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and corporate performance:
Evidence from the U.K.**

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Abstract

Purpose - The paper examines the relationship between managerial ownership and firm performance for British stock-exchange listed firms. We seek to establish a link between the predictions of agency theory and the corporate control environment by using key governance and disclosure thresholds as determinants of the non-linear relationship between managerial ownership and performance. We also argue that the use of conventional accounting and market-based performance measures can be problematic in estimating managerial efficiency.

Design/methodology/approach - Data is drawn from U.K. listed firms from the FTSE All Share Index. Piecewise regressions are used to test the impact of key regulatory thresholds that potentially affect managerial behaviour in addition to conventional non-linear regressions to identify the shape of the relationship. The in advanced-specified turning points in piecewise linear regressions are based on key disclosure and control thresholds of U.K. Company Law. The Clean Surplus Accounting Rate of Return is used as a performance variable in addition to Tobin's Q and ROE.

Findings - Our findings confirm that key control and disclosure thresholds impact the non-linear relationship between the equity stakes owned by executive directors and the financial performance of U.K. companies. We find that shareholder wealth is maximised when the equity ownership by executives is below 5% of share capital and executives are unprotected against disciplining by shareholders under U.K. Company Law. Shareholdings between 5% and 15% are found to lead to declining performance, whilst equity stakes exceeding the 15% ownership threshold have the effect of enhancing shareholder value by triggering greater disclosure requirements.

Research limitations/implications - The results indicate that the relationship between managerial ownership and corporate governance outcomes might be linked to key regulatory disclosure thresholds and minority shareholders rights of U.K. Company Law.

Originality/value - The findings confirm the importance of testing thresholds based on corporate governance regulation rather than inductively deriving them from the data. We also show that it is desirable to decompose board ownership into executive and non-executive components.

Keywords - Corporate governance, managerial ownership, corporate performance

Paper type - Research paper

1. Introduction

The relationship between managerial ownership and firm performance continues as an important and controversial debate in the corporate governance and literature¹. Economists argue that the ownership structure of firms should be thought as an endogenous outcome and irrelevant in the economic performance process due to market efficiency and the price mechanism (see Demsetz, 1983; Demsetz and Lehn, 1985). The herald of formal agency theories that challenge this view and the emergence of alignment and entrenchment as predominant forces to explain the relationship between managerial ownership and performance have sparked a renewed interest in this area.

Despite these advances in the literature through a collective theoretical framework and new econometric techniques, important aspects of the empirical analysis have gone unnoticed. Most notably, little is known about the underlying determinants that shape the performance-ownership relationship within different institutional settings. In this study we seek to fill this gap in the literature and examine the relationship between managerial ownership and firm performance for listed firms on the London Stock Exchange. We model the relationship with piecewise linear regressions in addition to conventional non-linear regressions. In piecewise regressions we utilise pre-determined inflection points that are based on key regulatory disclosure and governance (control) thresholds of U.K. Company Law and argue that the regulatory framework impacts the performance-ownership relationship.

Section 2 of this paper review the literature and highlights some issues that warrant more careful attention. Section 3 discusses the economic performance variables used in this

¹ The discussion reaches back as far as Berle and Means (1932), who argued that the separation of ownership and control had led to a divergence between the interests of professional managers and outside shareholders.

papers, in particular the drawback of market-based firm performance evaluation. Section 4 develops the hypothesis and section 5 discusses the data and methodology. Section 6 presents the results of the multivariate regression analysis and section 7 draws conclusions.

2. Literature review

The opposing forces of alignment and entrenchment that affect managerial behaviour point toward a non-linear relationship between managerial ownership and firm performance (Morck, Shleifer and Vishny, 1988; Jensen and Warner, 1988). Consistent with this view, McConnell and Servaes (1990), Keasey, Short and Watson (1994) and Chen (2006) report a bell-shaped relationship between managerial ownership and firm performance. McConnell, Servaes and Lins (2008) find that changes in insider ownership and abnormal returns are related in an inverse U-shaped form. Seifert, Gonenc and Wright (2005) find a U-shaped relationship and Faccio and Lasfer (1999) test a cubic specification across a number of performance variables, such as return on assets (ROA), return on equity (ROE) and Tobin's Q (Q), but find only little systematic evidence that managerial ownership affects firm performance. Morck *et al.* (1988), Hermalin and Weisbach (1991), Mudambi and Nicosia (1998), Griffith (1999), Short and Keasey (1999), De Miguel, Pindado and De la Torre (2004), Florackis (2005) and Mura (2007) find a cubic relationship, whereas Davies, Hillier and McColgan (2005) and Florackis, Kostakis and Ozkan (2009) report a quintic form.

Where some studies on the relationship between managerial ownership and firm performance within the U.K. system of governance are comparable, there nonetheless exist variations in the reported impact levels. Short and Keasey (1999) report that equity stakes by the board of directors affect firm value as measured by Q positively when members own below 12.99% or above 41.99% of equity. In firms where managers own 12.99% to 41.99% of equity, they find that performance declines, thus suggesting managerial entrenchment. Mura (2007) finds that the interests of managers and shareholders converge until the board

owns 15.06%, after which entrenchment dominates in the region of 15.06% to 45.43%. When board ownership exceeds 45.43% of share capital, he observes a return to a positive trend of board ownership with Q. Through comparison of the turning points to those of Morck *et al.* (1988), who document a negative influence of management ownership on Q in U.S. firms when the board owns 5% to 25% of equity capital, Short and Keasey (1999) and Mura (2007) conclude that U.K. boards become entrenched at higher ownership levels than their U.S. counterparts. However, their findings are in contrast to those of Davies *et al.* (2005) who identify two maxima points of Q at 7.01% and 51.4% and two minima points at 26% and 75.7% of board ownership and validate their results with piecewise linear regressions.

Faced with these often-conflicting results it is therefore often difficult to derive definitive conclusions concerning the nonmonotonic relationship between managerial ownership and performance for the U.K.. In this paper we attempt to shed further light on this issue and argue that a number of factors might contribute to the wide variety of results in the literature. We draw the attention to four key issues.

First, we assess the relationship between managerial ownership and firm performance with an alternative measure of performance because conventional performance variables to assess managerial efficiency can be problematic. Secondly, we argue that an important aspect of performance-ownership research is that, with the exception of Morck *et al.* (1988), Griffith (1999) and Bhagat and Black (2002) for the U.S. and of Florackis (2005), Mura (2007) and Florackis, Kostakis and Ozkan (2009) for the U.K., most research use the combined shareholdings of the board to test relations between managerial ownership and firm performance. It is therefore often assumed that executive and non-executive directors respond to alignment and entrenchment effects in a similar way, implying that their shareholdings impact corporate performance homogeneously. We argue that this view might be overly restrictive as a number influential papers note that inside and outside board members have

different responsibilities and financial incentives (Fama, 1980; Fama and Jensen, 1983a; Hart, 1995).

Third, we suggest that the common non-normality of the ownership data and the statistical analysis adopted are areas that might require more careful attention. Patterns of board ownership around lower shareholdings are common in performance-ownership research and this distribution of equity ownership can create difficulties in specifying accurate non-linear models with multiple inflection points.

