

Corporate Boards and Environmental Offence Conviction: Evidence from the United Kingdom

Abstract

Purpose

This paper reports the results of an investigation into the relationship between corporate boards and the likelihood of a firm being convicted of an environmental offence in the United Kingdom (UK).

Design/Methodology/Approach

The study uses a probit model to analyse the relationship between corporate boards and the likelihood of a firm being convicted of an environmental offence in the UK, controlling for firm size, financial leverage and profitability.

Findings

The results suggest that the likelihood of a firm being convicted of an environmental offence increases with board size, but decreases with the presence of a woman on the board. No support is found for our hypotheses about the proportion of outside directors and the presence of a lawyer on the board. Marginal effects results also show that adding one member to the board increases the chance of a firm being convicted for an environmental offence by 4.2% while having a woman on the board decreases the likelihood of a firm being convicted of an environmental offence by 31.8%.

Research limitations/implications

The sample size of 55 firms is small which could affect the generalisability of the study.

Originality/Value

The study uses proprietary data obtained from the UK Environmental Agency to provide evidence for the first time how corporate boards affect the chances of a listed firm being convicted of an environmental offence in the UK.

Keywords

Corporate boards, environmental offence conviction, marginal effects, United Kingdom.

Paper Type Research Paper

Introduction

The boards of directors, in particular, are paying more attention to environmental issues due to increased concerns over climate change, decreased natural resources, and increased pressure from regulators, customers, investors and environmental stakeholders (Dixon-Fowler, Ellstrand and Johnson, 2015). In the context of the United Kingdom (UK), one primary source of increased pressure on boards of listed firms is the UK Government. For example, the UK Government passed the world's first legally binding Act of Parliament in the form of the Climate Change Act 2008. The Act requires the Government to set legally binding 'carbon budgets' and commits the UK to reducing emissions by at least 80% by 2050 from the 1990 levels. To increase the pressure on listed firms' environmental performance, the Government enacted the Companies Act 2006 (Strategic Report and Directors' Reports) Regulations (2013) which require quoted companies to report on greenhouse gas (GHG) emissions for which they are responsible in their annual reports.

To underscore the seriousness of poor environmental performance, the UK Government's new sentencing guidelines for environmental offences were brought in, effective from the 1st of July, 2014. Under the guidelines, the court will determine the seriousness of the offence using two criteria of culpability (deliberate, reckless, negligent or low/no culpability) and harm (ranging from 'Category 1' - polluting material of a dangerous nature, major adverse effects to people or nature to 'Category 4' - risk of minor, localised adverse effect). The starting point for a large organisation for a deliberate 'Category 1' environmental offence is a fine of £1 million but in most cases the fine will be in the range of £450,000 to £3,000,000. Despite the deterrence of these large financial fines, some UK firms are convicted and fined every year by the UK Environmental Agency for environmental offence violations.

The purpose of this paper is to investigate the relationship between corporate boards and the likelihood of a firm being convicted of an environmental offence (a measure of

environmental performance) using UK data. Specifically, we investigate whether corporate boards' characteristics (size, the proportion of outside directors, the presence of a woman and the presence of a lawyer on the board) are associated with the probability of a firm being convicted of an environmental offence. We examine this relationship on the basis that the board of directors is at the apex of the decision-making process in many organisations and every major strategic decision including the firm's policy towards the environment must go through the board. According to Kassinis and Vafeas (2002), even though boards sometimes exert little real power over decision making, boards are ultimately responsible for corporate environmental strategy.

This study contributes to growing academic research interest in the efficacy of corporate boards in improving environmental performance (e.g., McKendall, Sanchez and Sicillian, 1999; Kassinis and Vafeas, 2002; de Villiers, Naiker and van Staden, 2011; Walls, Berrone and Phan, 2012; Post, Rahman and McQuillen, 2015). Together, these studies have yielded some useful insights into the effectiveness of corporate boards in enhancing environmental performance. For example, Kassinis and Vafeas (2002) found that the likelihood of a firm being a lawsuit defendant increased with board size, fraction of directors in industrial firms and fraction of inside ownership but decreased with the number of directorships held by outside directors. Research by de Villiers et al. (2011) reported that board size, active CEOs and law experts on the board of directors have a positive influence on environmental performance. A study by Walls et al. (2012) uncovered many significant associations between corporate governance and environmental performance, but many in the directions not predicted by theories used in past research.

Despite the extent and growth of research on the impact of corporate boards on environmental performance, we argue that further research is needed and our research

contributes in three main ways. Firstly, our study contributes by providing evidence of the efficacy of corporate boards on environmental performance in the UK context, where such evidence does not exist. All studies that have drawn their data from a single country to date are based on the United States (US) with the exception of Earnhart and Lizal (2006) on Czech Republic, Wang and Jin (2007) and Meng, Zeng, Tam & Xu (2013) on China, Ben-Amar and McIlkenny (2014) on Canada and Guerci, Longoni & Luzzini (2015) on Italy. A study based on a different environment such as the UK will make a significant contribution to our understanding of the relationship between corporate governance mechanisms and environmental performance since the relationship may differ from one country to the other due to the legal and cultural differences. For example, Kock and Min (2015) found that a shareholder-focused common law legal origin is significantly associated with higher emissions of CO₂ and that international agreements such as the Kyoto Protocol seem to have a more pronounced effect in shareholder-centric economies than other economies.

Secondly, the study also contributes to existing literature by reporting results of the relationship between corporate boards and environmental performance based on a more objective measure of environmental performance (i.e. environmental offence conviction). Apart from McKendall et al. (1999) and Kassinis and Vafeas (2002), the operationalisation of environmental performance by existing studies has mostly been that derived from the Kinder, Lydenberg, and Domini's (KLD) database (e.g., De Villiers et al., 2011; Walls et al., 2012; Dixon-Fowler et al., 2015; Glass et al., 2015; Post et al., 2015). Although the database has been used extensively, it is acknowledged that it has some limitations as the data is partly based on the firm's self-reported measures (see Walls et al., 2012). Given the difficulties in measuring environmental performance, there is a need for further research evidence based on different proxies of environmental performance. According to Kassinis and Vafeas (2002), the use of a conditional measure of environmental performance such as the one employed by the current

study has a distinct advantage over subjective assessments such as questionnaires. This is because such a measure is a product of an evaluation by an independent government agency, in our case the UK Environmental Agency. Thus, the environmental performance measure we use is an indication of how the firms measure up to the requirements of the relevant environmental legislation. Similar to Kassinis and Vafeas (2002), we argue that our binary measure of environmental performance has a high degree of objectivity given the litigation costs incurred by the UK Environment Agency in bringing the cases to the court of law and securing a conviction.

