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# Board of Directors and Tobin's Q: Evidence from U.K.Firms

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**Abstract** This study investigates whether board of director characteristics have an impact on corporate performance. Recent studies highlight that findings that such characteristics do have an impact may be affected by endogeneity issues in the data, which could lead to biased results. This study responds to this concern by using a generalised method of moments regression model) developed by Wintoki *et al.* (2011). Data for the analysis are extracted from BoardEx, FAME, and Datastream databases for the period 1999 – 2009. The final sample includes a total of 634 UK firms listed in the London Stock Exchange. The results suggest that board structure is partly determined by past corporate performance. Considering this, the results document that there is no relation between characteristics of the board of directors and corporate performance measured by Tobin's Q. This is inconsistent with much prier empirical studies and policy recommendations on corporate governance that suggests that corporate governance mechanisms develop corporate performance. In addition, this result indicates that the findings of the earlier corporate governance studies that do not take into account the dynamic nature of corporate governance may be affected by bias.

***Keywords:*** *corporate governance, board of directors, duality, board size, director ownership, board subcommittees, performance*

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## 1. Introduction

The conflicts of interest among the contractual parties in a firm is a main focus of corporate governance literature. According to Jensen and Meckling (1976), the three main parties with the potential for such a conflict are the directors, the shareholders, and debtors. Corporate governance mechanisms are based on principles from several fields, including finance, management, and law (e.g., Durisin and Puzone, 2009, Mallin, 2009, Solomon, 2010). Consequently, prior work investigates corporate governance issues from different theoretical viewpoints. These viewpoints include agency theory, organisational behaviour, legal regulations, political and economic impacts, and shareholding and stake holding concepts. A detailed discussion of these can be found in Clarke (2004). This study looks at corporate governance from a financial perspective and uses a quantitative research methodology to investigate the relationship bet ween corporate governance mechanisms and corporate performance.

The main objective of corporate governance reforms is to encourage directors to act in the best interests of shareholders, as a result, reducing agency costs (e.g., Cadbury, 1992, Higgs, 2003). Generally, the vast majority of corporate governance studies have been conducted in the light of agency theory (Filatotchev and Boyd, 2009). However, recently it has been suggested that different theories should be used to exemplify the nature of corporate governance mechanisms, because agency theory itself includes many theoretical orientations such as information asymmetry and stewardship theory (Kiel and Nicholson, 2003, Haniffa and Hudaib, 2006, Filatotchev and Boyd, 2009, Van Ees *et al.*, 2009). Therefore, it is essential to review not only the literature that relates to corporate governance mechanisms alone, but also the different theories that could explain these mechanisms.

## 2. Literature Review

This next section reviews the extant theoretical and empirical literature and theories of corporate governance and shows to what extent the corporate governance mechanisms affect corporate performance.

### 2.1. Agency Theory

During the last decade, collapses of famous companies have emphasised the risks that are included in the contractual relationship between managers and shareholders. Unlike other fund providers such as debt holders and banks, shareholders are residual claimants on its dividends (Hansmann, 1992). Consequently, shareholders do not have an overt contract to assure their interest, but they depend on the corporate governance system to control management in order to balance their

best interest with the interest of managers. Theoretically, it is the shareholders' responsibility to ensure a proper relationship with managers. Up to date, the corporate scandals of the twenty-first century have shown that, on a practical level, it seems difficult for shareholders to practise effective monitoring of managers. In other words, it is an awkward task for shareholders to align the interests of managers with their own best interest, and it is clear that shareholders are the party most affected by the corporation collapses (Hermalin and Weisbach, 1998, Ferris *et al.*, 2003, Heath, 2009).

According to transaction cost theory and property rights theory, shareholders should get residual monitoring rights in the company since they are residual claimants and will push toward residual returns, which leads to the company having efficient managers. However, realistically, shareholders cannot monitor the firm. Berle and Means (1932) document that, over the period of the 1920s, shareholders of public firms were broadly distributed. Many small shareholders had shares in a small fraction of a huge company, and they were unable to direct the commercial operations and control the daily activities this was done by managers. This separation between ownership and monitoring leads to agency problem and agency theory. Agency problems have become the main focus of many studies since the publication of Theory of the Firm by Jensen and Meckling (1976). In that article, the authors have drawn attention to the contractual relationship between shareholders, managers and debt-holders. They concentrate on corporate governance by analysing it in terms of agency theory with the explanation of property rights theory. The majority of the literature has grown up to explain the nature of that relationship and how it can be resolved within the framework of agency theory.

The literature on agency problems has grown up rapidly since the publication of Jensen and Meckling's (1976) theory of the firm. This theory focuses mainly on conflict of interest between contracting parties, namely owners, managers and debt-holders. The literature attempts to clarify the nature of the conflict and how can be resolved. The Cadbury Report (1992) concentrates mainly on improving the monitoring mechanisms that restrict the degree of agency problems. In order to get a better understanding of what the Cadbury Report aims to achieve, it is essential to go through the agency conflict between managers and shareholders. It is difficult to summarise all the studies that have been conducted in the field of agency problems, but what follows is a summary of the main points from the major studies that have been conducted, taking into account the causes of agency problems.

## 2.2. Information Asymmetry

A considerable number of prior empirical studies have depended on information asymmetry and managerial signalling to explain the relationship between shareholders and directors (e.g., Black, et al., 2006b; Healy and Palepu, 2001; Padgett and Shabbir, 2005). Information asymmetry suggests that, since the directors manage the daily operations of a company, they have more information about the company than do shareholders or future shareholders (Healy and Palepu, 2001; Kapopoulos and Lazaretou, 2007). Because of this, investors face two choices when they make investment decisions in a company. First, they have to decide which firms have a good management team - this situation is called adverse selection (Rhee and Lee, 2008). The second possible problem is moral hazard, which means that the managers do not use the extra information in pursuit of extravagant behaviour; or confirming that managers distribute dividends to shareholders rather than to employees or other groups. This could lead to over investing, which could be more influential than managers' perquisites and may result in reducing corporate performance (Brennan, 1995; Kapopoulos and Lazaretou, 2007).

However, in the light of uncertainty and moral hazard, investors have to include the possible costs of these problems when they weigh up whether or not to invest in the investment opportunity (Jensen and Meckling, 1976; Mishkin, 2004). Regardless of which choice the investors go with, this situation may negatively affect the cost of outside equity for companies. In order for companies to reduce the impact of adverse selection and moral hazard, they have to adopt a good corporate governance system, which is considered a signal of the quality of a firm's management team. Theoretically, complying with recommendations of corporate governance codes is fundamentally regarded as a good signal by companies toward markets and investors. This indicates that, because a company follows the best practices of corporate governance, investors will be assured that managers will act in the best interests of shareholders. This means that the investors will offer high prices for companies with a good corporate governance system, because the investment in such companies will be profitable (e.g., Beiner, et al., 2006; La Porta, et al., 2002).

For instance, adding more independent non-executive directors to the board is considered a signal to investors and markets that the company will improve its corporate governance to meet the expectations of investors. Also, the disclosure of such an event is likely to increase the share price, due to the demand for shares by investors in the market, and to reduce information asymmetry (Black, et al., 2006b; Black, et al., 2006c). Consequently, an increase in share prices is supposed to reduce the cost of outside equity (Botosan, 1997).

## 2.3. Stewardship Theory

Stewardship theory assumes that managers are fundamentally trustworthy people and therefore they are good managers of investors' resources (Donaldson, 1990, Donaldson and Davis, 1991, Donaldson and Davis, 1994, Nicholson and Kiel, 2007). This suggests that these managers should have full authority to direct the business because they are trustworthy people as assumed by stewardship theory (Letza *et al.*, 2004). In addition, stewardship theory assumes that, because executive directors in the top level generally work for a long time in the firms they manage, so they have more knowledge and expertise than outside directors, and take priority when important decisions are made (Donaldson and Davis, 1991). Another assumption is that better decisions need knowledge and expertise, which executive directors have (Donaldson and Davis, 1994). In addition, stewardship theory assumes that the directors attempt to develop their reputation and human capital in the market, and they have

to be competitive directors in the labour markets; this situation reduces agency costs (Fama, 1980, Fama and Jensen, 1983b).

### 2.4. Resource Dependence Theory

Resource dependence theory suggests that the components of corporate governance mechanisms, such as board of directors and its sub-committees, are not enough to ensure effective monitoring of managers. These mechanisms play a crucial role in connecting the company and the needed resources to increase corporate performance (Pfeffer, 1973). However, corporate governance mechanisms have essential sources that companies need. First, the board of directors and especially its independent non-executive directors have experience, expertise, knowledge and skills, which a firm needs (Haniffa and Cooke, 2002). Second, the presence of these directors builds the reputation of the firm and provides the firm with necessary business network (Haniffa and Hudaib, 2006). Third, the directors on the board have their own personal relationships, which they can use to access extra information from business and political elites (Nicholson and Kiel, 2007). Last, the board of directors is regarded as the most important link to outside resources such as creditors, suppliers, customers and institutional investors. Consequently, as Nicholson & Kiel (2007) argue, a strong relationship with outside resources has a positive impact on the corporate performance.

Corporate governance mechanisms aim to mitigate the agency problem and ensure that directors act in the best interests of shareholders (e.g., Jensen and Meckling, 1976, Fama, 1980, Netter *et al.*, 2009). In this regard, the most important component of any corporate governance system is the board of directors (Lipton and Lorsch, 1992, John and Senbet, 1998, Filatotchev and Boyd, 2009). The board's chief task is to monitor the managers and ensure that a firm's obligations to shareholders and others are met. To this end, the board of directors advises and supervises managers, chooses strategy, and ensures the optimal use of resources, and supervise management, all the while being accountable to shareholders for its actions (Demsetz and Lehn, 1985, Brennan, 2006). Given these many duties, and their importance to firm success, it is necessary that the board act effectively and efficiently (Jensen, 1993, Brennan, 2006). Prior studies suggest that there are several characteristics that affect board of director performance, including, for example, the presence of independent directors, size of the board, and directors' experience (e.g., Yermack, 1996, Baranchuk and Dybvig, 2009).