The fourth and most important aspect of this paper is that we investigate a potential link between the general predictions of agency theorists and the institutional setting to explain the relationship between managerial ownership and firm performance. Inflection points in conventional non-linear regressions often arise inductively out of the statistical analysis but these turning points have no specific governance meaning. In this paper we suggest that ownership-performance relationships may be linked to key governance and control thresholds. In particular, we propose that minority shareholder rights and disclosure requirements of U.K. Company Law and the Takeover Code impact the shape of performance-ownership relationships.

3. Economic performance

One important and contentious issue is the measurement of firm performance. Despite frequent use, Tobin's Q (Q) and other market-based performance variables have limitations as proxies for firm performance and managerial efficiency. For instance, although the denominator of Q can be adjusted to reflect variations in financing strategies, it cannot capture whether managers under- or over-invest in the growth of assets (Gugler, Mueller and Yurtoglu, 2004). If a firm retains a large proportion of income then future earnings are expected to be higher because of the extra income generated by accumulation (Walker, 1997).

Q also creates the problem of endogeneity through the link of incentive structures, managerial wealth and performance measured as a function of stock market value (Demsetz and Villalonga, 2001). Research and development costs (R&D) and advertising expenditure (ADV) must also be included as independent variables when Q is used as a performance measure to capture intangible assets that are entwined in the numerator (Morck *et al.*, 1988; Chauvin and Hirschey, 1993; Short and Keasey, 1999).

Furthermore, when research uses market-based performance indicators it is necessary to assume that capital markets efficiently price all relevant information (Börsch-Supan and Köke, 2002). In practice, however, capital markets are semi-efficient and analysts rely primarily on public information through the dissemination of company annual reports or other voluntarily corporate disclosure to draw conclusions on projected internal rates of return. Consequently, market-based performance variables such as Q are driven by expectations about managerial efficiency rather than actual achievement (McFarland, 1988; Demsetz and Villalonga, 2001).

There are also problems with traditional accounting rate of return (ARR) calculations. These performance indicators can be distorted by accounting manipulation, managerial discretion over the recognition of income and the impact of financial leverage (Rees, 1995). For example, managerial discretion in the application of accounting and financial reporting policies can lead to a divergence between reported income and underlying firm economics². This can undermine comparative analysis between individual firms (O'Hanlon and Rees, 1995; McFarland, 1988; Wernerfelt and Montgomery, 1988).

To overcome these limitations of most accounting and market-based performance measures we introduce the clean surplus ARR (CSARR) as an alternative performance ratio.

² For an extensive discussion surrounding the controversy of the use of the IRR v the ARR as measures of firm performance, see Harcourt (1965), Livingstone and Salamon (1970), Stauffer (1971), Fisher and McGowan (1983), Long and Ravenscraft (1983), Fisher (1984), Van Breda (1984), Salamon (1985) and Edwards, Kay and Mayer (1987).

The CSARR is defined as the change in book value of shareholders' equity and reserves in the last financial period, plus dividends and the tax charge for the year, divided by the book value of shareholders' equity and reserves at the end of the prior financial period. The CSARR is derived from the residual income valuation model of Ohlson (1989, 1995) and Feltham and Ohlson (1995). Their framework develops the link between the outputs of accruals accounting and the value of a firm's equity capital.

One aspect that makes the CSARR a more reliable measure to draw conclusions about managerial efficiency is that it takes into account the capital and financing structure of firms that is at the discretion of managers. Firms can be inclined to retain earnings for investments into projects with positive net present value and only partially pay out current or retained earnings in the form of dividends. As such, prosperous and high-growth firms may withhold dividends because internal financing is cheaper than the issuance of new equity capital (Easterbrook, 1984).

Another important aspect of the CSARR is that it overcomes the problem of creative accounting, specifically the use of reserve accounting and variations in the application of other accounting policies that impact conventional ARR calculations. This property of the CSARR is an important benefit insofar as U.K. Generally Accepted Accounting Practice (U.K. GAAP) has traditionally been considered as being more vulnerable to earnings manipulation and less informative than other reporting environments (Smith, 1992; Alford, Jones, Leftwich and Zmijewski., 1993).

4. Hypotheses

According to Jensen and Meckling's (1976) 'convergence-of-interests' or 'alignment-incentive' hypothesis, managers have the tendency to seek pecuniary and non-pecuniary benefits or shirk at the expense of shareholder wealth when their capital bonding is marginal.

Their seminal analysis of the agency relationship between managers and shareholders, in which the distribution of equity ownership between inside and outside investors can influence the value of a firm, posits that firm value and performance uniformly increases with greater managerial ownership. The argument is that managers will divert progressively fewer firm resources to non-value maximising activities when their equity stakes increase as they must bear an increasing fraction of agency costs associated with their expropriation activity.

On the other hand, Fama and Jensen (1983b), Morck *et al.* (1988) and Stulz (1988) note that corporate control markets can be ineffective when a large fraction of equity is owned by managers. They suggest that greater share ownership provides managers with extra voting power and allows them to assume effective control over the firm without being subject to internal monitoring by the board or external control markets. In such situations of ‘entrenchment’ managers can seek the maximisation of their bonus plans and enjoy perquisites at the expense of shareholders, thereby leading to declining corporate performance with greater managerial ownership. The opposing forces of alignment and entrenchment that affect managerial behaviour therefore have the effect that the relationship between managerial ownership and firm performance can be of non-linear form (Morck *et al.*, 1988; Jensen and Warner, 1988).

Hypothesis 1: The forces of alignment and entrenchment that affect managerial behaviour lead to a non-linear relationship between share ownership by the board of directors and economic performance.

We also examine how the equity stakes of executive and non-executive directors influence firm performance individually. According to Fama (1980) and Fama and Jensen (1983), inside (executive) and outside (non-executive) directors perform specialised roles and have

different responsibilities. Executives are responsible for the generation of proposals for resource utilisation and the implementation of strategies that have received board approval. The responsibility of non-executives lies within their role as delegated monitor that are charged on behalf of shareholders to ratify decisions over resource allocation and to monitor the performance of executive management. This separation of duties can be economically efficient and the appointment of non-executives to the board can also reduce the threat of entrenchment when managerial labour markets are weak or managers collude to expropriate benefits once they have gained control over the firm (Fama, 1980).

A split between executive and non-executive directors and their equity stakes is also important from the perspective of U.K. corporate governance guidelines (i.e. Cadbury, 1992; Greenbury, 1995; Hampel, 1998; Smith, 2003; Higgs, 2003). These guidelines have played a major role in enhancing the efficacy of U.K. boards (Filatotchev, Jackson, Gospel and Allcock, 2007). In particular, the Cadbury Report (1992) and Higgs Review (2003) emphasize the distinction between executive and non-executive directors and set out guidelines on appropriate board structure and the financial relationship of executive and non-executive directors within the firm.

It can also be assigned to the Cadbury (1992) and Higgs (2003) recommendations that share ownership by non-executive directors remains generally low, although it has been on a steady increase since the 1990's (Marchica and Mura, 2005; Mura, 2007). Both reports take the view that it can be beneficial to compensate non-executive directors with shares in lieu of cash, but material shareholdings are discouraged and non-executives should not participate in equity-based compensation plans that can affect their independence (Higgs Report, 2003, para. 12.26, p. 57). Thus, it is reasonable to expect that the performance-ownership relationship should not be affected significantly by non-executive shareholdings when these

guidelines are strictly followed. Consistent with this view, Florackis (2005) and Mura (2007) find no evidence that non-executive ownership influences firm performance.

Hypothesis 2: Share ownership by non-executive directors has no significant influence on firm performance as their equity stakes are not substantial in the U.K..