Thirdly, our study also contributes by reporting evidence of the marginal effects of the different corporate board characteristics on environmental performance. To our knowledge, such evidence does not currently exist. Marginal effects show the effects of a one-unit change in the independent variable on the probability that the dependent variable is equal to one (in our case, that the firm committed an environmental offence). Marginal effects can be an informative means of summarizing how changes in board characteristics are related to changes in environmental performance. For example, marginal effects will tell us the effect of increasing the board size by one member or how the presence of a woman affects the likelihood of a firm being convicted of an environmental offence. Such knowledge is important for policymakers to improve corporate governance. For example, depending on the marginal effects of different corporate governance mechanisms, policymakers may opt to require implementation of those mechanisms which have a greater marginal effect on environmental performance and at the same time only recommending adoption of those mechanism with a less profound effect on environmental performance.

The rest of the paper is organised as follows. The next section discusses the literature review which is subdivided into three subsections dealing with the theoretical framework, prior literature and hypotheses development. This is followed by an outline of our research

methodology. We then present and discuss our findings. The final section is a summary and conclusion.

Literature Review

Theoretical framework

This paper adopts a multi-theoretical approach in explaining why corporate boards would influence environmental performance. For example, one such applicable theory is the agency theory. Agency theory is concerned with the problems that can arise in any cooperative exchange when one party (the principal) contracts with another (the agent) to make decisions on behalf of the principals (Fama and Jensen, 1983). Agency costs will arise because agents (managers) can hide information and/or take actions that favour their own interests. Agency theory provides the rationale for the board's critical function of monitoring management on behalf of the shareholders (Eisenhart, 1989; Fama and Jensen, 1983). In order to exercise its monitoring function, the board needs the appropriate mix of experience and capabilities to evaluate management and assess business strategies and their impact on corporate social responsibility (CSR) (Hillman and Dalziel, 2003).

Stakeholder theory is also applicable in explaining the relationship between corporate boards and environmental performance. Freeman (1984, p. 46) defines a stakeholder as 'an individual or group who can affect or is affected by the achievement of the organisation's objectives'. Stakeholder theory therefore recognises that a variety of constituency groups have legitimate claims upon the organisation and can affect the organisational outcomes. According to stakeholder theory, organisations are viewed as social institutions which have responsibilities over and above fiduciary responsibility to shareholders (Carroll, 1979) such as protecting the environment. Although, stakeholder and agency theories have different origins, it has been suggested they have something in common. For example, it has been suggested that

both agency theory and stakeholder theory particularly considering instrumental stakeholders, view the firm as a network of contracts with stakeholders (Fama, 1980; Jones, 1995; Mcguire, Dow & Argheyd, 2003).

Resource dependency theory, which offers the rationale for the board's function of providing critical resources to the firm including legitimacy, advice and counsel (Hillman and Dalziel, 2003), has also been widely used to explain why corporate boards will influence financial performance and can similarly explain why the board can influence environmental performance. According to Johnson et al. (1996), directors serve three primary roles: control, resource dependence and service. In that regard, directors use their expertise and experience to monitor managerial performance, secure important resources, provide expert advice, and oversee strategy development and implementation. According to Pfeffer and Salancik (1978) and Boyd (1990), directors also play a resource dependence role, enhancing firm performance by linking a firm with important constituencies. This is consistent with the suggestion that the directors, through their external networks, can help a firm in reducing uncertainty and securing valuable resources (e.g., Johnson et al., 1996; Hillman et al., 2000).

Directors play a service role by using their expertise to advise the chief executive officer and top management team and are active in reviewing and ratifying strategic initiatives (e.g., Lorsch and MacIver, 1989; Zahra and Pearce, 1989). Thus the directors help to determine the overall strategy of the firm and influence firm-level decision-making, performance and other outcomes which may include environmental performance (e.g., Hill and Snell, 1988; Johnson et al., 1996). From a service perspective, directors may be concerned with their firm's strategy and act in the best interests of shareholders because they view the firm's performance as a reflection of their own abilities and reputation (Fama 1980; Davis et al., 1997; Johnson et al., 1996). According to Daily et al. (2003) directors essentially manage their own reputations by acting as a steward of a firm.

Prior studies

Although there are a number of prior studies that have examined the relationship between corporate governance and corporate social responsibility (which includes environmental performance) (e.g., Coffey and Fryxell, 1991; Wang and Dewhirst, 1992; David, Bloom and Hillman, 2007; Bear, Rahman and Post, 2010), this literature review concentrates on those studies that specifically investigated the impact of corporate governance on environmental performance. A study by McKendall et al. (1999) was the first to investigate the effect of board structure on environmental performance. The study examined how different corporate boards are related to the likelihood of a firm committing a non-serious or a serious environmental violation. The results indicated that the value of stocks owned by corporate officers and directors was positively and significantly associated with serious environmental violations. This positive association was rationalised by saying that directors may be more likely to ignore compliance with environmental law if they expect such action to increase company profits and hence their personal wealth. Outsider dominance, joint CEO-chairpersons, social responsibility committees, and attorneys on the boards were not significantly related to corporate illegal behaviour. The control variables of size, industry profitability, firm profitability and industry concentration were found to be significantly related to environmental violations.

Kassinis and Vafeas (2002) questioned why each year hundreds of US firms were prosecuted for violating environmental laws and fined hundreds of millions of dollars in penalties yet others avoided the penalties by adhering to the provisions of the environmental laws. The study compared the pre-lawsuit profile of 209 firms which were subject to environmental offence litigations to a sample of matched control firms. The findings suggest that the likelihood of a firm being a lawsuit defendant increased with board size, fraction of directors in industrial firms and fraction of inside ownership, but decreased with the number of

directorships held by outside directors. Craig and Dibrell (2006), among others, also investigated the differences between family and non-family owned firms on natural environment related policies. Using data from questionnaire responses from a sample of 396 small and medium sized enterprises, the study reported that family firms are better able to facilitate environmentally friendly firm policies than non-family owned firms.

Earnhart and Lizal (2006) analysed the effects of ownership on environmental performance and also how financial performance affects environmental performance using an unbalanced data panel of Czech firms from 1993 to 1998. The study found that increased state ownership improves environmental performance relative to all other types of ownership types. Earnhart and Lizal (2006) also found evidence that successful financial performance improves future environmental performance, which, the authors argue, is consistent with the hypothesis that a liquidity constraint may be limiting investment in activities that directly or indirectly lower emissions. Wang and Jin (2007) also investigated the efficacy of different types of ownership on environmental performance in China. Specifically, the study examined the differences in pollution control performance of industries that were state owned enterprises (SOE), collectively or community owned (COE) and privately owned enterprises (POE). The findings of the study indicate that the COEs have better environmental performances in water pollution discharges than the SOEs and the POEs.

Salo (2008) argues that, while both corporate governance and environmental performance are increasingly examined within the financial market place, there is a very limited empirical research that examines them both together. The study therefore sets out to examine the link between corporate governance and environmental performance. Salo (2008) concluded that the findings did not suggest that there was a direct correlation between corporate governance and environmental performance. Berrone and Gomez-Mejia (2009) investigated the relationship between environmental performance and executive compensation. They found

that, in polluting industries, good environmental performance increases CEO pay and that environmental governance mechanisms strengthen this linkage.