## 3. Characteristics of the Board of Directors

The board of directors is the most important part of the corporate governance system and its main role is to ensure that managers act in the best interests of shareholders (Fama and Jensen, 1983b, Gillan, 2006). The vast majority of empirical corporate governance studies conclude that corporate governance mechanisms have an impact on corporate performance but that the opposite is not true (See for example, Vafeas and Theodorou, 1998, Weir *et al.*, 2002, Dahya and McConnell, 2007, Dahya *et al.*, 2009). That is, the relationship between corporate governance and corporate performance is a one-way street: corporate governance affects corporate performance but corporate performance does not simultaneously affect corporate governance. However, it is argued that there are two channels through which *past* corporate performance can explicitly affect *current* corporate governance mechanisms (Wintoki *et al.*, 2012). First, Hermalin and Weisbach (1998) argue that the board's independence is the result of a bargaining process between it and the CEO. The CEO's bargaining power is based in his or her perceived ability relative to possible successors. Wintoki *et al.* (2012)suggest that this process of bargaining has two important implications: first, the board's independence will be negative related to the ability of the firm's managers; second, the board's structure will be associated with past corporate performance.

The second channel through which past corporate performance may affect the current corporate governance has to do with the firm's characteristics; that is, board structure is determined by characteristics of the firm (Raheja, 2005), and these characteristics are affected by past corporate performance. Therefore, the board's structure is related to past corporate performance through the impact of corporate performance on firm characteristics.

To date, only a few studies of U.K. corporate governance have used panel data to examine the relationship between corporate governance and corporate performance (Short and Keasey, 1999, Ozkan and Ozkan, 2004, Guest, 2008, Guest, 2009, McKnight and Weir, 2009). Furthermore, unlike this study, none of the above-cited studies use the most up-to-date and comprehensive data; indeed, the data used in the majority of these other studies is current only up to 2002. which Thus, this paper has an advantage over existing studies on corporate governance in the United Kingdom.

The majority of existing empirical studies on corporate governance model corporate performance as a function of corporate governance mechanisms. These empirical studies often face several serious methodological problems related to endogeneity (Guest, 2009, Wintoki *et al.*, 2012). One such is the presence of unobserved heterogeneity, which occurs when corporate performance and a specific corporate governance mechanism are jointly determined by an observed firm-specific variable. This problem can be solved by using a fixed effect regression model. Second, a simultaneous endogeneity problem arises when a specific corporate governance variable and corporate performance may be simultaneously determined. Also, a dynamic endogeneity problem may occur as a result of a specific corporate governance variable that is determined by the past corporate performance. A number of studies attempt to address this problem by employing an instrumental variable (See for example, Eisenberg *et al.*, 1998, Adams and Mehran, 2005, Bennedsen *et al.*, 2008). However, although employing instrumental variable regressions can possibly mitigate endogeneity, the method requires a strict definition for instrumental variables, which is difficult in practice since it is not easy to find an instrumental variable that is not affected by any of the firm's characteristics (Wintoki *et al.*, 2012).

Therefore, it can be argued that examining the relationship between corporate governance mechanisms and corporate performance by employing fixed effects models or instrumental variable regressions can lead to biased findings. To mitigate the endogeneity problem, Wintoki *et al.* (2012) suggest that the GMM estimator is appropriate for examining the relationship between corporate governance and corporate performance. However, Wintoki *et al.* (2012) do not include other corporate governance mechanisms that, empirically, have an impact on corporate performance, such as director ownership and presence of board subcommittees. This study fills this gap in the literature by examining an 11-year period of time, from 1999 to 2009, using GMM to discover how corporate performance is influenced by corporate governance mechanisms.

The present study extends the work of Wintoki *et al.* (2012) by adding two more board characteristics: shareholdings by directors on the board and the presence of board subcommittees. Specifically, it employs the generalised method of moments to examine the relationship between the characteristics of the board of directors and corporate performance, taking into account the dynamic nature of this relationship.

## 3.1. Nonexecutive Directors on the Board

Agency theory suggests that the presence of nonexecutive directors on the board is a crucial element in ensuring that the managers will act in the best interests of shareholders. The general expectation is that nonexecutive directors, being independent and having the expertise to carry out their function, will be able to monitor executive directors (Fama and Jensen, 1983b). It is also suggested that the knowledge and experience in monitoring services of nonexecutive directors improves corporate performance (Fama, 1980, Fama and Jensen, 1983b). In addition, resource dependency theory indicates that the presence of nonexecutive directors might lead to increased profitability and, as a consequence, firm value, because these directors can make expert suggestions for future investment and strategy and can also network the firm with other firms, investors, and fund sources.

However, others argue that executive directors are in a better position to monitor managers than are nonexecutive directors, since they have more information and knowledge about the firm's daily operations (Baysinger and Hoskisson, 1990). This hands-on involvement enables them to make appropriate decisions and deal with problems in an effective and timely manner. In addition, nonexecutive directors usually serve on a part-time basis, which minimizes the extent of their monitoring and limits their awareness information necessary for decision making (Bozec, 2005). Therefore, the presence of nonexecutive directors on the board could decrease the firm's profitability and negatively affect corporate performance.

Empirical evidence on the impact of nonexecutive directors on the board is inconsistent. Using 10- year lags of the variables for U.S. firms, Baysinger and Butler (1985) report that the presence of nonexecutive directors on the board results in better corporate performance. Coughlan and Schmidt (1985) and Hermalin and Weisbach (1988) provide empirical evidence that nonexecutive directors have the ability to effectively monitor and act as disciplining mechanisms for managers. Weisbach (1988) documents that nonexecutive directors play a crucial role in dismissing poor directors and improving corporate performance. Other empirical support comes from event studies. Rosenstein and Wyatt (1997) and Shivdasani and Yermack (1999) find that announcing the appointment of nonexecutive directors increases a firm's value. Furthermore, in cross-country research, Dahya *et al.* (2008) report that there is a significant positive relationship between the presence of nonexecutive directors and a firm's value, especially in countries where legal protection for shareholders is weak.

In contrast, a number of studies find a negative relationship between the presence of nonexecutive directors and corporate performance (For example, Agrawal and Knoeber, 1996, Yermack, 1996, Laing and Weir, 1999). More recent empirical evidence also shows that the presence of nonexecutive directors on a board has a negative impact on profitability and productivity (Bozec, 2005). Based on the same data set, both Baysinger and Hoskisson (1990) and Hermalin and Weisbach (1991) provide empirical evidence that there is no relationship between the structure of a board of directors and corporate performance. Barnhart and Rosenstein (1998)find a weak curvilinear relationship between the percentage of nonexecutive directors on the board and corporate performance.

One possible explanation for the inconsistent empirical findings discussed above is that the findings are affected by endogeneity (Hermalin and Weisbach, 2003). Another reason might be the substitution effect of other variables, such as percentage of executive directors, director ownership, leverage, takeover, dominant shareholders, and the measure of corporate performance (Walsh and Seward, 1990, Agrawal and Knoeber, 1996, Bozec and Breton, 2003, Bozec *et al.*, 2010). Finally, the mixed results could be the result of the dynamic relationship between the board of directors and corporate performance (Hermalin and Weisbach, 2003, Hillier and McColgan, 2006, Wintoki *et al.*, 2012).

Based on the suggestions of agency theory that the presence of nonexecutive directors makes the board more effective at monitoring managers, and in light of the conventional wisdom as to the advantages of appointing nonexecutive directors (NEDs) to the board, this study examines the following hypothesis:

*Hypothesis 1: The percentage of NEDs on the board has a significant positive impact on corporate performance.*

## 3.2. Duality

Agency theory suggests that a board of directors dominated by executive directors cannot be monitored (Fama and Jensen, 1983b). Such domination of executive directors can occur, for example, when one individual is appointed as both the CEO and board chairman, a phenomenon known as 'duality'. Duality can result in entrenchment of the CEO since, as chairman, the CEO has the ability to change the board's plans and facilitate access to necessary information. Thus, combining the roles of CEO and chairman not only results in entrenchment of the CEO but also limits the board's monitoring ability. Thus, duality is expected to have a negative impact on corporate

performance. To ensure board independence, it is recommended that the functions of the CEO and chairman are split. Appointing different individuals to the positions of CEO and board chairman draws a clear boundary between the monitoring function of the nonexecutive directors and the operating function of the executive directors (Fama and Jensen, 1983b).

On the other hand, however, duality could improve corporate performance since it provides the firm with a CEO and chairman who has the knowledge and experience to make better decisions in a timely way. To date, there is no empirical evidence in strong support of either theory of duality. Using a sample of 192 U.S. firms, Boyd (1995) suggests that duality has a positive impact on corporate performance. In contrast, Dalton *et al.* (1998),for the United States, and Laing and Weir (1999), for the United Kingdom, report that duality has no significant impact on corporate performance.

In light of the agency theory perspective as to the advantages of combining the roles of CEO and chairman and the U.K. corporate governance recommendation that the roles should be split, this study investigates the following hypothesis:

*Hypothesis 2: There is a negative relationship between duality and corporate performance.*

## 3.3. Board Size

The size of the board of directors can affect performance in ways involving communication and the process of decision making (Lipton and Lorsch, 1992, Jensen, 1993). Lipton and Lorsch (1992) argue that a large number of directors can make the board dysfunctional as large boards of directors rarely review the policies of managers or compare corporate performance with other firms. The authors suggest that a small board of directors can function more effectively than a large one. Jensen (1993) suggests that the optimal board size is seven or eight directors, as beyond that point the board can be costly and less than effective. Agency theory suggests that a large board of directors becomes a symbolic mechanism and part of management itself (Hermalin and Weisbach, 2003). Thus, since a large board of directors may not be effective in carrying out its monitoring role, having a large board could negatively affect performance.