In contrast to ownership by non-executives, shareholdings by executive directors can intuitively be expected to affect firm performance because executives are the second-largest shareholder class in the U.K., although their shareholdings have been on a gradual decline since the 1990's (Marchica and Mura, 2005; Florackis and Ozkan, 2009). Most executive compensation plans, such as share-based incentive schemes, share and option awards, and Long-Term Incentive Plans, are often linked to performance benchmarks, i.e. earnings per share and share price returns (Conyon, Peck, Read and Sadler, 2000). Moreover, the Greenbury Report (1995) encourages executives to build up shareholdings in their firm to align their interest with those of shareholders (para. 6.32, p. 41 & 42). This should generally provide executives with the incentive to maximise firm performance. However, a positive link with performance might be restricted to low and high equity stakes, whereas intermediate ownership can give rise to entrenchment.

Besides compensation plans and the influence of the Greenbury Report (1995) on firm behaviour, there are two other reasons to believe in a positive relationship between firm performance and low levels of executive ownership. The first follows from the Association of British Insurer's (ABI) guidelines on executive remuneration. The ABI recommends that shares held under executive compensation schemes should not exceed 5% of a company's issued ordinary share capital (adjusted for share issuance and cancellation) in any 10 year

rolling period (para. 8.2). When in strict compliance with the ABI guidance it should therefore be unlikely that executive management can accumulate significant share ownership through the vesting of stock-based compensation plans that can give them leeway for entrenchment.

The second reason is that U.K. shareholders can constrain managerial actions that conflict with their interests when executive ownership is low. Sections 376 to 378 (s. 376-378) of the Companies Act 1985 (CA 1985) confer shareholders and managers that own equal or more than 5% of voting share capital with the right to introduce ordinary and special resolutions to the AGM agenda that may stipulate alternations to the articles of association, the replacement of auditors or the removal of directors³. Executive management with less than 5% of voting rights can therefore be unprotected against disciplining since they cannot introduce counter-resolutions to the AGM agenda as director-shareholders when their dismissal is sought. Accordingly the combination of bonus plan incentive and threat of disciplining yields the hypothesis:

Hypothesis 3a (H3a): In firms with share ownership by executive directors below 5% of equity capital, incentive-alignment is predominant and economic performance is positively affected as managers cannot use s. 376-378 of CA 1985 for protection against shareholder and market discipline.

For intermediate ownership by executive management, we argue that managerial entrenchment dominates and firm performance declines. This suggestion is built on the premise that it is unlikely that moderate equity takes arise from the vesting of stock options and other share-based incentive schemes (Davies *et al.*, 2005). Even in cases where firms

³ Transposed into section 338 of Companies Act 2006.

have decided to allocate up to the ABI's maximum of 5% of share capital to compensation plans, executive directors might run out of time before this key ownership threshold is reached. As O'Sullivan (2000) points out, the average tenure of executives of listed U.K. companies is on average six years only.

But there are appealing explanations why executives in the U.K. retain and accumulate additional equity stakes beyond their bonus plans rather than to diversify their personal investment. Significant share ownership gives managers greater scope to guarantee their employment by weakening internal and external governance markets (Manne, 1965; Stulz, 1988; Morck *et al.*, 1988). As pointed out above, a 5% voting stake gives executives control over decisions that must be ratified by shareholders. A 5% shareholding can therefore create situations in which directors can propose counter-resolutions to resolutions introduced by other shareholders when corporate strategies are called into question or to shield themselves from removal of office. Alternatively, executive managers may use intermediate shareholdings to seek the replacement of auditors to evade disputes over accounting and financial reporting policies.

Arguably, some weaknesses of the U.K. corporate governance systems further aggravate this threat of entrenchment. Minority shareholders typically do not attend AGMs and voting is normally done by simple show of hands. Unless a resolution is controversial each shareholder exercises only one vote irrespective of the size of his equity stake (Goergen and Renneboog, 1999). This voting pattern at AGMs can provide directors with intermediate ownership levels with additional power over shareholders and can make it easier to defeat proposal for their replacement or to push through their own resolutions.

Another reason why executives may accumulate moderate equity stakes beyond their compensation plans is that significant share ownership creates better capacity to resist a hostile bid. This can be equally beneficial and detrimental to shareholders. If the interests of

shareholders and executive directors are aligned then managers will leverage up the bid premium (Sudarsanam, 1995). Conversely, insulation from takeover markets can also lead to entrenchment when managers seek permanent employment (Manne, 1965; Stulz 1988). This can encourage executives to act opportunistically and subsequently affect corporate and takeover performance adversely.

We suggest that the relationship between managerial ownership in the region of 5% to 15% of share capital and firm performance is negative. Whilst executive management can use s. 376-378 of CA 1985 for protection against shareholder and market discipline, they are also under no statutory obligation to disclose to their strategic intent to shareholders. The Financial Services Authority (FSA) can only mandate executive management (as a single and coherent investor group acting in concert) to disclose their strategic intention under the Substantial Acquisition Rules 3&5 (SAR 3/5) of the City Code on Takeovers and Mergers 1967 (TC 1967)⁴ to shareholders once their equity stakes equal or exceed 15% of share capital. Executive management may therefore decide to engage in expropriation activities that reduce shareholder wealth when their equity stakes are above 5% and below 15% of share capital on the basis of informational asymmetries. The hypothesis is tested:

Hypothesis 3b (H3b): In firms with share ownership by executive directors between 5% and 15% of equity capital, entrenchment is predominant and economic performance is negatively affected as managers can use s. 376-378 of CA 1985 for protection against shareholder and market discipline, whilst not being subject to the disclosure requirements of SAR 3/5 of TC 1967.

⁴ Revised on 20 May 2006 and 30 March 2009 by the Panel on Takeover and Mergers.

For executive equity stakes above the 15% ownership threshold, we suggest that the relationship with firm performance is positive. There are two inviting factors to suggest a positive link. One is that the incentive of directors to engage in expropriation activities declines as they become owner-managers, given that high investment in a single undertaking implies undiversified risk (Jensen and Meckling, 1976). Consistent with this view, Mura (2007) documents a positive impact of high levels of executive ownership on firm valuation in the U.K. and Morck *et al.* (1988) report similar findings for the U.S..

Signalling the prosperity of the company to the market might also be a factor to be considered. Failure of managers to communicate a credible signal to shareholders under SAR 3/5 of TC 1967 could be seen as an indication for entrenchment and company shares might subsequently be traded at a discount. We test the hypothesis:

Hypothesis 3 (H3c): In firms with share ownership by executive directors above 15% of equity capitals, incentive-alignment is predominant and economic performance is positively affected as managers become owner-managers and SAR 3/5 of TC 1967 can impose significant statutory disclosure requirements.

The next section provides an overview of additional variables that are included in the analysis. These account for other factors that can influence financial performance and are included because corporate governance mechanisms are interdependent and not mutually exclusive (Jensen and Warner, 1988; Agrawal and Knoeber, 1996).

Other governance and control variables

In common with other studies, for the purpose of comparability, this study uses a number of important control variables. The impact of blockholders on firm performance is examined for a number of reasons. On one hand, it has been argued that large shareholders can facilitate takeovers and play an important role in the governance of firms as they can overcome the 'free-rider' problem and share private benefits of control with minority shareholders (Grossman and Hart, 1980; Shleifer and Vishny, 1986). The argument is that as the equity stake of large shareholder increases, the greater the incentive to increase the value of the firm.