Berrone, Cruz, Gomez-Mejia and Larraza-Kintana (2010) investigated the differences in environmental performance between family owned and non-family owned public US companies. They found that family controlled public firms protect the socioemotional wealth by having a better environmental performance than their nonfamily counterparts, particularly at the local level, and that for non-family firms, stock ownership by the CEO has a negative environmental impact. de Villiers et al. (2011) investigated the relationship between a strong firm environmental performance and board characteristics that capture boards' monitoring and resource provision abilities. Specifically, the study investigated the influence of board characteristics that represent boards' monitoring role (independence, CEO-duality, concentration of directors appointed after CEO, and director shareholding) and resource provision role (board size, directors on multiple boards, CEOs of other firms on the board, lawyers on the board, and director tenure). The findings suggest a positive relationship between board size, larger representation of active CEOs on the board, and legal experts on the board and environmental performance.

Kock, Santalo and Diestre (2012) relied on the stakeholder-agency theory in investigating the impact of exposure to the market for corporate control, managerial exposure to the legal and regulatory systems, influence of stakeholders over corporate board and equity based managerial incentives on environmental performance (waste and toxic waste). The results suggest that there is a positive relationship between exposure to the market for corporate control, managerial exposure to the legal and regulatory systems and environmental performance (waste). The results also indicate a negative relationship between influence of stakeholders over corporate board and equity based managerial incentives and environmental performance (waste and toxic waste).

A study by Walls et al. (2012) investigated how the relationships between and among the firms' owners, managers and boards of directors influence environmental performance. The study uncovered many significant associations between corporate governance and environmental performance. For example, the findings suggest a positive relationship between environmental committee and environmental strength and also a positive relationship between environmental committee, board independence, board size, CEO salary and shareholder activism. They also indicated that the corporate governance-environmental performance may be different for those firms operating in other nations under different governance regimes.

Calza, Profumo and Tutore (2014) investigated the relationship between corporate ownership and environmental proactivity. The results show that ownership structure matters in firms' environmental proactivity. In particular, firms with higher percentage of state ownership present superior green proactivity, while ownership concentration appears negatively related to proactive environmental strategy. Their sample excluded UK as a typical market based system characterised by different corporate ownership.

Ortiz-de-Mandojana & Aragon-Correa (2015) highlight the importance of a firm's board with respect to the sustainability issue by analysing the relationship between director interlocks and a firm's environmental performance. The paper utilises the insights from a resource based view and research on social capital to demonstrate that environmental performance of a firm is also influenced by a difficulty to imitate capabilities that are embedded in the networks and relationships of its directors. The results indicate that director interlocks are positively connected with the environmental performance of a firm.

A study by Post et al. (2015) argues that, although there is a growing body of work suggesting a link between the presence of women and independent directors on boards and environmental performance, the channels through which this link is established were not well understood. The study therefore tested the mediating role of sustainability-themed alliances in

the relationship between board composition and environmental performance. The results indicated that the higher the representation of women on the board, the more likely the firm is to form sustainability-themed alliances. Post et al. (2015) also found that the higher the representation of independent directors on the firm's board, the more likely the firm was to form sustainability-themed alliances.

A study by Kock and Min (2015) found support for their hypothesis that a shareholder focused common law legal origin is associated with significantly higher emissions of CO₂, and also that international environmental agreements like the Kyoto Protocol seem to have a more pronounced effect in shareholder centric economies than thus far assumed.

Glass, Cook and Ingersoll (2015) investigated the impact women leaders had on the corporate environmental strategies of organisations. The findings revealed that the effects of gender diversity on environmental practice are nuanced and context dependent. Specifically, the study found no significant effect of women CEOs on environmental practice. Despite previous research indicating that women leaders are more likely than men CEOs to strengthen the environmental practices of firms the study found no such evidence. The study however found that board interlock was positively associated with environmental strength but not environmental concerns.

Dixon-Fowler et al. (2015) investigated the relationship between the existence of board environmental committees, stakeholder representation, presence of a sustainability manager and environmental performance. The results indicated that there was a positive association between the existence of a board environmental committee and environmental performance. The presence of senior-level environmental manager positively moderates this relationship but is not effective in isolation. The study found no support for influences of stakeholder representation.

Thus overall, there is growing literature that has investigated the relationship between corporate governance and environmental performance. However, as argued before, most of the literature is US centric and very little is known about the relationship between corporate governance mechanisms and environmental performance in other countries. This research is a step toward filling that gap in literature.

Hypotheses development

Board size

Existing literature indicates that larger boards may be associated with superior environmental performance because such boards are likely to include more experienced and knowledgeable directors who possess better expertise to manage environmental issues. For example, according to de Villiers et al. (2011), larger boards are more likely to be diverse and include directors with different skill sets and foci. This increases the likelihood that a director or some directors have been exposed to the effects of the environmental agenda. This is consistent with Goodstein, Gautam, and Boeker (1994) who suggested that corporate boards may be able to have an effect on the company's environmental performance on the basis that resource dependence theory suggests that larger boards enhance firm performance by ensuring greater ability of firms to form links to their environmentally critical resources. The increased resources in terms of expertise and networks would allow larger corporate boards valuable financial leeway towards achieving more environmentally responsible behaviour. Zahra and Pearce (1989) suggest that as the number of corporate directors rises there are more people to draw on, providing management with otherwise unobtainable expert advice. Consequently, it can be expected that a greater number of directors may reduce the likelihood of a firm being convicted for an environmental offence.

Birnbaum (1984) finds that uncertainty and lack of information are mitigated by larger board sizes. However, Goodstein et al. (1994) suggest that large boards are not as cohesive in initiating strategic action compared to smaller boards. Consequently, larger boards perform less strategic planning and may encounter more problems in setting and implementing an acceptable agenda on the environment. Also, according to agency theory, larger boards experience process losses while they also hinder the free exchange of ideas among board members. Consistent with these arguments, Kassinis and Vafeas (2002) and de Villiers et al. (2011) found a positive relationship between board size and environmental performance. However, Walls et al. (2012) found no significant relationship between board size and environmental performance. We therefore hypothesize as follows:

H₁ The likelihood of a firm being convicted of an environmental offence is positively associated with board size.

Proportion of outside directors

The link between outside directors and environmental performance can be explained in terms of a number of theories and arguments. For example, Post et al. (2015) suggest that following agency theory logic, among the outside directors, the independent ones, are expected to have greater impact on corporate governance. This is because independent directors are primarily interested in aligning with stakeholder interests and using their contacts and business expertise to participate in the strategy of the focal firm to maintain or enhance their own reputations, which are intertwined with addressing stakeholder issues. According to Zahra, Oviatt & Minyard (1993), the number of outside directors on a company's board increases the racial, ethnic and gender diversity of the firm. The resource dependence framework suggests that the selection of outside members can be viewed as a strategy for dealing with an organisation's relationship with its environment (Pfeffer and Salancik, 1978). In addition, outside directors

may enhance the reputation and credibility of an organisation and help to establish and maintain its legitimacy (Pfeffer and Salancik, 1978).