Yermack (1996) reports a significant negative relationship between board size and Tobin's Q as a proxy of corporate performance. This conclusion is supported by Eisenberg *et al.* (1998), who find the same relationship for Finnish firms. However, using 1,650 U.K. quoted companies, Faccio and Lasfer (1999) provide evidence that firms with boards larger than the median size have higher corporate performance. Nevertheless, Hermalin and Weisbach (2003) indicate that board size seems to be decreasing over time, suggesting that firms and markets recognise the advantage of smaller board size when it comes to fulfilling responsibilities and improving firm value.

The Combined Code on Corporate Governance sets out general principles about the size of the board of directors without specifying any exact number of directors for a board. Section A.3 states: 'The board should include a balance of executive and non-executive directors (and in particular independent non-executive directors) such that no individual or small group of individuals can dominate the board's decision taking'. The supporting principles for Section A.3 add: 'The board should not be so large as to be unwieldy. The board should be of sufficient size that the balance of skills and experience is appropriate for the requirements of the business and that changes to the board's composition can be managed without undue disruption'. These principles suggest that despite its consideration of the effect of board size on corporate performance, board size is discretionary under the Code. A possible interpretation for not setting an exact number of directors on the board is that every firm functions differently, especially across industrial sectors (MacNeil and Xiao, 2006).

Based on the above discussion, this study examines the following hypothesis:

*Hypothesis 3: There is a positive relationship between board size and corporate performance.*

## 3.4 Director Ownership

Director ownership is a mechanism that may align the interests of managers with the best interests of shareholders. Jensen and Meckling (1976) suggests that if directors' ownership in equity falls, their claim on the outcomes falls, leading them to appropriate larger amounts of the firm's resources in the form of perquisites. Sappington (1991) indicates that it is important to motivate managers in a fashion that will align their interests with shareholders and maximise the firm's value. That is, managers should be motivated to work effectively and efficiently so as to increase the surplus (Jensen and Meckling, 1976).

Jensen and Meckling (1976) and Jensen (1993) suggest that director ownership can be a mechanism for aligning the interests of managers with those of shareholders. However, it has been suggested that managers with a considerable stake in a firm can have a negative impact on corporate performance (Jensen and Meckling, 1976, Fama and Jensen, 1983a). This view is supported by Denis *et al.* (1997), and Stulz (1988) finds an inverse relation between top management turnover and director ownership. This lack of discipline provides evidence of a deficiency in incentives for managers to maximise shareholder value at this level of ownership. This implies that larger director ownership can lead to the entrenchment of managers, allowing them to misuse the firm's resources and, as a consequence, decrease corporate performance (Harris and Raviv, 1988, Morck *et al.*, 1988,Stulz, 1988).

Corporate governance studies are ambiguous regarding the relationship between director ownership and corporate performance. Using a cross-section of 371 U.S. firms, Morck *et al.* (1988)report that director ownership positively affects Tobin's Q when it amounts to 5 percent, has a negative affect for the range of ownership between 5 and 25 percent, and then is positive again beyond 25 percent. This result is supported by Short and Keasey (1999), who find the same trend for U.K. listed firms using return on equity as a measure of corporate performance. Hermalin and Weisbach (1988)examine CEO ownership and Tobin's Q and find that Tobin's Q increases if the CEO's stake is between 0 and 1 percent, declines when the stake is between 1 and 5 percent, increases again in a range between 5 and 20 percent, and

than again declines when the CEO's stake is more than 25 percent.

McConnell and Servaes (1995)find that the relationship between Tobin's Q as a measure of corporate performance and ownership by executive directors is positive for an ownership range between 40 and 50 percent, then negative. More recent empirical evidence for U.K. firms shows that the impact of director ownership on performance has more than two turning points(Davies *et al.*, 2005, Florackis *et al.*, 2009). In contrast, a number of studies report no systematic relationship between executive ownership and corporate performance (Loderer and Martin, 1997, Himmelberg *et al.*, 1999, Demsetz and Villalonga, 2001). Using OLS and simultaneous regression models, Agrawal and Knoeber (1996) report no relationship between director ownership and Tobin's Q. In addition, if the endogeneity is ignored, director ownership has no impact on performance (Morck *et al.*, 1988); even after considering ownership as endogenous, director ownership shows no impact on performance (Demsetz and Lehn, 1985). However, using lagged Tobin's Q as an explanatory variable, Weir *et al.* (2002) indicate a positive relationship between CEO ownership and performance.

Following previous studies, this study defines director ownership as the percentage of shares hold by both executive and nonexecutive directors (See for example, Morck *et al.*, 1988, McConnell and Servaes, 1990, Short and Keasey, 1999, Holderness, 2009). Theoretically, director ownership has been suggested as a mechanism to mitigate agency problems (Stulz, 1988). Therefore, this study examines the following hypothesis:

*Hypothesis 4: There is a positive relationship between director ownership and corporate performance.*

### 3.5. Presence of Board Subcommittees

Prior literature suggests that board subcommittees play a role in making the board of directors more effective and efficient (Harrison, 1987, Jiraporn *et al.*, 2009, Laux and Laux, 2009). The main tasks of these committees involve ensuring that qualified directors are nominated, daily operations are appropriately audited, and proper remuneration is correctly rewarded (See for example, Fama and Jensen, 1983b, Chhaochharia and Grinstein, 2009, Jiraporn *et al.*, 2009). Many corporate governance codes recommend establishing board subcommittees (e.g., the 1999 U.K. Cadbury Report; the 1999 U.S. Blue Ribbon Committee). Indeed, the presence of board subcommittees has increased dramatically over the last few decades.

The empirical evidence about the impact of board subcommittees on corporate performance is mixed. On one hand, it is suggested that board subcommittees can play a crucial role in improving corporate performance and increasing profitability (e.g, Harrison, 1987, Wild, 1994, Sun and Cahan, 2009) mostly because board subcommittees usually include independent nonexecutive directors who have more expertise and are in a better position to protect small shareholders' interests (e.g, Klein, 1998, Vafeas, 1999b). Further, since board subcommittees are relatively smaller than the actual board, they are able to meet more frequently and make decisions on a more timely basis (Karamanou and Vafeas, 2005). In addition, board subcommittees are specialised in specific tasks that enhance performance. For example, audit committees enhance the financial reporting system and internal control system, while nomination committees nominate directors who have the expertise and knowledge needed to improve performance.

On the other hand, however, a number of empirical studies suggest that the presence of a board subcommittee can have a negative impact on corporate performance for several reasons. First, the establishment of board subcommittees is accompanied by extra costs such as expenses and remuneration for the directors on these committees (Vafeas, 1999b). Second, board subcommittees may impose excessive monitoring on executive directors, which can have a dampening effect on their initiatives for improving the firm (Goodstein *et al.*, 1994, Conger *et al.*, 1998, Vafeas, 1999b, Vafeas, 1999a). Third, board subcommittees could end up repeating the tasks of the board itself, thus causing extra expense for the firm as a whole. Finally, having subcommittee directors with different expertise and knowledge than that possessed by directors on the main board and/or other other subcommittees could generate inter-board conflicts.

The Combined Code on Corporate Governance, version dated July 2003, adopted the Turnbull Guidance regarding internal control, the Smith Guidance regarding audit committees, and recommendations of the Higgs Report (Higgs, 2003) regarding nonexecutive directors. The Combined Code is regularly updated but, to date, no significant changes have been made to it regarding board subcommittees. The Code requires all U.K. listed firms to establish nomination, remuneration, and audit committees, all of which should be chaired by independent nonexecutive directors. The Code requires U.K. listed firms to establish a remuneration committee of at least three independent nonexecutive directors; for the nomination committee, the Code specifies that more than half should be independent NEDs. The Code requires audit committees to have at least three independent NEDs, one of whom should have recent and relevant financial experience. These recommendations suggest that the Combined Code on Corporate Governance assumes that the formation of board subcommittees will have a positive impact on corporate performance.

Given the recommendations of the Combined Code on Corporate Governance and the general expectations from the establishment of board subcommittees, this study examines the following hypothesis:

*Hypothesis 5: There is a positive relationship between the presence of board subcommittees and corporate performance.*

## 4. Data

This study uses data on the corporate governance and financial characteristics of a sample of U.K. firms listed in the FTSE All-Share Index over the period 1999 to 2009. The sample includes any company that was part of the FTSE All-Share Index during that period. Both listed and de-listed companies are included in the sample of U.K. firms listed on the London Stock Exchange (LSE) from the beginning of 1999. Initially, the sample was comprised of 1,513 companies for any relevant year for which a firm had the required data. Firms were dropped from the

sample when any of the independent variables required for the analysis were missing. Since the data were collected from different sources, the sample includes any firm that has available data in both databases, the BoardEx Database and Datastream Database. This selection process reduced the sample to 648 companies. Also, 199 firms from the financial industry, which accounts for about 31 percent of the entire population, were excluded from the sample because financial firms are heavily regulated, which may differently affect their corporate governance systems and corporate performance compared with other sectors (Yermack, 1996, Weir *et al.*, 2002, Cheng, 2008). Therefore, the final sample includes 435 firms and 3,875 firm-year observations over the 11-year period.

Table 1 reports mean, median, and standard deviation of board variables over the period from 1999 to 2009. During this period, the average percentage of nonexecutive directors on a board increased from 51 percent in 1999 to 61 percent in 2009. Interestingly, this increase is not accompanied by an increase in the average of board size, suggesting that there is a trend for boards of directors to have more nonexecutive directors than executive directors. In addition, duality increased dramatically from 11 percent in 1999 to 3 percent in 2009, suggesting that U.K. firms tend to comply with corporate governance regulations. Director ownership fluctuated over the period under study: it was 8 percent in 1999, decreased to 6 percent in 2002, increased again to reach its highest level of 9 percent in 2006, and finally dropped to 5 percent in 2009. Finally, the presence of board subcommittees is common among U.K. listed firms. The only noticeable increase is in the establishment of nomination committees, which increased from 76 percent in 1999 to 93 percent in 2009.