On the other hand, self-dealing and over-monitoring by large shareholders can overly constrain internal management and inhibit their ability to make costly firm-specific and performance maximising investment decisions (Aghion and Tirole, 1997; Burkhardt, Gromb and Panunzi, 1997; Pagano and Röell, 1998). Furthermore, large shareholders can seek the maximisation of their own wealth and expropriate private benefits of control that are not shared with other investors, thus affecting corporate performance adversely (Shleifer and Vishny, 1997).

We include the ratio of non-executive directors on the board to examine how board independence influences firm performance. Non-executives perform an important role and are central to the effective resolution of agency problems between managers and shareholders. Among other responsibilities, non-executives should critically assess, approve and review the financial and operational decisions of executive management (Fama, 1980; Fama and Jensen, 1983a). The inclusion of this variable also again takes into account U.K. corporate governance guidelines. The recommendations of Cadbury (1992), Greenbury (1995), Hampel (1998) and Higgs (2002) emphasize that U.K. boards should be equally balanced between executive and independent non-executive directors to ensure managerial accountability.

The debt/equity ratio is included as debt can act as a valuable tax shield, hence increasing corporate value (Modigliani and Miller, 1963). Debt can also serve as a signal from internal management to outside investors (Myers, 1977; Ross, 1977), or according to the cash-flow hypothesis, increase the value of the firm because managers bond themselves to achieve cash flows necessary to meet payments of fixed capital expenditure (Grossman and Hart, 1982; Jensen, 1986).

The debt/equity ratio further controls for the possibility that debtholders may exert significant influence over managerial discretion and the operations of the firm. According to Stiglitz (1985), effective control over firms is exerted by lenders, especially banks, and not by shareholders. However, lenders might not always be able to exercise *de facto* control over decisions and dismiss management. Managers could therefore use external debt as a costly way of financing (Easterbrook, 1984) since debt holders might lack the incentive and/or the voting rights to prevent managers of consuming private benefits unless managers are unable to meet interest payments, the redemption of principals or covenants to which they have committed themselves.

We include a proxy for firm size as one managerial incentive can be to inflate the size of the firm beyond the point of value and profit maximisation to indulge their need for increased status, power and compensation (Baumol, 1959; Williamson, 1963, 1964). Larger firms can also find it easier to generate funds internally and have superior access to external financing (Short and Keasey, 1999). These firms can benefit from economies of scale that enable them to create barriers for entry and exit, thus improving corporate performance (Schmalensee, 1989).

Prospective firm growth is included following Baumol's (1959) analysis that growth can be a source of agency conflicts. Further, a link between performance, financing structure and growth has been suggested (Morck *et al.*, 1988; McConnell and Servaes, 1990). The

inclusion is also motivated by the possibility that high-growing firms retain a large fraction of their earnings for re-investment rather than paying them out in the form of dividends. These firms can earn extra income generated by accumulated retention and lower cost of capital (Easterbrook, 1984; Walker, 1997).

In line with the previous model specifications of Morck *et al.* (1988), McConnell and Servaes (1990) and Short and Keasey (1999), research and development (R&D) expenditures is included to capture the influence of intangibles that are entwined in Q. Lastly, dummies for two-digit U.K. 2003 Standard Industrial Classifications (U.K. 2003 SIC) are introduced to control industry-specific effects that can affect firm performance (Schmalensee, 1985; Rumelt, 1991; McGahan and Porter, 1997).

[Table 1 about here]

5. Data and methodology

In order to carry out this study, we include the shareholdings held by executive and non-executive members of the board that have been hand-collected from company annual reports for non-financial firms listed on the London Stock Exchange (LSE). Financial firms such as commercial and saving banks, insurance companies and institutional investors have been eliminated from the sample as variations in balance sheet and profit and loss account positions between financial and non-financial companies require adjustments to accounting ratios. Firms also had to be listed for a minimum of 6 years after their Initial Public Offering. We imposed this condition because significant changes in the capital and ownership structure of U.K. firms during the first six years of official listing could lead to a serious mis-measurement in the level of managerial ownership (Goergen, 1997; Goergen and Renneboog, 2003).

We also exclude firms in which executive and non-executive directors own more than 30% of equity capital. Peasnell, Pope and Young (2003) and Davies *et al.* (2005) for the U.K., for example, find that there are only few companies in which management owns large equity stakes. This non-normality of ownership data and the statistical analysis adopted can create difficulties in specifying accurate non-linear models with multiple inflection points as high managerial shareholdings can pull the regression line disproportionately towards them (McConnell and Servaes, 1990; Chen, Hexter and Hu, 1993). After eliminating companies for which only incomplete financial and other information was available, a total of 236 constituents of the FTSE All Share Index are included in our final sample.

[Table 2 about here]

All non-linear and piecewise linear regressions for the dependent variables ROE, Q and CSARR are estimated in a pair wise manner to allow a comparison among the different performance measures. The test is constructed as a comparison in the coefficients and R²s to permit an assessment of the non-linear and piecewise linear regression estimates.

The first set of piecewise linear regressions is used to verify the robustness of the non-linear equation technique as theory provides little specific information about the regions of managerial ownership that are beneficial or detrimental to shareholder wealth. An econometrically better approach is therefore to re-estimate the turning points of the non-linear equation models with piecewise linear equations (Morck *et al.*, 1988, Börsch-Supan and Köke, 2002). Piecewise linear specifications also retain the essential flexibility of non-linear regressions to model the proposed non-linear relationship of managerial ownership with firm performance (Ramsay, 1988). We estimate the following non-linear regression model:

$$\begin{aligned}
\text{Performance}_{it} = & \alpha_0 + \beta_{1it}EXOWN + \beta_{2it}EXOWN^2 + \beta_{3it}EXOWN^3 + \beta_{4it}NEOWN + \\
& \beta_{5it}NEOWN^2 + \beta_{6it}NEOWN^3 + \beta_{7it}INST5 + \beta_{8it}OTHER5 + \beta_{9it}RNEXEC + \beta_{10it}GROWTH + \\
& \beta_{11it}R \& D + \beta_{12it}LEV + \beta_{13it}IND + \varepsilon_{ijt}
\end{aligned} \tag{1}$$

and the piecewise linear specification for verification of the turning points:

$$\begin{aligned}
\text{Performance}_{it} = & \alpha_0 + \beta_{1it}EXOWN1 + \beta_{2it}EXOWN2 + \beta_{3it}EXOWN3 + \beta_{4it}NEOWN + \beta_{5it}INST5 + \\
& \beta_{6it}OTHER5 + \beta_{7it}RNEXEC + \beta_{8it}GROWTH + \beta_{9it}R \& D + \beta_{10it}LEV + \beta_{11it}IND + \varepsilon_{ijt}
\end{aligned} \tag{2}$$

where EXOWN1, EXOWN2 and EXOWN3 are the regions of executive ownership that are obtained from the non-linear regression equation (1).