Since outside directors have reputations to protect (Fama & Jensen, 1983) and are hired to help manage external constituencies, including local communities (Pfeffer, 1972), they will presumably feel that investments in the quality of products and services are in the best interests of shareholders. According to Johnson and Greening (1999), outside directors, representing many constituencies and being knowledgeable about the critical contingencies facing firms, may be more inclined to comply with environmental standards to avoid penalties, fines and negative media exposure and a subsequent loss of reputation, all of which will affect future profit. Empirical evidence for the effectiveness of outside directors is however mixed. For example, Boeker and Goodstein (1991) found some support for effectiveness of outside directors as resource acquisitions agents. However, Berrone and Gomez-Mejia (2009) did not find evidence to suggest that outside directors influence environmental performance. We therefore hypothesize as follows:

H₂ The likelihood of a firm being convicted of an environmental offence is negatively associated with the proportion of outside directors.

Board diversity

According to Glass et al. (2015), while gender socialization perspective predicts that women CEOs will be more likely than men CEOs to pursue environmentally friendly policies, there is also evidence to suggest that gender diverse boards will be more amenable to environmentally sustainable practices than non-diverse boards. Research by Post, Rahman and Rubow (2011) found evidence that firms with a critical mass on the board spend more time on environmental and corporate social responsibility concerns. Hillman et al. (2002) concluded that the presence of women on the board is expected to have a positive impact on environmental performance since women are more educated than their male counterparts. For example, on boards, women

are more than twice as likely as men to hold a doctoral degree. Female directors are more likely than male directors to have expert backgrounds outside business and to bring a different perspective to the board (Hillman et al., 2002). In addition women on boards are more likely than men to support specialists and community initiatives (Hillman et al., 2002). Therefore having more female directors may sensitize boards to CSR initiatives and provide perspectives that can be helpful in addressing CSR issues.

On the assumption that that gender differences in leadership styles also exist at board director levels, the presence of female directors may stimulate more participative communication among board members (Eagly, Johannesen-Schmidt & van Engen, 2003) and perhaps a more communal atmosphere than in an all-male board (Rudman and Glick, 2001). Therefore, having more women on board could encourage more open conversation among members of the board. A broader perspective may enable the board to better assess the needs of diverse stakeholders. The result may enhance the board's ability to effectively address CSR. Hillman et al. (2002) also suggested that having more women on the board enhances the board's expertise by increasing the range of professional experience and augmenting the number of board members with advanced degrees. These added qualities brought about by female board members enable the board to monitor management more effectively (Hillman and Dalziel, 2003). Empirical results on the relationship between proportion of outside directors and environmental performance is, however, mixed. For example, Glass et al. (2015) found that the proportion of women on the board has an effect on environmental strengths but not weaknesses while Post et al. (2015) found that the higher the representation of women on the board, the more likely the firm is to form sustainability-themed alliances. We therefore hypothesize as follows:

H₃ The likelihood of a firm being convicted of an environmental offence is negatively associated with the presence of women on the boards.

Presence of lawyers on the board

The suggestion that the presence of lawyers on the board of directors can have an impact on environmental performance is based on the evidence that appropriate experience and expertise of board members is associated with superior outcomes (e.g., Kroll, Walters and Wright, 2008; McDonald, Westphal and Graeber, 2008). This is especially so given that that lawyers are more likely to possess the analytical skills to assess environmental opportunities and be knowledgeable about the stakeholder impacts of environmental actions (de Villiers et al., 2011). Chamberlain (1982) also suggests that lawyers bring a necessary perspective to boards because they are sworn to uphold the judicial system, they understand legal liability, and they are more cognizant of the public effects of corporate choices.

We suggest that corporate boards with one or more members who are qualified as an attorney will have legal advice at their disposal and thus the ability to ask broader questions about any proposed action involving environmental law thus are less likely to be in breach of the law. Another reason for expecting the presence of lawyers on the board to impact environmental performance is that lawyers are held to a higher professional standard, have a better understanding of the legal environment, and are more adept at dealing with politically sensitive areas such as the environmental performance (Harris and Valihura, 1998). Since lawyers are held to a higher professional standard similar to Pfeffer and Salancik (1978), we argue that a board of directors that has a lawyer as at least one of its members has readily accessible expertise that can help the board to maintain its legitimacy.

Empirical evidence of how the presence of a lawyer on the board affects environmental conviction is mixed. For example, while de Villiers et al. (2011) found evidence in support of the effectiveness of the presence of lawyers on the board on environmental performance,

McKendall et al. (1999) did not find a significant relationship. We therefore hypothesize as follows:

H₄ The likelihood of a firm being convicted of an environmental offence is negatively associated with the presence of lawyers on the boards.

Control Variables

We control for a number of underlying firm-specific characteristics that could influence environmental performance. First, firm size is known to be a proxy for a number of factors such as public visibility; large firms tend to attract the attention of diverse stakeholders, who use intense pressure and scrutiny to force them to engage in environmental management as a way of maintaining their legitimacy within their operating environment. The majority of studies have found a significant positive relationship between firm size and environmental performance (e.g., McKendall et al., 1999; Cordeiro and Sarkis, 2008; Berrone and Gomez-Mejia, 2009; Walls et al., 2012). Secondly, we control for leverage (measured as a ratio of long term debt scaled by shareholders' equity plus long term debt), considered to be a measure of risk to which both equity holders and debt holders are exposed. Kock et al. (2012), Walls et al. (2012) and Meng et al. (2013) found financial leverage to have a significant influence on environmental performance. Finally, we also control for firm profitability. McKendall et al. (1999) found profitability to be related to environmental performance. However, Dixon-Fowler et al. (2015) found no significant relationship.

Methodology

Data and sample

The population of our study are the 74 London Stock Exchange listed firms that were identified as having been convicted of an environmental offence over a 15 year period between 2000 and 2014 according to the data obtained from the Environment Agency under the UK Freedom of Information Act 2000. Given that some of the firms have either gone out of business, merged or have been taken over, we were able to obtain data for 51 of those firms. These firms were then matched with 51 similar firms on the basis of firm size (total assets), year of conviction and industry. However, because some of the 51 companies were convicted more than once over the 15 year period, we were therefore able to include the same firm twice or more depending on the number of times it was convicted. This increased the sample size to 55 firm years for the convicted firms. These were then matched with 55 other firms on the basis of year of conviction, size (total assets) and industry. Therefore, the results reported in this study are based on 110 firm years. The analysis of the firms and their matched pairs is presented in Table 1.

[INSERT TABLE 1 ABOUT HERE]

The table shows that most of the companies convicted belonged to the consumer services industry consisting of 40% of all environmental convictions. This is followed by the consumer goods industry with 25.45% of the convictions. The fact that the consumer industry has the most convictions suggests that the government is very keen to protect the members of the public. Apart from these two, 'industrials' is the only other industry that has a significant number of firms being convicted of an environmental offence in our sample with 10.91% of the firms.

