checks

- NED is a director/partner/employee/owner of a company that is engaged in business with the firm.
- NED is a director/partner/employee/owner of a company that provides consultancy services to the firm.
- NED is a director/partner/employee/owner of one (or more) of the firm's subsidiaries/joint ventures/associated undertakings.
- NED is a director/partner/employee/owner of one (or more) of the firm's business clients.
- NED is a director/partner/employee/owner of a company that receives or has received a loan from the firm.

- NED is a director/partner/employee/owner of a company that provides or has provided the firm with a loan.
- NED is a director/partner/employee/owner of a company that has a material interest in any contract or arrangement that is significant in relation to the business of the firm or any of its subsidiaries/joint ventures/associated undertakings.
- NED is a director/partner/employee/owner of the firm's stockbrokers/solicitors/financial advisors/bankers/auditors.
- NED acts or has acted as an advisor/consultant to the firm.
- NED acts or has acted as an advisor/consultant to the firm's stockbrokers/solicitors/financial advisors/bankers/auditors.
- NED acts or has acted as an advisor/consultant to one (or more) of the firm's subsidiaries/joint ventures/associated undertakings/business clients.
- NED was appointed to the board on the acquisition of a company in which he/she was employed.
- NED was appointed to the board on a merger with a company in which he/she was employed.
- NED was appointed to the board on a demerger from a company in which he/she was employed.
- NED was employed by the firm prior to being appointed to the board.
- NED is affiliated with a company that is engaged in business with the firm.

Financial Affiliation Checks

- NED receives Employee Stock Options from the firm.
- NED receives a pension from the firm.
- NED receives performance-related pay/bonuses from the firm.
- NED receives pay for work undertaken for the firm in a non-director capacity.
- NED is a member of the firm's Long Term Incentive Programme.
- NED is an ex-employee of the firm.
- NED is an ex-chairman of the firm.
- NED is or used to be company secretary.
- NED is or has worked for the firm in an executive capacity (including on a temporary basis).

Personal Affiliation Checks

- NED is a founder/co-founder of the firm.
- NED is a member of a family that owns/founded the firm.
- NED is related to any fellow board member through family.

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