The second set of piecewise linear regressions explicitly test the impact of s. 376-378 of the CA 1985 and SAR3/5 of the TC 1967 on the relationship between executive ownership and firm performance. The following model is tested:

$$\begin{aligned}
\text{Performance}_{it} = & \alpha_0 + \beta_{1it}EXOWN 0-5\% + \beta_{2it}EXOWN 5-15\% + \beta_{3it}EXOWN 15-30\% + \\
& \beta_{4it}NEOWN 0-30\% + \beta_{5it}INST5 + \beta_{6it}OTHER5 + \beta_{7it}RNEXEC + \beta_{8it}GROWTH + \beta_{9it}R \& D + \\
& \beta_{10it}LEV + \beta_{11it}IND + \varepsilon_{ijt}
\end{aligned} \tag{3}$$

Table 3 presents the descriptive statistics and Table 4 the Spearman cross-correlation matrix for the sample. The next section discusses the results of this paper.

[Table 3 about here]

[Table 4 about here]

6. Multivariate analysis

Table 5 reports the results in which a cubic relationship between executive ownership and firm performance is examined with conventional non-linear regressions. Consistent with our predictions, we find that low and high levels of executive ownership can create value for shareholders, whereas intermediate equity stakes give rise to managerial entrenchment and declining performance. The calculated turning points for the ROE estimates are 4.98% and 18.41% (model (1)) and 6.27% and 18.79% for the CSARR estimates (model (3))⁵. Model (2) is estimated on the basis of Q and underperforms in comparison to models (1) and (3) The turning points in models (1) and (3) are different to those of Mura (2007), but similar to the ones found by Davies *et al.* (2005). The turning point are confirmed in piecewise linear regressions (Table 6). Our results therefore support the view of Morck *et al.* (1988) and Stulz (1988) that governance markets can effectively constrain opportunistic behaviour when managers own only little equity and that highly invested managers can be detrimental to shareholder wealth.

No evidence is found that the equity stakes of non-executive directors influence firm performance. Our results are consistent with those of Florackis (2005) and Mura (2007) and may be seen as indication that non-executives are truly independent in terms of their personal shareholdings. On the other side and reflecting the argument of Hart (1995), Hambrick and Jackson (2000) and Shen (2005), this lack of financial incentives by non-executive directors could be one of the reasons why executive directors, at least in the U.K., are able to create inefficient boards and are able to entrench themselves.

[Table 5 about here]

⁵ The regression residuals post-estimation were corrected to meet the normality criteria of a Probability Density Function (PDF) under the Shapiro-Wilk test. This elimination of regression residuals has the effect of reducing the number of observations included for the different regression models.

[Table 6 about here]

Table 7 report the results for sets of piecewise linear regressions that examine the effect of s. 376-378 of CA 1985 and SAR3/5 of TC 1967 on managerial behaviour by testing the effect of the 5% and 15% EXOWN threshold. Our results confirm the hypothesis that the 5% ownership threshold is of significance in explaining the behaviour of executive directors in relation to the maximisation of firm performance. Equity ownership by executive directors below this important control threshold has the effect to improve firm performance whereas equity stakes above the 5% threshold lead to declining performance. Our results are consistent with the piecewise linear regression estimates of Morck *et al.* (1988) for the U.S. although they test the non-linear relationship between managerial ownership and firm performance on the basis of total board ownership and the 5% threshold is arbitrarily chosen.

The results also support the hypothesis that the 15% ownership threshold of SAR3/5 of the TC 1967 has a significant impact on managerial behaviour. Equity stakes of executive directors beyond this disclosure threshold positively influence the financial performance of firms. The t-statistics for the 15-30% equity ownership regressors of the ROE and CSAAR model is 4.69 and 2.71 and significant at the 0.01 confidence level. The Q specification underperforms in comparison to ROE and CSARR and no evidence for an impact of SAR3/5 of the TC 1967 on the market valuation of U.K. firms is found. At this point, the FSA investor can ask individual shareholders, formal voting coalition or those that are deemed to 'act in concert' (i.e. management) to express their intention to bid for the firm. Our results suggest that this requirement induces executive management to re-align their interests with those of outside shareholders because failure to communicate a credible signal might result in significant reductions in the value of their shares and subsequently personal wealth.

Control variables

Other agency and control variables also add to the explanatory power of the models, but there are differences in the reported impact levels between ROE, Q and CSARR. Our results generally support that INST5 and OTHER5 play a significant role in the corporate governance process and affect firm performance adversely. This result seems to support the arguments of Aghion and Tirole (1997), Burkhardt *et al.* (1997) and Pagano and Röell (1998), that excessive monitoring by large shareholders or self-dealing can lead to declining firm performance.

Specifically, a negative relationship of INST5 with ROE and CSARR is found, but the result provides no support that these shareholdings significantly affect Q. One reason for this difference between the performance variables might be that the market generally perceives the involvement of INST5 as unproblematic, although they negatively affect firm profitability. In the view of market makers, the associated monitoring role of large shareholders may outweigh their potential expropriation activity (evidenced by a fall in ROE and CSARR) of other minority shareholders. In contrast to INST5, OTHER5 play no significant role in explaining variation in ROE and CSARR. These findings might be consistent with different interpretations.

One explanation for the negative association between OTHER5 and Q is that the market regards the presence of OTHER5 as problematic in the maximisation of corporate value. In fact, market-makers might discount the threat of collusive arrangements and potential expropriation activity of OTHER5 (i.e. family members of directors, etc.) with internal management from market value. Alternatively and following prior research of Gedajlovic and Shapiro (1998) and Thomsen, Pedersen and Kvist (2006), non-linearities between large shareholders and performance in the U.K. may exist. Similar to executive

management, INST5 and OTHER5 could be subject to the forces of alignment and entrenchment that are unaccounted for in this paper.

We find no support that an increasing representation of non-executive directors on the board improves corporate performance. Our results are consistent with those of Mura (2007), but contrary to U.K. corporate governance recommendations that non-executive act as effective monitors and mitigate the risk that executive directors become entrenched. The observed insignificance of board independence may therefore be construed as evidence that non-executive directors may not only lack the financial incentives to monitor executive management but also that U.K. corporate governance recommendations have been ineffective in improving the governance of listed U.K. firms.

Consistent with Morck *et al.* (1988), Chen *et al.* (1993), Short and Keasey (1999) and Demsetz and Villalonga (2001) we find that R&D expenditure is positively linked to Q. We attribute the positive relation between R&D and Q to market expectations about future cash flows from investments in intangible assets that are entwined in the numerator of Q (McFarland, 1988; Wernerfelt and Montgomery, 1988; Chauvin and Hirschey, 1993).

In contrast to the impact on Q, R&D is found to significantly decrease ROE. This appears to reflect the accounting treatment of R&D expenditure under U.K. GAAP and International Accounting Standards (IAS) since companies are required to treat all research expenditure as an immediate expense in the income statement. U.K. GAAP and IAS restrict the capitalisation of R&D costs for internally generated intangible assets in the balance sheet to situations when an active market for the asset exists. If a firm cannot distinguish between the R&D phases, then the expenditures must be treated as if they were incurred in the research phase only, thus lowering income measures such as ROE.

LEV is found to affect firm performance adversely. This finding is in line with prior research of Faccio and Lasfer (1999) and Seifert *et al.* (2005), but in contrast to the results of

Short and Keasey (1999), Davies *et al.* (2005), Florackis (2005) and Mura (2007). There is consequently no support for the argument of Stiglitz (1985) that lenders assert effective control over managerial discretion, that debt provides a valuable tax shield to increase the value of the firm (Modigliani and Miller (1963), it acts as a managerial signal to outside investors (Ross, 1977; Myers, 1977) or for the cash-flow hypothesis (Grossman and Hart, 1982; Jensen, 1986). Notably, LEV has the most significant impact on ROE. At first, this negative association between LEV and ROE seems surprising as managers could be inclined to report a higher ROE by adding debt to a firm (Rees, 1995). However, the threat remains that managers can overuse debt as a costly way of external financing, thus lowering cash flows that accrue to shareholders. This increase in the cost of capital can also explain the negative but less pronounced impact of debt on CSARR.