[INSERT TABLE 2 ABOUT HERE]

Empirical strategy

Regarding empirical analysis, the following probit model was estimated:

$$ENVP = \beta_0 + \beta_1 BOSZ + \beta_2 PROD + \beta_3 BODI + \beta_4 LAW B + \beta_5 FISZ + \beta_6 LEVR + \beta_7 PROF + \varepsilon$$

Where ENVP is the dependent binary variable equal to 1 if the firm is being convicted of an environmental offence, and zero otherwise. The variables of interest are the board size (*BOSZ*), a binary variable for the presence of women on board (*BODI*), a binary variable for the presence of non-executive directors on board (*PROD*), a binary variable for the presence of lawyers on board (*LAWB*). Control variables include firms' total assets (*FISZ*), leverage (*LEVR*) and the level of profitability (*PROF*) (see Table 2 for the variable definitions). Finally, ε denotes the error term.

The choice of the estimation model is dictated by the nature of the dependent variable. Namely, given that the dependent variable is a binary indicator taking on values of 0 and 1, applying the Ordinary Least Squares (OLS) estimator would produce biased estimate. Therefore, we need to employ a discrete choice model, either probit or logit (logistic). The former assumes that the error terms in the model follow a standard normal distribution, whereas the latter relies on the assumption that the error terms follow a standard logistic distribution (Wooldridge, 2008, p. 577). We first estimated the probit model and tested the assumption of normality in error terms utilizing the Lagrange Multiplier Test. The test indicates that the null hypothesis of normality in error terms cannot be rejected at any conventional level of significance (the results are available upon request). Therefore, we report the results from the probit model. To take into account heteroscedasticity of the error terms, we report bootstrapped standard errors (the number of replications is 1,000).

Results and Discussion

Results

Descriptive statistics

Table 3 shows descriptive statistics for the dependent and independent variables. Because the sample consists of matched firms, the mean of the dependent variable ENVVP is 0.5. The average board has seven members, while the average for the proportion of non-executive directors is 24 percent.

[INSERT TABLE 3 ABOUT HERE]

A rather small number of boards have a female member (14 percent), and similarly, only 10 percent of firms have a lawyer on board. The average total assets (firm size) are £50,123,474.04, while the average leverage is 69.1 percent. Finally, the average value of profitability (return on assets) is 4.47%. Detailed descriptive statistics for the subsamples of environment offenders and firms without environment offence is given in Table 4.

We have also tested the differences in the means of independent variables between matched firms, i.e. those firms that were convicted of environmental offence and similar firms that were not convicted. The results are presented in Table 4.

[INSERT TABLE 4 ABOUT HERE]

The results show that there is insufficient evidence to reject the null hypotheses of no difference in means at any conventional significance levels for the following variables: the presence of non-executive directors on board (*PROD*), presence of lawyers on board (*LAWB*), firms' total assets (*FISZ*), leverage (*LEVR*) and profitability (*PROF*). For the board size (*BOSZ*) and its

diversity (*BODI*), the null hypothesis cannot be rejected at the 5% level, but it can be rejected at the 10% level of significance.¹

The pairwise Pearson correlation coefficients between the independent variables are reported in Table 5. The correlations are overall weak to moderate (Taylor, 1990), therefore we proceed with the estimation of the model. ~~The choice of the estimation model is dictated by the nature of the dependent variable. Namely, given that the dependent variable is a binary indicator taking on values of 0 and 1, we can either estimate the probit or the logit (logistic) model. The former assumes that the error terms in the model follow a standard normal distribution, whereas the latter relies on the assumption that the error terms follow a standard logistic distribution (Wooldridge, 2008, p. 577). We first estimated the probit model and tested the assumption of normality in error terms utilizing the Lagrange Multiplier Test. The test indicates that the null hypothesis of normality in error terms cannot be rejected at any conventional level of significance (the results are available upon request). Therefore, we report the results from the probit model. To take into account heteroscedasticity of the error terms, we report bootstrapped standard errors (the number of replications is 1,000).~~

[INSERT TABLE 5 ABOUT HERE]

Table 6 shows the estimated coefficients and the corresponding marginal effects. Our interpretation of the estimated coefficients is qualitative, i.e. discussing their signs and statistical significance, while marginal effects will be interpreted quantitatively. With respect to the variables of interest, the estimated coefficients suggest that the board size (*BOSZ*) has a positive and marginally significant impact on environment performance (at the 10% level of significance). This means that our hypothesis 1 (H_1) which predicted a positive relationship

¹ The results are available upon request.

with environmental performance (*ENVP*) is accepted. In contrast, board diversity (*BODI*) has a negative and statistically significant impact (at the 5% level of significance).

[INSERT TABLE 6 ABOUT HERE]

These results means that our hypothesis 3 (H_3) is accepted while our hypothesis 4 (H_4) is rejected at all conventional levels of significance. The presence of non-executive directors on the board (*PROD*) has no impact on firm environment performance. This means our hypothesis 2 (H_2) is rejected. Regarding control variables, our results indicate no impact of firm size (*FISZ*), leverage (*LEVR*) and profitability (*PROF*) on the probability of a firm being convicted of an environmental offence.

Next, we turn our focus on the interpretation of marginal effects at the sample mean, showing the instantaneous changes in the dependent variable (*ENVP*) when the variables of interest with respect to the corporate boards change by one unit of measure (Figure 1 presents all marginal effects graphically). When the board size (*BOSZ*) increases by an additional director, the probability of a firm being convicted for an environment offence increases by 4.2 percentage points.

[INSERT FIGURE 1 ABOUT HERE]

Firms with boards with female members (*BODI*) are less likely to be convicted for an environmental offence by 34.1 percentage points, relative to their counterparts without female board members. Although our results hint at a negative association between the proportion of outside directors (*PROD*) and the probability of environment offence (i.e. the larger the number of outside directors on the board, the smaller the probability of environmental offence), its

estimated coefficient and the corresponding marginal effect are not statistically significant at any conventional level. Finally, the estimated marginal effects for control variables are also statistically insignificant at any conventional level.

Figure 2 shows how the probability of environmental offence changes as the number of directors on a board (*BOSZ*) rises. The trend in probability is positive, which means that the more directors the board has, the higher the probability of an environmental offence.

[INSERT FIGURE 2 ABOUT HERE]

The likelihood of committing an environmental offence for firms with the smallest number of directors on boards (two directors) is 30 percentage points, while the likelihood for firms with the largest number of directors (15 directors) on board is 80 percentage points.