**Table 1. Summary of Statistics of Board Characteristics**

The table contains the sample characteristics of the boards used in the study: percentage of nonexecutive directors on the board (NED), duality (DUAL), board size (BSIZE), director ownership (MOWNER), presence of board subcommittees, audit committees (AC), remuneration committees (RC), and nomination committees (NC).

| | Mean (Median) [Standard Deviation] of Board Characteristics | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| *NED* | 0.51 | 0.51 | 0.53 | 0.53 | 0.55 | 0.56 | 0.57 | 0.58 | 0.60 | 0.60 | 0.61 |
| | (0.50) | (0.50) | (0.50) | (0.50) | (0.56) | (0.57) | (0.57) | (0.60) | (0.60) | (0.60) | (0.60) |
| | [0.14] | [0.13] | [0.13] | [0.13] | [0.13] | [0.13] | [0.13] | [0.12] | [0.12] | [0.12] | [0.12] |
| *DUAL* | 0.11 | 0.09 | 0.09 | 0.07 | 0.06 | 0.07 | 0.06 | 0.05 | 0.03 | 0.04 | 0.03 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| | [0.31] | [0.29] | [0.28] | [0.26] | [0.23] | [0.25] | [0.25] | [0.22] | [0.17] | [0.19] | [0.18] |
| *BSIZE* | 8.71 | 8.49 | 8.36 | 8.26 | 8.17 | 8.11 | 7.98 | 7.97 | 7.88 | 8.01 | 7.96 |
| | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) | (8.00) |
| | [2.84] | [2.69] | [2.73] | [2.61] | [2.55] | [2.60] | [2.63] | [2.59] | [2.43] | [2.64] | [2.70] |
| *MOWNER* | 0.08 | 0.08 | 0.07 | 0.06 | 0.07 | 0.07 | 0.08 | 0.09 | 0.08 | 0.05 | 0.05 |
| | (0.00) | (0.01) | (0.00) | (0.00) | (0.00) | (0.01) | (0.01) | (0.01) | (0.01) | (0.00) | (0.00) |
| | [0.17] | [0.17] | [0.17] | [0.15] | [0.16] | [0.17] | [0.16] | [0.18] | [0.16] | [0.13] | [0.14] |
| *AC* | 0.97 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 | 0.98 | 0.99 | 0.99 | 1.00 | 1.00 |
| | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) |
| | [0.16] | [0.12] | [0.11] | [0.11] | [0.11] | [0.10] | [0.13] | [0.11] | [0.11] | [0.07] | [0.05] |
| *RC* | 0.95 | 0.96 | 0.97 | 0.97 | 0.98 | 0.98 | 0.97 | 0.98 | 0.98 | 0.99 | 0.99 |
| | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) |
| | [0.22] | [0.19] | [0.18] | [0.16] | [0.13] | [0.14] | [0.16] | [0.15] | [0.15] | [0.11] | [0.10] |
| *NC* | 0.76 | 0.73 | 0.76 | 0.79 | 0.84 | 0.89 | 0.88 | 0.88 | 0.89 | 0.91 | 0.93 |
| | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) | (1.00) |
| | [0.43] | [0.45] | [0.43] | [0.41] | [0.37] | [0.31] | [0.32] | [0.32] | [0.31] | [0.29] | [0.25] |

# 5. Results

## 5.1. The Needed Lags for Dynamic Panel GMM Estimator

It has been suggested that one lag is sufficient to capture the influences of the past on the current data (Glen *et al.*, 2001, Gschwandtner, 2005,Wintoki *et al.*, 2012). To discover whether this is indeed the case, this study follows Wintoki *et al.* (2012)and estimates a regression of current corporate performance on four lags, including other control variables; any lag that is significant with both measures of corporate performance will be selected. To this end, the following modelis employed:

$$CP_{it} = \alpha_1 + \sum_{p=1}^{p=4} k_p CP_{it-p} + kControl.v_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Where

$CP_{it}$ represents corporate performance measured by Tobin's Q *(TQ)*, which is calculated as the total assets minus book value of equity plus market value of equity, all divided by total assets.

$Control.v_{it}$ represents the following control variables:

Sales growth (*SALESG*)—the ratio of current year's sales minus previous year's sales, all divided by previous year's sales.

Capital expenditure (*CAPITE*)—the ratio of total capital expenditure to total assets.

Firm size (*FSIZE*)—the natural logarithm of the book value of total assets.

Leverage (*LEV*)—the ratio of total debt to total assets.

Research and development (*R&D*)—the ratio of R&D expenditure to total assets.

Industry dummy is a dummy variable for each of nine industry sectors: oil & gas (*IN0*), basic materials (*IN1*), …technology (*IN9*).

Year dummy is a dummy variable for each one of the 11 years from 1999–2009. 1999 (*Y1*), 2000 (*Y2*) … 2009 (*Y11*).

Table 2 shows the results of the dynamic panel GMM estimator using TQ as a measure of corporate performance. Results indicate that the use of one lag is sufficient to examine the dynamic nature of the relationship between corporate governance and corporate performance. As can be seen from Table 2, the one lag is statistically significant at 1 percent, whereas the other lags are not significant.

Furthermore, there is a significant relationship between all control variables and TQ, but sales growth has no significant relation with Tobin's Q. Finally, R-square is 86 percent under Tobin's Q, indicating that Tobin's Q has clear explanatory power in finding the right lag for the GMM estimator.

**Table 2. Dynamic Panel GMM Estimator to Test the Appropriateness of Lags on Corporate Performance**

This tablereports results from the OLS estimation of Model 5.1. All t-statistics are based on robust, firm-clustered standard errors. Year and industry dummies are included in all specifications. *, **, *** indicate that the relationship is significant at 10%, 5%, and 1%, respectively.

| Dependent Variable | TQ |
|---|---|
| *Performance (-1)* | 0.737*** |
| | (0.000) |
| *Performance (-2)* | -0.028 |
| | (0.407) |
| *Performance (-3)* | 0.140 |
| | (0.887) |
| *Performance (-4)* | -0.023 |
| | (0.341) |
| *SALESG* | 0.002 |
| | (0.129) |
| *CAPITE* | -0.037*** |
| | (0.000) |
| *FSIZE* | -0.01*** |
| | (0.000) |
| *LEV* | 0.278*** |
| | (0.000) |
| *R&D* | 0.075*** |
| | (0.000) |
| R-square | 0.86 |

## 5.2. The Relationship Between the Board of Directors and Corporate Performance

This section examines the empirical relationship between the characteristics of the corporate board and corporate performance using the dynamic model adopted from Wintoki *et al.* (2012). Section 5.2.1 presents direct empirical evidence of the dynamic relationship between the board's characteristics and past corporate performance measured by return on assets and Tobin's Q. Section 5.2.2 investigates the relationship between board characteristics and corporate performance using the dynamic panel GMM estimator and compares the results with those from ordinary least square (OLS) and fixed-effects models. Finally, Section 5.2.3 examines the validity of the instrument set that was included in the dynamic GMM estimation in Section 5.2.2.

### 5.2.1. The Relationship Between Past and Present Board Characteristics

It is argued that poor performance leads to having more independent nonexecutive directors on the board (Hermalin and Weisbach, 1998). This argument is supported by Dedman (2000), who finds that firms are likely to comply with the corporate governance recommendations by adding more nonexecutive directors to the board following poor corporate performance. In other words, past corporate performance has an impact on the future structure of corporate governance in any firm. Based on this relationship, and following Wintoki *et al.* (2012), the relationship between board characteristics and control variables are examined by several tests. The first of these checks the current board characteristics and control variables, changes in these variables on the past corporate performance, and historical values of control variables by employing ordinary least square regression OLS.

$$BOD_{i,t} = \alpha + CP_{i,t-1} + \beta BOD_{i,t-1} + \beta Control.V_{i,t-1} + \mu_i + \varepsilon_{it} \quad (2)$$

$$\Delta BOD_{i,t} = \alpha + CP_{i,t-1} + \beta BOD_{i,t-1} + \beta Control.V_{i,t-1} + \mu_i + \varepsilon_{it} \quad (3)$$

Where BOD includes the following board characteristics:

Percentage of nonexecutive directors on the board (*NED*)—the ratio of total independent nonexecutive directors to total number of directors on the board.

Duality (*DUAL*)—a dummy variable equal to 1 if the position of CEO and chairman are filled by the same director; 0 otherwise.

Board size (*BSIZE*)—the total number of directors on the board at the end of the financial year.

Director ownership (*MOWNER*)—the ratio of total number of ordinary shares owned by directors on the board to total number of outstanding ordinary shares.

Presence of audit committees (*AC*)—a dummy variable equal to 1 if a firm has an audit committee; 0 otherwise.

Presence of remuneration committees (*RC*)—a dummy variable equal to 1 if a firm has a remuneration committee; 0 otherwise.

Presence of nomination committees (*NC*)—a dummy variable equal to 1 if a firm has a nomination committee; 0 otherwise.

Control. V represents the control variables sales growth (*SALEG*), capital expenditure (*CAPITE*), firm size (*FSIZE*), leverage (*LEV*), and R&D expenses (*R&D*).

Panel A of Table 3 shows the results from OLS regression of the levels of board characteristics and control variables on past corporate performance from one year back. The first test is conducted by using Tobin's Q as a proxy for corporate performance. Panel B of Table 3 reports the results of OLS regressions of the levels of board characteristics and control variables on Tobin's Q from one year back. The results show that among board characteristics, only board size and the presence of board subcommittees are significantly related to past Tobin's Q, while board independence, duality, and director ownership have no significant impact on past Tobin's Q. This suggests that firms that had high firm value in the past are likely to have a large board of directors and be motivated

to form board subcommittees in the future, as indicated by Fama and Jensen (1983b) and Black and Kim (2011), among others.