Growth opportunities impact the CSARR in a strongly positive manner, which is consistent with the intuition that prosperous firms may withhold dividends for internal financing and through this have an attenuated demand for additional debt and equity financing. As can also be seen from the results, the CSARR again outperforms ROE, thereby suggesting that the CSARR measure is superior in capturing the influence of growth opportunities. This can be explained by one important aspect of the CSARR. The CSARR will only be positive if projects with positive Net Present Value (NPV) were accepted at decision making time (Bromwich and Walker, 1998).

7. Conclusion and recommendations

This paper has shown that managerial ownership has a significant non-linear impact on the performance of U.K. firms. Our results further suggest that a decomposition of managerial ownership is important because these shareholder groups have different financial incentives and U.K. corporate governance guidelines emphasize a distinction between the equity stakes

of executive and non-executive directors. Whereas share ownership by executive directors impacts firm performance, no evidence is found that the equity stakes of non-executive directors play a significant role in explaining variation in firm performance.

Furthermore, our results are the first to demonstrate a potential link between the ownership structure of firms, U.K. Company Law and the incentive of executive management to act in best interest of shareholders. We find that minority shareholder rights of s. 369 and s. 376 to 378 of CA 1985 and disclosure requirements of SAR3/5 of TC 1967 can explain the non-linear relationship between managerial ownership and firm performance.

The findings of this paper give rise to important policy implications. The main theme to emerge is that it might not be in the interest of shareholders to compensate executives with shares in lieu of cash. Greater share ownership by executives could lead to more instances of shareholder-manager conflicts as executives could consolidate and extend their power by seeking protection against their dismissal through the use of minority rights of U.K. Company Law. We suggest that one viable consideration is to introduce formal guidance on share ownership on the background of key control and disclosure thresholds.

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Table 1: Definition of variables

Variable Code	Description	Source
<i>ROE</i>	Return on Equity, defined as earnings before tax/ shareholders' equity.	FAME-database
<i>Q</i>	Tobin's Q, defined as market-to-book value of total assets.	FAME-database
<i>CSARR</i>	Book value of shareholders' equity and reserves in last financial year - book value of shareholders' equity and reserves in previous financial year + dividends to ordinary shareholders, excluding preference dividend payments and minority interests + tax charge/ book value of shareholders' equity and reserves in the last financial year.	Datastream
<i>EXOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.	Company annual reports
<i>EXOWN</i> ²	The cubed value of EXOWN.	
<i>EXOWN</i> ³	The squared value of EXOWN.	
<i>NEOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by non-executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.	Company annual reports
<i>INST5</i>	Cumulative shareholdings by large institutional shareholders holding 5% or more of total voting rights.	FAME-database
<i>OTHER5</i>	Cumulative shareholdings by large non-institutional shareholders holding 5% or more of total voting rights.	FAME-database
<i>RNEXEC</i>	Ratio of non-executive directors on the board.	Company annual reports
<i>SIZE</i>	Logarithmic transformation of the moving average turnover for firm <i>i</i> for the previous five years to balance sheet date.	FAME-database
<i>GROWTH</i>	Moving average growth in turnover for firm <i>i</i> for the previous five years to balance sheet date.	FAME-database
<i>R&D</i>	Ratio of research and development expenditures to book value of total assets.	Datastream
<i>LEV</i>	Leverage ratio, measured as the book value of short and long-term debt to book value of total assets.	Datastream
<i>IND</i>	Two-digit primary company industry classification by UK SIC (2003) industry codes. IND1 = real estate and construction (reference group), IND2 = utilities and transport, IND3 = primary, mining, and services, IND4 = manufacturing and retail.	FAME-database

Total number of U.K. firms listed on the <i>FTSE ALL Share Index</i> on the LSE	Around 750 firms in 2004/05
Non-financial firms	481
Less: Firms listed for less than six years since IPO	(78)
Sub-Total	403
Less: Firms with incomplete ownership information	(79)
Sub-Total	324
Less: Firms with incomplete other information	(44)
Sub-Total	280
Less: Firms with incomplete financial data	(30)
Sub-Total	250
Less: Firms with executive and non-executive ownership above 30% of equity capital	(14)
Number of firms included in the final sample	236

Table 2: Sample

Table 3: Descriptive statistics

All observations (N = 236)

Variable	Mean	Std. Dev.	Minimum	Lower quartile	Median	Upper quartile	Maximum
CSARR	0.1886	0.4170	-1.9048	0.0895	0.2020	0.3025	3.9652
Q	3.1629	3.4292	0.6000	1.3875	2.2900	3.3750	40.2400
ROE	0.1536	0.3045	-1.8869	0.0527	0.1656	0.2729	1.7039
EXOWN	0.0246	0.0541	0.0000	0.0011	0.0040	0.0180	0.2890
NEOWN	0.0144	0.0384	0.0000	0.0003	0.0012	0.0043	0.2601
INST5	0.1477	0.1178	0.0000	0.0579	0.1222	0.2163	0.6603
OTHER5	0.0507	0.1087	0.0000	0.0000	0.0000	0.0644	0.6226
RNEDEC	0.5478	0.1129	0.2727	0.4545	0.5556	0.6250	0.8750
SIZE (in £'000)	231,001	441,950	130	36,378	91,523	233,422	4,903,176
GROWTH	0.9934	4.5462	-0.6834	0.0634	0.3821	0.8278	66.1790
LEV	0.2120	0.1542	0.0002	0.0725	0.2058	0.3148	0.7602
R&D	0.0200	0.0610	0.0000	0.0000	0.0000	0.0165	0.7551

ROE	Return on Equity, defined as earnings before tax/ shareholders' equity.
Q	Tobin's Q, defined as market-to-book value of total assets.
CSARR	Book value of shareholders' equity and reserves in last financial year - book value of shareholders' equity and reserves in previous financial year + dividends to ordinary shareholders, excluding preference dividend payments and minority interests + tax charges/ book value of shareholders' equity and reserves in last financial year.
EXOWN	Cumulative beneficial and unrestricted ordinary voting shares held by executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
NEOWN	Cumulative beneficial and unrestricted ordinary voting shares held by non-executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
INST5	Cumulative ownership by large institutional shareholders holding 5% or more of total voting rights.
OTHER5	Cumulative ownership by other large non-institutional shareholders holding 5% or more of total voting rights.
RNEDEC	Ratio of non-executive directors on the board.
SIZE	Moving average turnover for firm i for the previous five years to balance sheet date.
GROWTH	Moving average growth in turnover for firm i for the previous five years to balance sheet date.
R&D	Ratio of research and development expenditures to book value of total assets.
LEV	Leverage ratio, measured as the book value of short and long-term debt to book value of total assets.
IND	Two-digit primary company industry classification by UK SIC (2003) industry codes: IND1 = real estate and construction (reference group), IND2 = utilities and transport, IND3 = primary, mining, and services, IND4 = manufacturing and retail.