[INSERT FIGURE 3 ABOUT HERE]

Figure 3 demonstrates marginal effects of having a female member on board. While the probability of committing an environmental offence is 54.8 percentage points for firms in which boards with no female members, while for firms in which boards have a female member, this probability is 22.2 percentage points. Figure 4 presents marginal effects of board size for those boards with no female members (*BODI=0*) and for those with at least one female member (*BODI=1*). The graph shows that boards with up to eight members and at least one female member have no impact on the probability of an environmental offence (at the 5% level of significance). That is, the presence of a female member(s) neutralizes the impact of board size on the probability of an environmental offence up to a certain size of the board.

[INSERT FIGURE 4 ABOUT HERE]

The presence of a female member reduces to the point of insignificance the impact of the board size on the probability of an environmental offence if the board has less than eight members. In contrast, when the board reaches eight or more members, the effects become positive and highly statistically significant although the presence of female member(s) decreases the size of the effects relative to boards without female members.

Discussion

The results of our investigation, which indicate that the larger the board of directors, the higher the chances of the firm being convicted of an environmental offence, are consistent with studies by Kassinis and Vafeas (2002) and de Villiers et al (2011), which were all based on the US data. These results are also consistent with the argument that large boards are not as cohesive in initiating strategic action compared to smaller boards and that as a result perform less strategic planning and may encounter more problems in setting and implementing an acceptable agenda on the environment. Our finding of a statistically significant negative association between the presence of a woman on the board and the likelihood of a firm being convicted of an environmental offence is also consistent with growing literature showing the effectiveness of women on the board of directors (e.g., Glass et al., 2015; Post et al., 2015). These findings are also consistent with the suggestion by Hillman et al. (2002) that women on boards are more likely than men to be support specialists and individuals with influence in the community and that having more female directors may sensitize boards to CSR initiatives. Our finding that there is no support for the hypothesis that the likelihood of a firm being convicted of an environmental offence is negatively associated with the presence of a lawyer

on the board is consistent with McKendall et al. (1999) but inconsistent with de Villiers (2011) both of which are based on US data. Although the finding seems to contradict the suggestion by Chamberlain (1982) that boards with lawyers will be more effective because lawyers understand legal liability, the finding may be due to the fact that we only considered whether there was a lawyer on the board or not, without taking into account the proportion of lawyers on the board. It may well be that when it comes to voting, the lawyers are in the minority. Finally, the finding that the proportion of outside directors is not associated with the probability of a firm being convicted of an environmental offence suggests that outside directors may not be effective in improving firms' environmental performance. The finding is consistent with Berrone and Gomez-Mejia (2009) and Walls et al. (2012) who reported similar results using US data.

Overall, the results reported suggest that there are some similarities and also differences with extant literature mainly based on US data on the relationship between corporate boards and environmental performance (e.g. Mckendall et al., 1999; Kassinis and Vafeas, 2002; de Villiers et al., 2011 and Walls et al., 2012). However, to the best of our knowledge, this is the first time that the relationship between corporate boards and environmental performance has been investigated in the context of the UK. Our findings, therefore, add to the understanding of how corporate boards affect environmental performance specifically in the context of the UK. Moreover, our use of a conditional measure of environmental performance (i.e. environmental offence conviction) has a clear advantage over subjective assessments such as questionnaires because it is a product of an assessment by an independent government agency, in our case the UK Environmental Agency. Thus, we argue that our binary measure of environmental performance has a high degree of objectivity given the litigation costs incurred by the UK Environment Agency in bringing the cases to the courts of law.

Finally, and perhaps more importantly, we have been able to show the marginal effect of corporate board's characteristics on the likelihood of a firm being convicted of an environmental offence. For example, we have been able to show that an increase in the board by one director increases the chance of a firm being convicted of an environmental offence by 4.2 percentage points and that boards with at least one female member are 34.1 percentage points less likely to be convicted of an environmental offence. These findings are important for those charged with the function of improving the corporate governance as they clearly show that the presence of a woman on the board makes a big difference in the likelihood of a firm being convicted of an environmental offence.

Summary and Conclusion

This paper investigated the relationship between corporate board characteristics (board size, proportion of outside directors, presence of a woman and presence of a lawyer on the board) and the probability of a firm being convicted of an environmental offence. We found that the probability of a firm being convicted of an environmental offence increases with board size but decreases with the presence of women on the board. We then reported the marginal effects of board size and presence of a woman on the board. Specifically, the results show that each additional director to the board increases the chance of environmental offence conviction by 4.2 percentage points and the presence of a woman on the board decreases the likelihood of an environmental conviction by 34.1 percentage points. We also reported a moderating role of female board members on the impact of board size on the likelihood of an environmental offence. When the board has less than eight members, the presence of a female board member reduces to insignificance the impact of board size on the probability of an environmental offence. In contrast, when the board reaches eight or more members, the size impact on the

likelihood of an environmental offence becomes positive and significant, although its magnitude is reduced by the presence of a female member.

Our findings should be interpreted in the light of the following limitations. Our analysis is based on cross section data and therefore the results are not indicative of the relationship between corporate boards and environmental offence conviction over time. Moreover, in the cross-sectional setting, we are unable to control for the time effects and the effects of changes with respect to governance and environmental regulations. Another limitation of our study is the limited sample size of 110 firm years. However, this equates to roughly 70% of the population of the listed firms convicted between 2000 and 2014 and thus the sample is representative. Also because of the limited number of firms convicted of environmental offences, we were only able to incorporate a few corporate board characteristics. It is possible that some of the corporate boards characteristics not examined in this study such as ownership structure and presence of environmental committees are more significant determinants of environmental offence conviction.

Despite these limitations, on the basis of the findings reported, our study contributes to the existing literature in three main ways. Firstly, the study is unique in that it is the first study in the UK context to empirically investigate the association of corporate boards with the probability of a firm being convicted of an environmental offence – a proxy for environmental performance. Despite the differences in corporate governance arrangements between the UK and US, the results reported in this study are mostly consistent with similar studies based on the US data, such as McKendall et al. (1999) and Kassinis and Vafeas (2002). Secondly, our study also contributes to existing literature because it uses a conditional measure of environmental performance (i.e. conviction) that has clear advantages over subjective assessments such as questionnaires. From a practical point of view, the results are important to the firms and also policy makers. For example, given that a large board is costly in financial

terms, our results indicate that firms need to consider having smaller boards in order to be more effective in avoiding environmental convictions. In addition, the firms also need to make sure that they have women on their boards which will reduce the probability of environmental conviction. In the light of our findings, the UK policy makers need to consider making it a requirement to have women on the board as it may lead to improvement in environmental performance. Thirdly, unlike existing research on the relationship between corporate boards and environmental performance (e.g. Mckendall et al., 1999; Kassinis and Vafeas, 2002) we have been able to show the marginal effect of corporate board characteristics (board size and presence of a woman on the board) on the likelihood of environmental conviction. We argue that showing the marginal effect of these corporate board characteristics are important for policy makers in improving corporate governance of firms.