Panel B of Table 3 reports the findings of OLS regressions of changes in board characteristics and control variables on the levels of Tobin's Q using one lag. The results show that the number of variables that are significantly related to past corporate performance is less than those reported in Panel A. Clearly, changes in board characteristics are no longer significantly related to past Tobin's Q. This result is inconsistent with the findings of Wintoki *et al.* (2012), who report a significant positive relationship between board size and corporate performance, and a negative relationship between board independence and corporate performance. However, changes in certain control variables, namely, sales growth, capital expenditure, and R&D expenses, show a significant negative response to the past Tobin's Q, while changes in firm size are positive. This suggests that there is still the possibility for control variables to be dynamically endogenous even after using different measures of corporate performance.

**Table 3. Relationship Between Board Characteristics, Control Variables, and Past TQ**

This table reports the results of OLS regressions of current percentage of nonexecutive directors on the board (*NED*), duality (*DUAL*), board size (*BSIZE*), director ownership (*MOWNER*), presence of board subcommittees (*AC, RC, NC*), and current control variables, on past performance and historic values of control variables. Performance is measured by return on assets (*TQ*). The control variables include sales growth (*SALEG*), capital expenditure (*CAPITE*), firm size (*FSIZE*), leverage (*LEV*), and R&D expenditure *(R&D*). Panel A reports the results of the regressions in which the dependent variables are current levels. Panel B reports the results of the regressions in which the dependent variable is the change from *t-1* to t. All *p*-values (in parentheses) are based on robust standard errors. Year and industry dummies are included in all specifications. Items with ***, **, or * are significant at 1%, 5%, and 10%, respectively.

**Panel (A) Dependent variable is level at time *t***

| | NED | DUAL | BSIZE | MOWNER | AC | RC | NC | SALESG | CAPITE | FSIZE | LEV | RD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *TQ(-1)* | -0.015 | 0.021 | 0.694*** | 0.007 | 0.028*** | 0.074*** | 0.101*** | -0.192*** | -0.007** | 0.041*** | -0.015 | -0.012*** |
| | 0.246 | 0.348 | 0.003 | 0.668 | 0.001 | 0.000 | 0.003 | 0.000 | 0.020 | 0.010 | 0.180 | 0.000 |
| *SALESG(-1)* | -0.008 | 0.015 | 0.45*** | 0.017** | -0.003 | -0.006 | -0.049*** | 0.169*** | 0.006*** | 0.039*** | 0.001 | 0.005* |
| | 0.167 | 0.178 | 0.000 | 0.039 | 0.612 | 0.440 | 0.008 | 0.000 | 0.003 | 0.000 | 0.858 | 0.056 |
| *CAPITE(-1)* | -0.121*** | 0.346*** | 1.758** | 0.196*** | -0.008 | 0.066 | -0.319** | 0.159 | 0.733*** | 0.161*** | 0.144*** | -0.021*** |
| | 0.003 | 0.000 | 0.016 | 0.001 | 0.838 | 0.168 | 0.015 | 0.336 | 0.000 | 0.001 | 0.000 | 0.000 |
| *FSIZE(-1)* | 0.053*** | -0.019*** | 2.054*** | -0.045*** | 0.01*** | -0.008* | 0.145*** | -0.048*** | 0.001 | 0.987*** | 0.011*** | -0.001 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.061 | 0.000 | 0.000 | 0.472 | 0.000 | 0.000 | 0.188 |
| *LEV(-1)* | 0.034** | -0.065** | -1.434*** | -0.022 | 0.004 | -0.02 | -0.126*** | 0.123*** | 0.002 | -0.067*** | 0.851*** | 0.008** |
| | 0.044 | 0.024 | 0.000 | 0.315 | 0.739 | 0.263 | 0.006 | 0.009 | 0.762 | 0.000 | 0.000 | 0.045 |
| *R&D(-1)* | 0.238*** | -0.155*** | 4.932*** | -0.111** | 0.015 | -0.044 | -0.146 | 0.327 | -0.043*** | -0.017 | -0.04 | 0.902*** |
| | 0.000 | 0.002 | 0.000 | 0.027 | 0.697 | 0.362 | 0.268 | 0.163 | 0.000 | 0.773 | 0.236 | 0.000 |
| R square | 0.120 | 0.013 | 0.345 | 0.059 | 0.013 | 0.011 | 0.129 | 0.049 | 0.472 | 0.947 | 0.625 | 0.821 |

**Panel (B) Dependent variable is level at time *t-1* to *t***

| | △NED | △DUAL | △BSIZE | △MOWNER | △AC | △RC | △NC | △SALESG | △CAPITE | △FSIZE | △LEV | △RD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *TQ(-1)* | 0.002 | -0.009 | 0.035 | 0.014 | 0.001 | 0.002 | -0.018 | -0.192*** | -0.007** | 0.041*** | -0.015 | -0.012*** |
| | 0.889 | 0.608 | 0.772 | 0.170 | 0.983 | 0.838 | 0.279 | 0.000 | 0.020 | 0.010 | 0.180 | 0.000 |
| *SALESG(-1)* | 0.005 | -0.007 | 0.142*** | -0.001 | -0.005 | -0.006 | 0.019* | -0.832*** | 0.006*** | 0.039*** | 0.001 | 0.005* |
| | 0.250 | 0.305 | 0.002 | 0.936 | 0.375 | 0.293 | 0.091 | 0.000 | 0.003 | 0.000 | 0.858 | 0.056 |
| *CAPITE(-1)* | -0.006 | -0.005 | 0.308 | 0.044 | 0.026 | -0.009 | 0.044 | 0.159 | -0.268*** | 0.161*** | 0.144*** | -0.021*** |
| | 0.830 | 0.951 | 0.485 | 0.185 | 0.361 | 0.836 | 0.512 | 0.336 | 0.000 | 0.001 | 0.000 | 0.000 |
| *FSIZE(-1)* | 0.006*** | 0.002 | -0.03 | 0.001 | -0.003 | -0.001 | -0.011*** | -0.048*** | 0.001 | -0.014*** | 0.011*** | -0.001 |
| | 0.004 | 0.697 | 0.320 | 0.790 | 0.149 | 0.746 | 0.004 | 0.000 | 0.472 | 0.000 | 0.000 | 0.188 |
| *LEV(-1)* | -0.016 | 0.025 | -0.168 | -0.003 | -0.008 | -0.013 | -0.001 | 0.123*** | 0.002 | -0.067*** | -0.15*** | 0.008** |
| | 0.147 | 0.289 | 0.320 | 0.824 | 0.330 | 0.335 | 0.962 | 0.009 | 0.762 | 0.000 | 0.000 | 0.045 |
| *R&D(-1)* | 0.011 | 0.018 | -0.348 | 0.031 | -0.01 | -0.005 | -0.02 | 0.327 | -0.043*** | -0.017 | -0.04 | -0.099*** |
| | 0.626 | 0.643 | 0.238 | 0.435 | 0.716 | 0.881 | 0.718 | 0.163 | 0.000 | 0.773 | 0.236 | 0.000 |
| R square | 0.003 | 0.001 | 0.001 | 0.002 | 0.003 | 0.002 | 0.007 | 0.014 | 0.040 | 0.016 | 0.037 | 0.007 |

The second test to examine the exogeneity of corporate governance variables and control variables is conducted as suggested by Wooldridge (2002) and Wintoki *et al.* (2012) by estimating the following fixed-effects model:

$$CP_{i,t} = \alpha + \beta BOD_{i,t} + \beta Control.V_{i,t} + BOD_{i,t+1} + Control.V_{i,t+1} + \mu_i + \varepsilon_{it} \quad (4)$$

In light of the null hypothesis of strict exogeneity, Ω = 0, which means that the future values of corporate governance and control variables are not associated with the current values of corporate performance. Table 4 shows the results of Equation (4) with different subsets of the board characteristics and control variables using TQ as a measure of corporate performance. In each column of Table 4 the coefficient estimates for the future values of board characteristics ($NED_{t+1}$, $DUAL_{t+1}$, $BSIZE_{t+1}$, $MOWNER_{t+1}$, $AC_{t+1}$, $RC_{t+1}$, $NC_{t+1}$) are insignificantly different from zero. This insignificant relationship indicates that board characteristics cannot be considered as strictly exogenous and do not respond to Tobin's Q, which contradicts the results of the first test of exogeneity. In addition, the coefficient estimates on the future values of only one control variable ($CAPITE_{t+1}$) are significantly different from zero, indicating that this variable adjusts to corporate performance measured by Tobin's Q. However, this result is still inconsistent with the findings of Table 3, which show a significant relationship between past values of Tobin's Q and current values of control variables.

In conclusion, the results reported in this section suggest that board characteristics and control variables cannot be considered strictly exogenous.