Table 4: Spearman correlation matrix

All observations (N = 236)

	ROE	Q	CSARR	EXOWN	NEOWN	INST5	OTHER5	RNEXEC	SIZE	GROWTH	R&D
Q	0.4302 *										
CSARR	0.5284 *	0.2626 *									
DIROWN	0.0372	-0.0279	0.1256								
EXOWN	0.0746	0.0403	0.2653 *								
NEOWN	-0.0497	-0.0749	0.0072	0.2662 *							
INST5	-0.1479 *	-0.0187	-0.0756	0.0229	0.0499						
OTHER5	-0.0559	-0.0957	0.0415	0.2318 *	0.3178 *	-0.0917					
RNEXEC	-0.0702	-0.0175	-0.1849 *	-0.4019 *	0.0733	-0.0659	-0.0748				
SIZE	-0.0333	0.1263	-0.0643	-0.4150 *	-0.3208 *	-0.1472 *	-0.2486 *	0.3053 *			
GROWTH	0.1441 *	0.1006	0.1199	0.1859 *	-0.0203	-0.2003 *	0.1856 *	-0.0649	-0.0523		
R&D	-0.0928	0.2290 *	-0.0612	-0.1273	0.0300	0.0446 *	-0.1601 *	0.1110	0.0537	-0.1782 *	
LEV	-0.1451 *	-0.0532	-0.0965	-0.0911	-0.0575	-0.1694 *	-0.0300	0.0763	0.1200	0.1910	-0.2379 *

*Significance at the 0.05 confidence level

ROE	Return on Equity, defined as earnings before tax/ shareholders' equity.
Q	Tobin's Q, defined as market-to-book value of total assets.
CSARR	Book value of shareholders' equity and reserves in last financial year - book value of shareholders' equity and reserves in previous financial year + dividends to ordinary shareholders, excluding preference dividend payments and minority interests + tax charges/book value of shareholders' equity and reserves in last financial year.
EXOWN	Cumulative beneficial and unrestricted ordinary voting shares held by executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and
NEOWN	Cumulative beneficial and unrestricted ordinary voting shares held by non-executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and
INST5	Cumulative ownership by large institutional shareholders holding 5% or more of total voting rights.
OTHER5	Cumulative ownership by other large non-institutional shareholders holding 5% or more of total voting rights.
RNEXEC	Ratio of non-executive directors on the board.
SIZE	Logarithmic transformation of the moving average turnover for firm <i>i</i> for the previous five years to balance sheet date.
GROWTH	Moving average growth in turnover for firm <i>i</i> for the previous five years to balance sheet date.
R&D	Ratio of research and development expenditures to book value of total assets.
LEV	Leverage ratio, measured as the book value of short and long-term debt to book value of total assets.
IND	Two-digit primary company industry classification by UK SIC (2003) industry codes. IND1 = real estate and construction (reference group), IND2 = utilities and transport, IND3 = primary, mining, and services, IND4 = manufacturing and retail.

Table 5 Non-linear regressions of ROE, Q and CSARR on EXOWN and NEOWN

Model No.	(1)		(2)		(3)
Specification	OLS		OLS		OLS
No. of observations	198		198		198
Variable	Dependent variable				
	ROE		Q		CSARR
	Coefficient		Coefficient		Coefficient
	t-statistic		t-statistic		t-statistic
Constant	0.213 (2.66) **		0.159 (0.50)		0.181 (1.83) *
<i>EXOWN</i>	3.154 (3.13) ***		6.688 (1.56)		3.695 (3.44) ***
<i>EXOWN</i> ²	-40.257 (-3.47) ***		-64.096 (-1.34)		-39.311 (-3.57) ***
<i>EXOWN</i> ³	114.779 (3.75) ***		158.186 (1.22)		104.602 (3.75) ***
<i>NEOWN</i>	0.861 (0.75)		-4.020 (-0.93)		1.225 (0.90)
<i>NEOWN</i> ²	-2.908 (-0.22)		81.356 (1.55)		-11.761 (-0.72)
<i>NEOWN</i> ³	0.040 (0.00)		-285.715 (-1.96) *		27.629 (0.62)
<i>INST5</i>	-0.209 (-3.78) ***		-0.424 (-1.29)		-0.196 (-1.86) *
<i>OTHER5</i>	-0.111 (-1.47)		-0.630 (-2.14) **		-0.178 (-1.61)
<i>RNEXEC</i>	-0.060 (-0.74)		-0.012 (-0.04)		-0.014 (-0.13)
<i>SIZE</i>	0.007 (1.11)		0.064 (2.29) **		0.002 (0.26)
<i>GROWTH</i>	0.000 (-0.11)		-0.004 (-2.06) **		0.007 (6.36) ***
<i>R&D</i>	-0.819 (-8.58) ***		1.836 (3.02) ***		-0.047 (-0.24)
<i>LEV</i>	-0.273 (-4.77) ***		-0.364 (-1.40)		-0.161 (-2.50) **
<i>Industries</i>	Yes		Yes		Yes
Adjusted R ²	36.93%		19.43%		21.05%
F-statistic	12.07 ***		6.60 ***		8.86 ***
Inflection points	4.98% 18.41%		7.07% 19.95%		6.27% 18.79%

*, **, ***Significant at the 0.10, 0.05 and 0.01 confidence level (two-tailed).
t-statistics are computed using White's (1980) heteroskedasticity consistent matrix

<i>ROE</i>	Return on Equity, defined as earnings before tax/ shareholders' equity.
<i>Q</i>	Tobin's Q, defined as market-to-book value of total assets.
<i>CSARR</i>	Book value of shareholders' equity and reserves in last financial year - book value of shareholders' equity and reserves in previous financial year + dividends to ordinary shareholders, excluding preference dividend payments and minority interests + tax charge/ book value of shareholders' equity and reserves in last financial year.
<i>EXOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
<i>NEOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by non-executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
<i>INST5</i>	Cumulative ownership by large institutional shareholders holding 5% or more of total voting rights.
<i>OTHER5</i>	Cumulative ownership by other large non-institutional shareholders holding 5% or more of total voting rights.
<i>RNEXEC</i>	Ratio of non-executive directors on the board.
<i>SIZE</i>	Logarithmic transformation of the moving average turnover for firm <i>i</i> for the previous five years to balance sheet date.
<i>GROWTH</i>	Moving average growth in turnover for firm <i>i</i> for the previous five years to balance sheet date.
<i>R&D</i>	Ratio of research and development expenditures to book value of total assets.
<i>LEV</i>	Leverage ratio, measured as the book value of short and long-term debt to book value of total assets.
<i>IND</i>	Two-digit primary company industry classification by UK SIC (2003) industry codes. IND1 = real estate and construction (reference group), IND2 = utilities and transport, IND3 = primary, mining, and services, IND4 = manufacturing and retail.