Given that this study is the first to examine the link between corporate boards and environmental offence conviction, future studies may wish to investigate whether other corporate board characteristics such as chief executive age, directors' stock ownership and the presence of environmental committees are associated with the likelihood of a firm being convicted on an environmental offence. Another potential area of future research is the investigation of the relationship between corporate boards and the likelihood of environmental offence conviction using data of private firms. This is because to date, our knowledge of the association between corporate boards and environmental performance is based on public listed firms. The differences in the scale of agency costs and corporate governance arrangements between public and private firms may mean that the association between the corporate boards and environmental performance will differ depending on the type of firm. Finally, it would be useful to compare our findings to those from other European countries to deduce on the generalizability of our findings.

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Table 1: ICB Industrial Classification of firms convicted of environmental violations

Industry	Number of firms	Number of convictions	Percent of sample*
Financials	1	1	1.82
Consumer Services	19	22	40.00
Consumer Goods	13	14	25.45
Industrials	6	6	10.91
Utilities	1	1	1.82
Telecommunications	2	2	3.64
Technology	3	3	5.45
Healthcare	2	2	3.64
Oil and gas	1	1	1.82
Basic Materials	3	3	5.45
Total	51	55	100.00

*based on number of convictions

Table 2: Independent and dependent variables definitions		
Variables	Acronym	Measurement
<i>Dependent</i>		
Environment performance	ENVP	Measured as a dummy variable assuming the value of 1 if a firm was convicted for an environmental offence anytime between 2000 and 2015; 0 otherwise.
<i>Independent Variables</i>		
<i>Corporate Boards</i>		
Board size	BOSZ	The total number of all directors on the board of a firm at the preceding annual report date.
Proportion of non-executive directors	PROD	Proportion of non-executive directors, measured as the total number of non-executive directors divided by the total number of directors on the firm's board of directors at the preceding annual report date.
Board diversity	BODI	Measured as a dummy variable assuming the value of 1 if a firm has a woman on the board of directors; 0 otherwise, as at the preceding annual report date.
Lawyers on the board	LAWB	Measured as a dummy variable assuming the value of 1 if a firm has a lawyer on the board of directors; 0 otherwise, as at the preceding annual report date.
<i>Control variables</i>		
Firm size	FISZ	Firm size measured in terms of the natural log of total assets at the preceding annual report date.
Leverage	LEVR	Measured as long-term debt divided by shareholders' funds plus long-term loans at the preceding annual report date.
Profitability	PROF	Profit before interest and tax divided by total assets at the preceding annual report date.

Table 3. Descriptive statistics

Variable	Mean	Standard deviation	Maximum	Minimum
ENVP	0.50	0.50	0	1
BOSZ	6.99	3.14	2	15
PROD	0.24	0.25	0	0.78
BODI	0.15	0.35	0	1
LAWB	0.09	0.29	0	1
FISZ (in natural logarithm)	17.73	2.81	9.90	23.72
FISZ (in £)	50,123,474.04	16.61	19,930.37	20,020,047,831.17
LEVR	0.27	0.25	0	0.92
PROF	0.11	0.16	-0.01	1.51

Table 4. Descriptive statistics of the sample by environment offence.

Variable	Firms with environment offence (n=55)					Firms without environment offence (n=55)					Mann-Whitney test	Chi-square
	Mean	Median	25%	75%	SD	Mean	Median	25%	75%	SD		
BOSZ	7.53	8	5	10	3.25	6.45	7	4	9	2.95	-1.69*	-
PROD	0.24	0.14	0	0.42	0.26	0.25	0.25	0	0.44	0.25	0.42	-
BODI	0.07	0	0	0	0.26	0.22	0	0	0	0.42	-	4.68**
LAWB	0.05	0	0	0	0.23	0.13	0	0	0	0.34	-	1.76
FISZ (in natural logarithm)	17.96	17.79	15.62	20.58	2.99	17.50	17.99	16.04	19.49	2.61	-0.61	-
FISZ (in £s)	63,085,404.92	53,222,936.57	6,076,868.06	866,523,684.26	19.89	39,824,784.40	65,006,641.53	9,248,759.57	291,339,554.84	13.6	-	-
LEVR	0.27	0.27	0.00	0.39	0.23	0.27	0.17	0	0.46	0.27	-0.34	-
PROF	0.09	0.08	0.03	0.11	0.08	0.12	0.12	0.09	0.04	0.22	0.64	-

Notes: SD denotes standard deviation. *** p<0.01, ** p<0.05; * p<0.10.

Table 5. Correlation matrix

	BOSZ	PROD	BODI	LAWB	FISZ	LEVR	PROF
BOSZ	1.000						
PROD	0.535***	1.000					
BODI	0.158*	0.184*	1.000				
LAWB	0.173*	0.282***	0.049	1.000			
FISZ	0.534***	0.513***	0.209**	0.074	1.000		
LEVR	0.198**	0.154	0.176*	-0.016	0.118	1.000	
PROF	0.006	-0.042	0.010	0.249***	0.043	-0.086	1.000

Notes: *** p<0.01, ** p<0.05; * p<0.10.

Table 6. Results from the probit model.

Independent variables	Coefficients	Marginal effects
Variables of interest		
BOSZ	0.117* (0.066)	0.042* (0.022)
PROD	-0.706 (0.785)	-0.251 (0.274)
BODI	-0.958** (0.453)	-0.341** (0.150)
LAWB	-0.573 (0.544)	-0.204 (0.190)
Control variables		
FISZ	0.036 (0.065)	0.013 (0.023)
LEVR	-0.082 (0.580)	-0.029 (0.206)
PROF	-0.989 (1.512)	-0.352 (0.533)
Constant	-0.985 (0.978)	
No of observations	110	110
Log likelihood	68.661	

Notes: Bootstrapped standard errors in parentheses (number of replications is 1,000); *** p<0.01, ** p<0.05, * p<0.10.

Figure 1. Average marginal effects from Table 6.