**Table 4. Test of Strict Exogeneity (TQ Corporate Governance Measure)**

This table reports results from the fixed-effects estimation of the model. All *p*-valuesare based on robust standard errors. Year and industry dummies are included in all specifications. *, **, *** indicate that the relationship is significant at 10%, 5%, and 1%, respectively.

| *Dependent Variable (TQ)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| *NED(t)* | -0.04* | -0.053*** | -0.07** | -0.071** | -0.071** | -0.07** | -0.07** | -0.055* | -0.059 |
| | 0.085 | 0.010 | 0.030 | 0.029 | 0.029 | 0.029 | 0.031 | 0.061 | -0.115 |
| *DUAL(t)* | 0.001 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.004 |
| | 0.914 | 0.771 | 0.832 | 0.818 | 0.839 | 0.806 | 0.832 | 0.743 | -0.014 |
| *BSIZE(t)* | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 |
| | 0.377 | 0.385 | 0.213 | 0.344 | 0.345 | 0.335 | 0.343 | 0.211 | -0.005 |
| *MOWNER(t)* | -0.026 | -0.026 | -0.004 | 0.001 | -0.002 | -0.003 | -0.003 | 0.001 | -0.002 |
| | 0.150 | 0.162 | 0.914 | 0.991 | 0.967 | 0.942 | 0.931 | 0.983 | -0.047 |
| *AC(t)* | 0.026 | 0.026 | 0.036 | 0.036 | 0.02 | 0.036 | 0.037 | 0.022 | 0.027 |
| | 0.367 | 0.372 | 0.188 | 0.183 | 0.544 | 0.182 | 0.173 | 0.505 | -0.039 |
| *RC(t)* | 0.005 | 0.004 | -0.011 | -0.011 | -0.011 | -0.018 | -0.011 | -0.013 | -0.013 |
| | 0.823 | 0.831 | 0.570 | 0.569 | 0.580 | 0.320 | 0.565 | 0.461 | -0.045 |
| *NC(t)* | 0.014* | 0.014* | 0.013 | 0.013 | 0.013 | 0.013 | 0.01 | 0.012 | 0.012 |
| | 0.070 | 0.070 | 0.266 | 0.258 | 0.261 | 0.259 | 0.400 | 0.264 | -0.008 |
| *SALESG(t)* | -0.007 | -0.007 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | -0.001 |
| | 0.112 | 0.113 | 0.909 | 0.894 | 0.866 | 0.892 | 0.903 | 0.868 | -0.016 |
| *CAPITE(t)* | 0.035 | 0.035 | 0.093 | 0.093 | 0.094 | 0.092 | 0.092 | 0.093 | 0.042 |
| | 0.485 | 0.484 | 0.211 | 0.207 | 0.202 | 0.211 | 0.212 | 0.209 | -0.085 |
| *FSIZE(t)* | -0.057*** | -0.058*** | -0.121*** | -0.121*** | -0.122*** | -0.121*** | -0.121*** | -0.121*** | -0.146 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.213 |
| *LEV(t)* | 0.934*** | 0.935*** | 0.935*** | 0.935*** | 0.935*** | 0.935*** | 0.935*** | 0.935*** | 0.950 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.884 |
| *R&D(t)* | 0.72*** | 0.719*** | 0.805*** | 0.805*** | 0.807*** | 0.805*** | 0.805*** | 0.808*** | 0.750 |
| | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.304 |
| *NED(t+1)* | -0.026 | | | | | | | -0.034 | -0.035 |
| | 0.268 | | | | | | | 0.238 | -0.089 |
| *DUAL(t+1)* | | -0.005 | | | | | | -0.003 | -0.002 |
| | | 0.693 | | | | | | 0.832 | -0.021 |
| *BSIZE(t+1)* | | | 0.705 | | | | | 0.769 | -0.002 |
| | | | 0.705 | | | | | 0.769 | -0.002 |
| *MOWNER(t+1)* | | | | -0.01 | | | | -0.01 | -0.005 |
| | | | | 0.770 | | | | 0.770 | -0.068 |
| *AC(t+1)* | | | | | 0.052 | | | 0.045 | 0.049 |
| | | | | | 0.268 | | | 0.362 | -0.048 |
| *RC(t+1)* | | | | | | 0.022 | | 0.008 | 0.009 |
| | | | | | | 0.289 | | 0.667 | -0.027 |
| *NC(t+1)* | | | | | | | 0.006 | 0.002 | -0.001 |
| | | | | | | | 0.662 | 0.917 | -0.024 |
| *SALESG(t+1)* | | | | | | | | | -0.027 |
| | | | | | | | | | -0.045 |
| *CAPITE(t+1)* | | | | | | | | | 0.19** |
| | | | | | | | | | 0.034 |
| *FSIZE(t+1)* | | | | | | | | | 0.024 |
| | | | | | | | | | -0.036 |
| *LEV(t+1)* | | | | | | | | | -0.022 |
| | | | | | | | | | -0.083 |
| *R&D(t+1)* | | | | | | | | | 0.134 |
| | | | | | | | | | -0.185 |

### 5.2.2. The Impact of Board of Directors on Current Corporate Performance

This section is aimed at discovering the relationship between characteristics of the board of directors and corporate performance through the use of different regression models. Using different models makes it possible to compare the results of this study with the results of prior corporate governance studies, thus perhaps revealing possible problems in prior studies that have ignored the endogeneity of variables, as discussed above. Following Wintoki *et al.* (2012), the following models will be used:

1. An OLS model
2. A fixed-effects model

$$CP_{it} = \alpha_0 + \beta_1 BOD_{it} + \beta_2 Control.V_{it} + \varepsilon_{it} \quad (5)$$

3. A dynamic OLS model
4. A dynamic fixed-effects model (system GMM)

$$CP_{it} = \alpha_1 + k_1 BOD_{it-1} + k_2 CP_{it-1} + \beta BOD_{it} + \gamma Control.V_{it} + \mu_i + \varepsilon_{it} \quad (6)$$

Based on the results set out in Table 2, one lag of corporate performance is included in the dynamic models since one lag is significant with the proxy of corporate performance. In addition, one-year lags for board characteristics and other control variables are included as instruments. Therefore, two and three lags, respectively, have been used as instruments for all endogenous variables in the GMM estimates, as suggested by Wintoki *et al.* (2012). The main assumption in the GMM regression model is that all variables except industry and year dummies are endogenous. Furthermore, the GMM regression is examined for first-order *AR(1)* and second-order *AR(2)* serial correlation in the first differenced residual, under the null hypothesis of no serial correlation. In addition, as Wintoki *et al.* (2012) suggest, board characteristics and control variables lagged two and three periods are used as instruments in GMM regression.

Table 5 reports the results of Equations (5) and (6) using the TQ as a measure of corporate performance. The static OLS estimate indicates no relationship between percentage of nonexecutive directors on the board and Tobin's Q, whereas the fixed-effects model shows this relationship to be significantly negative. The result of the static OLS estimate is consistent with the findings of Hermalin and Weisbach (1991), while the result of the fixed-effects model is similar to that reported by Yermack (1996) and Bhagat and Black (2002). However, this relationship continues to be significantly negative with the dynamic OLS model, but insignificant with the system GMM model. One clear change that results from switching to the dynamic OLS model is the crucial role lagged Tobin's Q plays in examining the impact of board of directors on Tobin's Q. Note that the R-square increases from 48 percent in the static OLS model to 77 percent in the dynamic OLS model. This indicates that past values of Tobin's Q appear to explain a considerable portion of the variation in the current Tobin's Q.

In addition, the static OLS in Table 5 shows that duality has a significant positive impact on Tobin's Q. This result is consistent with the findings of Weir *et al.* (2002), who indicate a similar relationship for U.K. listed firms over the period 1994 to 1996. However, the fixed-effects model reveals that duality has no impact on corporate performance measured by Tobin's Q. The results continue to show no relationship between duality and corporate performance with dynamic OLS and the system GMM model. Further, static OLS shows that board size is significantly positively related to Tobin's Q, whereas the static fixed-effects model suggests that board size is significantly negatively related to Tobin's Q. The positive relationship between board size and Tobin's Q is consistent with a number of prior studies that used OLS as a main regression in examining the impact of board size (See for example, Bhagat and Black, 2002, Cheng, 2008), but inconsistent with Yermack (1996), who reports that both regressions OLS and fixed-effects models suggest a significant negative relationship between board size and Tobin's Q. However, the use of dynamic models shows that board size has no impact on Tobin's Q, which is also reported by Wintoki *et al.* (2012).

The results suggest that director ownership has no significant impact on Tobin's Q. This suggests that any increase or decrease in share ownership by directors will not increase or decrease corporate performance. This result is in contrast with findings that director ownership plays an important role in increasing corporate performance (See for example, Dedman, 2000, Peasnell *et al.*, 2003, Aidong and Kumar, 2004). However, a number of studies suggest that director ownership has a nonlinear relationship with performance (See for example, Griffith, 1999, Short and Keasey, 1999, McConnell *et al.*, 2005). Finally, the results of the static OLS and fixed-effects models in Table 5 indicate that the establishment of audit and remuneration committees has no impact on Tobin's Q, whereas the presence of nomination committees is significantly positively related to corporate performance. This result is partly consistent with Vafeas and Theodorou (1998), who indicate that the establishment of board subcommittees is significantly positively related to Tobin's Q. However, moving from static models to dynamic models shows that there is no relationship between the presence of board subcommittees and Tobin's Q. This suggests that complying with the corporate governance regulations does not lead to an improvement in corporate performance, although it could improve internal control systems.

It is worth noting that the differences in the sign of the coefficients of board characteristics and other corporate governance variables in static and dynamic models may be interpreted as differences in their impacts, both advantages and disadvantages. For instance, since ROA is a historical measure of corporate performance, it cannot represent the present variations in the business environment. On the other hand, Tobin's Q is considered a market measure that has the ability to predict improvement in future performance that may be explained by existing changes in the business environment. Tobin's Q also supports the empirical evidence of prior studies finding that directors, who mostly depend on ROA as a performance measure, and shareholders, who use Tobin's Q to evaluate performance, assess corporate performance differently (Black *et al.*, 2006, Haniffa and Hudaib, 2006 in the UK, Bebchuk *et al.*, 2009).

Table 5 also shows the results of specification tests, the *AR*(2) second-order serial correlation tests and the Hansen

*J* test of over-identifying restrictions. The *AR*(2) test shows a *p*-value of 0.124, which indicates that the null hypothesis of no second-order serial correlation can be accepted. The results in Table 5 also report a *J*-statistic with a *p*-value of 0.416 and thus the hypothesis that the instruments are valid can be accepted. Additionally, Table 5 presents the results of a test of the exogeneity of a subset of the study's instruments. As suggested by Wintoki *et al.* (2012), there is an additional exogeneity assumption for the system GMM estimator—that the relationship between endogenous variables and the unobserved effects is constant over the period of time. This assumption can be tested by using a difference-in-Hansen test of exogeneity (Hansen and Singleton, 1982). Table 5 shows a *p*-value of 0.948 for the *J*-statistic generated by the difference-in-Hansen test, meaning that the hypothesis that the additional subset of instruments included in the system GMM estimates is exogenous can be accepted. Overall, Table 5 documents that there is no relationship between board characteristics and corporate performance.