Table 6: Piecewise linear regressions of ROE, Q and CSARR on EXOWN and NEOWN

Model No.	(4)		(5)		(6)	
Specification	Piecewise		Piecewise		Piecewise	
No. of observations	198		198		198	
Variable	Dependent variable					
	ROE		Q		CSARR	
	Coefficient		Coefficient		Coefficient	
	t-statistic		t-statistic		t-statistic	
Constant	0.224 (2.99)	***	0.172 (0.54)		0.213 (2.18)	**
<i>EXOWN1</i>	2.315 (3.16)	***	3.076 (1.14)		2.119 (3.30)	***
<i>EXOWN2</i>	-4.511 (-3.95)	***	-4.399 (-0.88)		-3.645 (-3.17)	***
<i>EXOWN3</i>	6.714 (5.71)	***	4.205 (0.52)		4.639 (2.72)	***
<i>NEOWN</i>	0.345 (2.12)	**	0.061 (0.07)		0.113 (0.57)	
<i>INST5</i>	-0.311 (-4.40)	***	-0.487 (-1.49)		-0.210 (-2.02)	**
<i>OTHER5</i>	-0.101 (-1.37)		-0.638 (-2.19)	**	-0.179 (-1.63)	
<i>RNEXEC</i>	-0.535 (-0.65)		0.007 (0.02)		-0.006 (-0.05)	
<i>SIZE</i>	0.006 (0.98)		0.063 (2.17)	**	0.000 (-0.05)	
<i>GROWTH</i>	0.000 (-0.22)		-0.005 (-2.12)	**	0.006 (5.91)	***
<i>R&D</i>	-0.806 (-8.19)	***	1.912 (3.01)	***	-0.038 (-0.19)	
<i>LEV</i>	-0.268 (-4.76)	***	-0.351 (-1.33)		-0.159 (-2.41)	**
<i>Industries</i>	Yes		Yes		Yes	
Adjusted R ²	38.40%		17.65%		20.33%	
F-statistic	13.74	***	5.27	***	5.74	***

*, **, ***Significant at the 0.10, 0.05 and 0.01 confidence level (two-tailed).
t-statistics are computed using White's (1980) heteroskedasticity consistent matrix

Variables *EXOWN1*, *EXOWN2* & *EXOWN3* denote the ownership region that are estimated from the non-linear equation models (1) to (3):

Model (4) is estimated $ROE = EXOWN1 (0-4.98\%) + EXOWN2 (4.98-18.41\%) + EXOWN3 (18.41-30\%) + NEOWN (0-30\%) + \text{Control variables}$

Model (5) is estimated $Q = EXOWN1 (0-7.07\%) + EXOWN2 (7.07-19.95\%) + EXOWN3 (19.95-30\%) + NEOWN (0-30\%) + \text{Control Variables}$

Model (6) is estimated $CSARR = EXOWN1 (0-6.27\%) + EXOWN2 (6.27-18.79\%) + EXOWN3 (18.79-30\%) + NEOWN (0-30\%) + \text{Control Variables}$

<i>ROE</i>	Return on Equity, defined as earnings before tax/ shareholders' equity.
<i>Q</i>	Tobin's Q, defined as market-to-book value of total assets.
<i>CSARR</i>	Book value of shareholders' equity and reserves in last financial year - book value of shareholders' equity and reserves in previous financial year + dividends to ordinary shareholders, excluding preference dividend payments and minority interests + tax charge/ book value of shareholders' equity and reserves in last financial year.
<i>EXOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
<i>NEOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by non-executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
<i>INST5</i>	Cumulative ownership by large institutional shareholders holding 5% or more of total voting rights.
<i>OTHER5</i>	Cumulative ownership by other large non-institutional shareholders holding 5% or more of total voting rights.
<i>RNEXEC</i>	Ratio of non-executive directors on the board.
<i>SIZE</i>	Logarithmic transformation of the moving average turnover for firm <i>i</i> for the previous five years to balance sheet date.
<i>GROWTH</i>	Moving average growth in turnover for firm <i>i</i> for the previous five years to balance sheet date.
<i>R&D</i>	Ratio of research and development expenditures to book value of total assets.
<i>LEV</i>	Leverage ratio, measured as the book value of short and long-term debt to book value of total assets.
<i>IND</i>	Two-digit primary company industry classification by UK SIC (2003) industry codes. IND1 = real estate and construction (reference group), IND2 = utilities and transport, IND3 = primary, mining, and services, IND4 = manufacturing and retail.

Table 7: Piecewise linear regressions of ROE, Q and CSARR on EXOWN and

NEOWN with predetermined breaking points

Model No.	(7)	(8)	(9)		
Specification	Piecewise	Piecewise	Piecewise		
No. of observations	198	198	198		
Variable	Dependent variable				
	ROE	Q	CSARR		
	Coefficient t-statistic	Coefficient t-statistic	Coefficient t-statistic		
Constant	0.219 (2.94) ***	0.123 (0.39)	0.202 (2.06) **		
<i>EXOWN 0-5%</i>	2.516 (3.34) ***	5.270 (1.67) *	2.731 (3.27) ***		
<i>EXOWN 5-15%</i>	-5.504 (-4.12) ***	-8.414 (-1.40)	-4.557 (-3.11) ***		
<i>EXOWN 15-30%</i>	6.029 (4.96) ***	5.970 (0.87)	3.776 (2.71) ***		
<i>NEOWN</i>	0.364 (2.20) **	0.129 (0.15)	0.130 (0.67)		
<i>INST5</i>	-0.316 (-4.48) ***	-0.526 (-1.62)	-0.218 (-2.09) **		
<i>OTHER5</i>	-0.094 (-1.29)	-0.603 (-2.08) **	-0.169 (-1.55)		
<i>RNEXEC</i>	-0.049 (-0.60)	0.017 (0.05)	-0.003 (-0.03)		
<i>SIZE</i>	0.006 (1.00)	0.065 (2.29) **	0.000 (0.01)		
<i>GROWTH</i>	0.000 (-0.25)	-0.005 (-2.23) **	0.006 (5.82) ***		
<i>R&D</i>	-0.804 (-8.23) ***	1.914 (3.06) ***	-0.034 (-0.17)		
<i>LEV</i>	-0.266 (-4.69) ***	-0.339 (-1.30)	-0.156 (-2.38) **		
<i>Industries</i>	Yes	Yes	Yes		
Adjusted R ²	38.56%	18.24%	20.80%		
F-statistic	14.67 ***	5.75 ***	5.71 ***		

*, **, ***Significant at the 0.10, 0.05 and 0.01 confidence level (two-tailed).
t-statistics are computed using White's (1980) heteroskedasticity consistent matrix

<i>ROE</i>	Return on Equity, defined as earnings before tax/ shareholders' equity.
<i>Q</i>	Tobin's Q, defined as market-to-book value of total assets.
<i>CSARR</i>	Book value of shareholders' equity and reserves in last financial year - book value of shareholders' equity and reserves in previous financial year + dividends to ordinary shareholders, excluding preference dividend payments and minority interests + tax charge/ book value of shareholders' equity and reserves in last financial year.
<i>EXOWN</i>	Cumulative beneficial and unrestricted ordinary voting shares held by executive directors, excluding shareholdings held on behalf of their immediate families, charitable trusts and foundations.
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<i>OTHER5</i>	Cumulative ownership by other large non-institutional shareholders holding 5% or more of total voting rights.
<i>RNEXEC</i>	Ratio of non-executive directors on the board.
<i>SIZE</i>	Logarithmic transformation of the moving average turnover for firm <i>i</i> for the previous five years to balance sheet date.
<i>GROWTH</i>	Moving average growth in turnover for firm <i>i</i> for the previous five years to balance sheet date.
<i>R&D</i>	Ratio of research and development expenditures to book value of total assets.
<i>LEV</i>	Leverage ratio, measured as the book value of short and long-term debt to book value of total assets.
<i>IND</i>	Two-digit primary company industry classification by UK SIC (2003) industry codes. IND1 = real estate and construction (reference group), IND2 = utilities and transport, IND3 = primary, mining, and services, IND4 = manufacturing and retail.