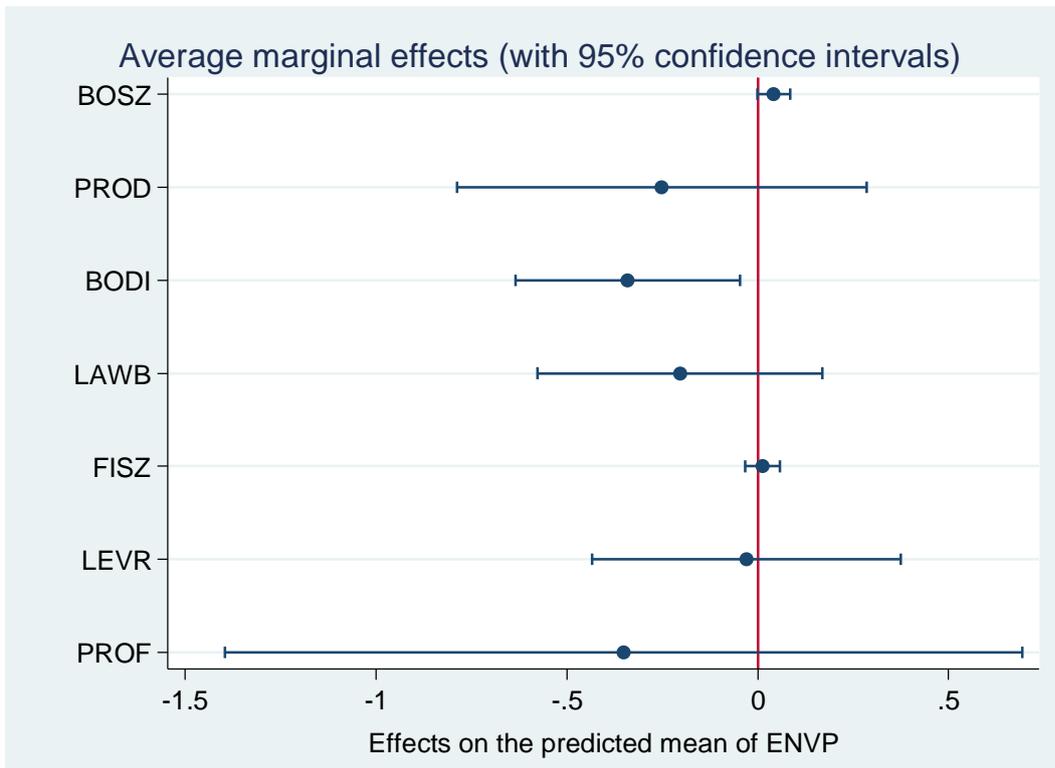


Figure 2. Adjusted predictions of the board size (BOSZ).

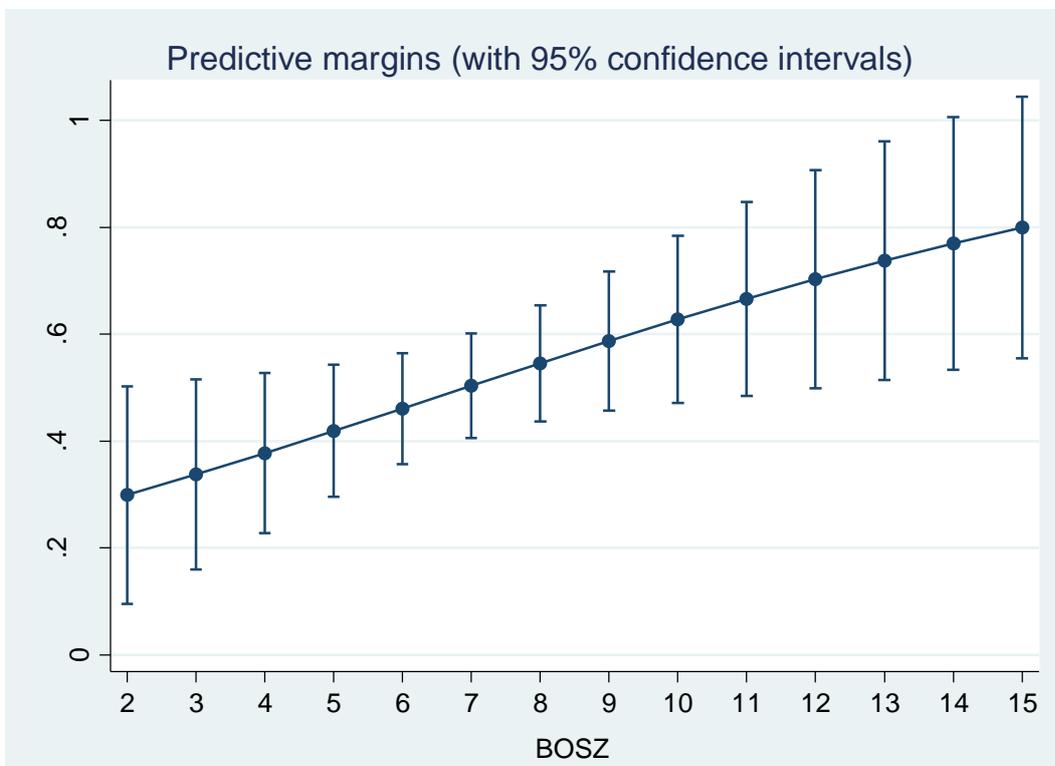


Figure 3. Adjusted predictions of the board diversity (BODI).

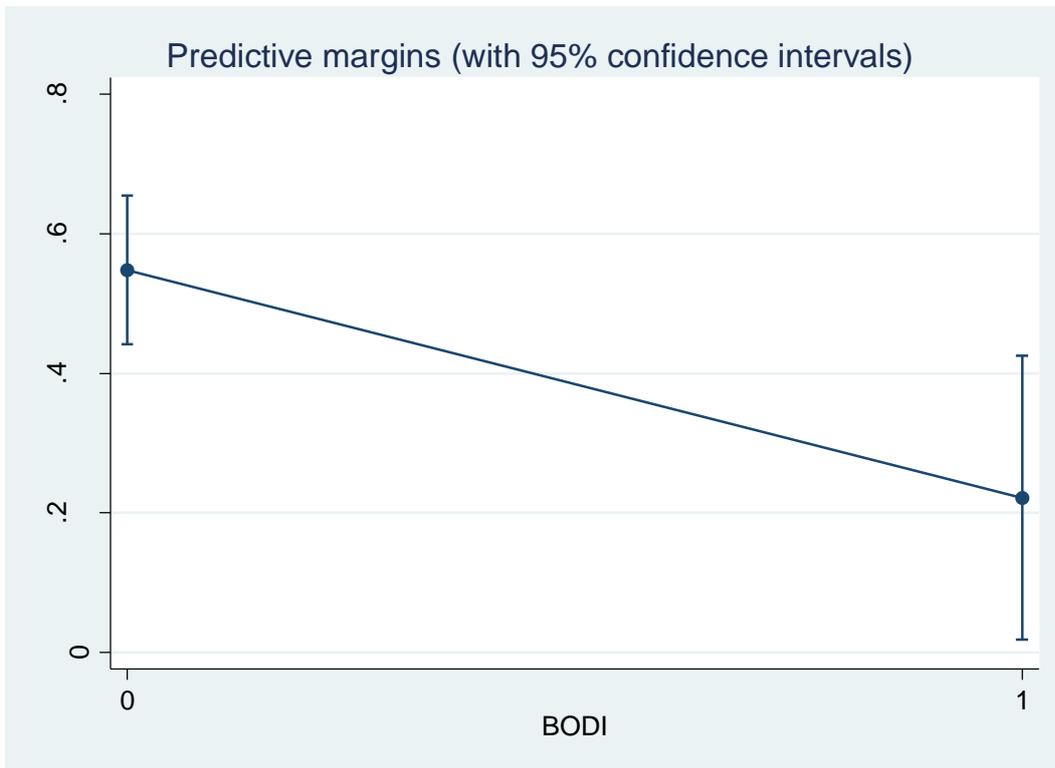


Figure 4. Adjusted predictions of the board size (BOSZ) with and without female members (BODI).