**Table 5. The Impact of Board Characteristics on Current Tobin's Q**

This table represents the results of static and dynamic models using Tobin's Q (TQ) as a measure of corporate performance. Industry and year dummies, *p*-valuesare reported in parentheses. All t-statistics are based on robust, firm-clustered standard errors. ***;**;* represent significance at the 1%, 5%, and 10% level, respectively. AR(1) and AR(2) are tests for first-order and second-order serial correlation in the first differenced residuals under the null of no serial correlation. The Hansen test of over-identification is under the null that all instruments are valid. The difference-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous.

| Dependent Variable (Tobin's Q) | Static Model | | Dynamic Model | |
|---|---|---|---|---|
| | OLS | FE | OLS | GMM |
| *NED* | -0.007 | -0.096*** | -0.022 | -0.057 |
| | 0.779 | 0.000 | 0.144 | 0.311 |
| *DUAL* | 0.024* | 0.006 | -0.001 | -0.002 |
| | 0.054 | 0.562 | 0.961 | 0.932 |
| *BSIZE* | 0.006*** | -0.003** | 0.002 | 0.003 |
| | 0.000 | 0.045 | 0.219 | 0.464 |
| *MOWNER* | 0.012 | -0.009 | 0.002 | -0.061 |
| | 0.543 | 0.599 | 0.886 | 0.228 |
| *AC* | -0.007 | 0.04 | -0.003 | 0.06 |
| | 0.838 | 0.132 | 0.899 | 0.624 |
| *RC* | 0.838 | 0.132 | 0.899 | 0.624 |
| | 0.000 | 0.712 | 0.121 | 0.927 |
| *NC* | 0.019** | 0.016** | -0.004 | -0.002 |
| | 0.044 | 0.032 | 0.577 | 0.947 |
| *SALESG* | -0.039*** | -0.002 | 0.011** | 0.004 |
| | 0.000 | 0.777 | 0.034 | 0.738 |
| *CAPITE* | -0.348*** | 0.111** | -0.008 | 0.218 |
| | 0.000 | 0.019 | 0.850 | 0.126 |
| *FSIZE* | -0.004 | -0.12*** | -0.007* | 0.005 |
| | 0.477 | 0.000 | 0.060 | 0.892 |
| *LEV* | 0.873*** | 0.938*** | 0.291*** | 0.857*** |
| | 0.000 | 0.000 | 0.000 | 0.000 |
| *R&D* | 0.119** | 0.759*** | 0.084** | 0.516 |
| | 0.031 | 0.000 | 0.014 | 0.240 |
| *TQ(t-1)* | | | 0.737*** | 0.129*** |
| | | | 0.000 | 0.005 |
| *TQ(t-2)* | | | 0.05*** | 0.075 |
| | | | 0.001 | 0.273 |
| R-square | 0.479 | 0.5586 | 0.766 | |
| *AR(1) test (p-value)* | | | | 0.000 |
| *AR(2) test (p-value)* | | | | 0.124 |
| *Hansen test of over-identification (p-value)* | | | | 0.416 |
| *Diff-in-Hansen tests of exogeneity (p-value)* | | | | 0.948 |

### 5.2.3. The Strength of Instruments

A number of studies suggest that in cases where the endogenous variables have a weak correlation with the instruments, the estimates from an instrumental variable could be biased (Bound *et al.*, 1995, Staiger and Stock, 1997,Stock and Yogo, 2005). However, Wintoki *et al.* (2012) suggest that a standard two-stage least squares (TSLS) be used to evaluate the strength or weakness of instruments. This procedure includes two steps. First, a first-stage regression is run for the endogenous variables on the instruments, after which the F-statistics are tested and the obtained F-statistic is compared with the critical value 10, as suggested by Staiger and Stock (1997) and Wintoki *et al.* (2012). The second step is to calculate a Cragg-Donald statistic from the first step and compare its value with the critical values for instruments developed by Stock and Yogo (2005). Also, to this point, the study has employed one lag; the TSLS permits using two and three lags as instruments in the analysis.

Based on the above discussion, the following models are run under GMM:

$$CP_{it} = \alpha + \beta_1 X_{it} + \varepsilon_{it} \text{Instruments} : \Delta X_{it-2} \quad (7)$$

$$\Delta CP_{it} = \alpha + \beta_1 \Delta X_{it} + \varepsilon_{it} \text{Instruments} : X_{it-3} \quad (8)$$

where X represents board of director characteristics, namely, proportion of nonexecutive directors (*NED*),duality (*DUAL*), board size (*BSIZE*), director ownership (*MOWNER*), presence of board subcommittees (*AC, RC, NC*), and control variables.

Table 6 shows the results of the first-stage regression and Cragg-Donald statistics for system GMM estimates, using TQ as a proxy for corporate performance. *F*-statistics for all the first-stage regressions are significant, which indicates that the instruments have significant explanatory power for the endogenous variables. Further, the Cragg-Donald statistic values for the levels equations and the differenced equations exceed all the critical values listed in Table 5.1 of Stock and Yogo (2005). This implies

that any bias from using the instruments is less than 5 percent of the bias from an OLS regression, with a 5 percent level of significance. In conclusion, the results of the tests for the strength of the instruments of the GMM model document that the findings of the GMM estimates are not affected by weak instruments.

**Table 6. First-Stage Regression and Cragg-Donald Statistics for GMM (TQ Proxy for Corporate Performance)**

F-statistics and $R^2$s of OLS first-stage regressions of levels and first differenced variables on lagged differences and lagged levels, respectively.

| Panel (A) Dependent variable *X* is in levels | | | |
|---|---|---|---|
| | F-Statistic | p-value | R-Square |
| *NED* | 17.290 | 0.000 | 0.079 |
| *DUAL* | 15.810 | 0.000 | 0.072 |
| *BSIZE* | 19.960 | 0.000 | 0.090 |
| *MOWNER* | 16.690 | 0.000 | 0.076 |
| *AC* | 17.110 | 0.000 | 0.078 |
| *RC* | 17.930 | 0.000 | 0.081 |
| *NC* | 18.340 | 0.000 | 0.083 |
| *SALESG* | 17.520 | 0.000 | 0.080 |
| *CAPITE* | 15.790 | 0.000 | 0.072 |
| *FSIZE* | 28.090 | 0.000 | 0.122 |
| *LEV* | 174.630 | 0.000 | 0.463 |
| *R&D* | 16.460 | 0.000 | 0.075 |
| Cragg-Donald statistic 141.183 | | | |
| Panel (B) Dependent variable ( $\Delta X$ ) is in firstdifferences | | | |
| | F-Statistic | p-value | R-Square |
| *NED* | 2.460 | 0.001 | 0.013 |
| *DUAL* | 2.420 | 0.001 | 0.013 |
| *BSIZE* | 2.500 | 0.001 | 0.013 |
| *MOWNER* | 2.380 | 0.001 | 0.012 |
| *AC* | 2.360 | 0.001 | 0.012 |
| *RC* | 2.360 | 0.001 | 0.012 |
| *NC* | 2.370 | 0.001 | 0.012 |
| *SALESG* | 2.920 | 0.000 | 0.015 |
| *CAPITE* | 2.410 | 0.001 | 0.013 |
| *FSIZE* | 3.380 | 0.000 | 0.018 |
| *LEV* | 184.590 | 0.000 | 0.493 |
| *R&D* | 6.960 | 0.000 | 0.035 |
| Cragg-Donald statistic 131.313 | | | |

### 5.2.4 The Impact of the Lagged Board of Directors on Corporate Performance

To this point, the main focus of the analysis has been on how the current structure of board of directors impacts current corporate performance. However, there is a possibility that the current structure of the board of directors has an impact on future corporate performance. In other words, a one-period lagged variable for the structure of board of directors might determine corporate performance. To examine this impact, this study follows Wintoki *et al.* (2012) and estimates the following model:

$$CP_{it} = \alpha_1 + k_1 CP_{it-1} + k_1 CP_{it-2} + \beta BOD_{it-1} + \gamma Control.V_{it-1} + \mu_{it} + \varepsilon_{it} \quad (9)$$

where *CP* represents corporate performance and *BOD* represents characteristics of the board of directors, namely, proportion of nonexecutive directors (*NED*), duality (*DUAL*), board size (*BSIZE*), director ownership (*MOWNER*), presence of board subcommittees (*AC, RC, NC*), and control variables.

Wintoki et al. (2012) state that there are two advantages to using a lagged variable of board of directors on current corporate performance. First, it allows examination of the impact of the board of directors on corporate performance using a different set of assumptions. Second, it allows the researcher to run an alternative GMM regression that does not depend on the instrumental variables used previously. Furthermore, since fixed-effects regressions do not consider the impact of corporate performance on current characteristics of the board of directors, these regressions could be biased. This bias can be corrected if there is no simultaneity between corporate performance and characteristics of the board of directors or control variables. In other words, $E(\varepsilon_{it}|X_{it-1}, Z_{it-1}) = 0$ in Equation (9). This condition means that the bias-corrected fixed-effects regressions may not be applicable when examining the impact of current characteristics of the board of directors on current corporate performance; itcan be applicable to examine lagged characteristics of the board of directors on corporate performance.

Table 7 shows the results of estimating the effect of current corporate performance measured by TQ on lagged board characteristics. Interestingly, results from the system GMM show that there is no relationship between lagged board characteristics and Tobin's Q. Furthermore, the pooled OLS model reports that lagged duality, board size, and presence of remuneration committees are significantly positively related to Tobin's Q. However, the bias-corrected fixed-effects model shows that lagged percentage of nonexecutive directors is the only board characteristic that is significantly related to Tobin's Q.

**Table 7. The Impact of Lagged Board Characteristics on Current Tobin's Q**

All t-statistics are based on robust, firm-clustered standard errors. ***;**;* represent significance at the 1%, 5%, and 10% level, respectively. AR(1) and AR(2) are tests for first-order and second-order serial correlation in the first-differenced residuals under the null of no serial correlation. The Hansen test of over-identification is under the null that all instruments are valid. The difference-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous.

| | Pooled OLS | System GMM | Bias-Corrected Fixed Effects |
|---|---|---|---|
| *NED(t-1)* | -0.015 | 0.030 | -0.11*** |
| | 0.629 | 0.571 | 0.005 |
| *DUAL(t-1)* | 0.027** | 0.024 | 0.016 |
| | 0.046 | 0.430 | 0.331 |
| *BSIZE(t-1)* | 0.006*** | 0.002 | -0.001 |
| | 0.001 | 0.548 | 0.955 |
| *MOWNER(t-1)* | -0.007 | -0.008 | -0.026 |
| | 0.786 | 0.872 | 0.391 |
| *AC(t-1)* | -0.021 | 0.010 | 0.02 |
| | 0.511 | 0.947 | 0.646 |
| *RC(t-1)* | 0.112*** | 0.006 | 0.009 |
| | 0.000 | 0.886 | 0.699 |
| *NC(t-1)* | 0.015 | -0.008 | 0.014 |
| | 0.183 | 0.664 | 0.234 |
| *SALESG(t-1)* | -0.04*** | -0.035** | -0.01 |
| | 0.000 | 0.043 | 0.350 |
| *CAPITE(t-1)* | -0.223*** | -0.111 | 0.144* |
| | 0.000 | 0.366 | 0.088 |
| *FSIZE(t-1)* | 0.009 | 0.009 | -0.051** |
| | 0.257 | 0.795 | 0.025 |
| *LEV(t-1)* | 0.719*** | -0.973*** | 0.46*** |
| | 0.000 | 0.000 | 0.000 |
| *R&D(t-1)* | 0.065 | -0.449 | 0.509*** |
| | 0.574 | 0.260 | 0.005 |
| *R-square* | 0.39 | | 0.20 |
| *AR(1) test (p-value)* | | 0.000 | |
| *AR(2) test (p-value)* | | 0.000 | |
| *Hansen test of over-identification (p-value)* | | 0.001 | |
| *Diff-in-Hansen tests of exogeneity (p-value)* | | 0.454 | |

### 5.2.5. The Determinants of Board Structure in a Dynamic Framework

The analysis so far has mainly focused on discovering how the board of directors impacts corporate performance. The main assumption has been that control variables, which represent a certain number of a firm's characteristics, affect the structure of the board of directors. In other words, it is assumed that exogenous components of these control variables have a minor impact on the board of directors' structure. Although prior corporate governance studies suggest that this is correct (See for example, Boone *et al.*, 2007, Linck *et al.*, 2008, Lehn *et al.*, 2009), these prior studies ignor the main sources of endogeneity in the relationship between board of directors and corporate performance: simultaneity, unobservable heterogeneity, and the possible impact of past corporate governance on control variables (Guest, 2009, Wintoki *et al.*, 2012).

This section examines whether firm characteristics are determinants of the structure of the board of directors using generalized method of moments (GMM) regression. That is, do control variables play a role in forming board of directors' characteristics? The following model is employed:

$$BOD_{it} = \alpha + \sum_{s} k_s BOD_{it-s} + \gamma Control.V_{it} + CP_{t-1} + \mu_i + \varepsilon_{it}, \quad s = 1, \ldots, p \tag{10}$$

Table 8 shows the results and compares the results obtained from the dynamic panel GMM estimator with those obtained from OLS using TQ as a proxy for corporate performance. The GMM results show that, after controlling for simultaneity, time-invariant unobservable heterogeneity, and the possible impact of past board characteristics on current control variables, sales growth, capital expenditure, and firm size are the only determinants of board size (Column 7) and presence of nomination committees (Column 15). The results of the system GMM estimator in Table 8 show that firm size is significantly positively related to board size, suggesting that large firms require a larger board of directors. Further, the significant positive relationship between firm size and

board size indicates that bigger firms today are likely to have larger board size. These results are similar to those obtained from OLS estimates of a static model in recent studies such as those by Boone *et al.* (2007) and Linck *et al.* (2008), and to those obtained from a GMM estimates model by Guest (2009) and Wintoki *et al.* (2012) for the United States. In addition, the presence of nomination committees is significantly negatively related to sales growth and capital expenditure, and positively to firm size. This indicates that firms that have suffered from low sales and large firms are likely to establish nomination committees.

**Table 8. The Determinants of Board Structure (Tobin's Q Measures Corporate Performance)**

The GMM models include one lag of the dependent variable. Year and industry dummies are included in all specifications. All t-statistics are based on robust, firm-clustered standard errors. ***;**;* represent significance at the 1%, 5%, and 10% level, respectively.

| | NED | | DUAL | | BSIZE | | MOWNER | | AC | | RC | | NC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OLS | GMM | OLS | GMM | OLS | GMM | OLS | GMM | OLS | GMM | OLS | GMM | OLS | GMM |
| *SALESG* | -0.015** | -0.005 | 0.024* | -0.008 | 0.205** | -0.163 | 0.027*** | -0.002 | -0.005 | -0.001 | -0.003 | -0.001 | -0.079*** | -0.046** |
| | 0.017 | 0.419 | 0.06 | 0.308 | 0.039 | 0.157 | 0.006 | 0.802 | 0.465 | 0.98 | 0.752 | 0.881 | 0 | 0.015 |
| *CAPITE* | -0.084** | -0.003 | 0.326*** | -0.111 | -0.691 | 0.12 | 0.09 | 0.123 | 0.032 | 0.012 | 0.121** | 0.059 | -0.094 | -0.457* |
| | 0.048 | 0.983 | 0.002 | 0.519 | 0.387 | 0.941 | 0.144 | 0.221 | 0.304 | 0.798 | 0.013 | 0.361 | 0.505 | 0.075 |
| *FSIZE* | 0.047*** | 0.01 | -0.014*** | 0.016 | 2.043*** | 1.864*** | -0.042*** | 0.004 | 0.008*** | 0.003 | -0.012** | -0.009 | 0.141*** | 0.128** |
| | 0.000 | 0.633 | 0.007 | 0.418 | 0.000 | 0.000 | 0.000 | 0.868 | 0.003 | 0.778 | 0.012 | 0.512 | 0.000 | 0.032 |
| *LEV* | 0.011 | -0.03 | -0.07** | 0.05 | -1.168*** | 0.456 | -0.046** | 0.028 | 0.009 | -0.003 | 0.028* | 0.014 | -0.067* | 0.119 |
| | 0.482 | 0.519 | 0.013 | 0.479 | 0.000 | 0.508 | 0.020 | 0.585 | 0.488 | 0.876 | 0.067 | 0.674 | 0.100 | 0.194 |
| *RD* | 0.13*** | 0.119 | -0.183*** | -0.026 | 5.531*** | 0.913 | -0.092* | 0.167 | 0.059 | 0.029 | -0.003 | 0.027 | -0.281* | -0.368 |
| | 0.002 | 0.506 | 0.010 | 0.921 | 0.000 | 0.671 | 0.096 | 0.481 | 0.276 | 0.720 | 0.969 | 0.769 | 0.054 | 0.339 |
| *TQ(t-1)* | 0.009 | 0.007 | 0.021 | 0.025 | 0.554** | 0.144 | 0.014 | 0.005 | 0.023*** | 0.002 | 0.059*** | 0.014 | 0.043 | -0.058 |
| | 0.437 | 0.793 | 0.287 | 0.669 | 0.017 | 0.708 | 0.348 | 0.879 | 0.002 | 0.789 | 0.000 | 0.340 | 0.148 | 0.252 |
| *R-square* | 0.182 | | 0.036 | | 0.382 | | 0.112 | | 0.028 | | 0.037 | | 0.181 | |
| *AR(1) test (p-value)* | | 0.793 | | 0.000 | | 0.000 | | 0.000 | | 0.924 | | 0.011 | | 0.000 |
| *AR(2) test (p-value)* | | 0.005 | | 0.165 | | 0.002 | | 0.192 | | 0.817 | | 0.887 | | 0.081 |
| *Hansen test of over-identification (p-value)* | | 0.001 | | 0.002 | | 0.000 | | 0.003 | | 0.520 | | 0.097 | | 0.006 |
| *Diff-in-Hansen tests of exogeneity (p-value)* | | 0.216 | | 0.999 | | 0.966 | | 0.721 | | 0.999 | | 1.000 | | 0.127 |

# 6. Summary

This paper examines the relationship between characteristics of the board of directors and corporate performance for U.K. listed firms. The board of directors is at the core of corporate governance and plays a crucial role in modern firms. Therefore, exploring this relationship is very important to understanding corporate governance. This paper makes a novel contribution to this pursuit by using GMM as a method for correcting endogeneity problems. To date, the vast majority of corporate governance studies consider two sources of endogeneity. First, unobservable heterogeneity, which occurs when the dependent and control variables are affected by unobservable factors. Second, simultaneity, which occurs when independent and dependent variables are determinants of each other.

However, corporate governance studies often ignore another source of endogeneity that arises from likely dynamic relationships among firms' observable characteristics (Wintoki *et al.*, 2012). This means that current changes in a firm affect the firm's future performance and, as a consequence, affect the firm's future board of directors. This study examines the relationship between board of directors and corporate performance taking into account the possibility that firms' observable characteristics are dynamic. Specifically, this study employs the generalised method of moments estimator (GMM) for a panel dataset covering the period 1999 to 2009 to examine the relationship between board characteristics and corporate performance. This study examines the percentage of nonexecutive directors on the board, duality, board size, director ownership, and the presence of board subcommittees.

The results suggest that board structure is partly determined by past corporate performance, but that there is no relation between characteristics of the board of directors and corporate performance measured by Tobin's Q. The results also indicate that the findings of prior empirical studies that examine the relationship between board of directors and corporate performance may be biased since they do not take dynamics into account.

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