



MANAGERIAL OWNERSHIP, CAPITAL STRUCTURE AND FIRM VALUE

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Abstract

This paper extends prior research to examine the managerial ownership influences on firm performance through the choices of capital structures by using a new sample of S&P 500 firm in 2005. The empirical results of OLS regressions replicate the nonlinear relationship between managerial ownership and firm value. However, we found that the turning points had moved up in our sample compared with previous papers, which implies that the managerial control for pursuing self-interest, and the alignment of interests between managers and other shareholders can only be achieved now by management holding more ownership in a firm than that found in the previous studies. Managerial ownership also drives the capital structure as a nonlinear shape, but with a direction opposite to the shape of firm value. The results of simultaneous regressions suggest that managerial ownership affects capital structure, which in turn affects firm value. Capital structure is endogenously determined by both firm value and managerial ownership; while managerial ownership is not endogenously determined by the other two variables.

Keywords: managerial ownership, capital structure, firm value, nonlinear

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1 Introduction

The effects of managerial ownership on firm value have been of particular research interest in corporate finance (Denis and McConnell, 2003). The literature generally agrees that managers' and shareholders' interests are not fully aligned. The interest conflict between management and shareholders produces agency problem, which in turn reduce firm value. Thus, an increase of managerial ownership from a low level can help to connect the interests between insiders and shareholders, and also lead to better decisions, producing higher firm value. However, when the equity owned by management reaches a certain level, this increase in managerial ownership may give managers greater freedom to pursue their own interests without considering a resulting decrease of firm value. Only when managerial ownership approaches a

considerably high level, can the agency problem be mitigated, and the firm value maximized. Therefore, we hypothesize that managerial ownership and firm value have a nonlinear relationship.

A series of researches examines the relationship between managerial ownership and firm value. The literature provide evidence to support the nonlinear relationship hypothesis. Morck et al. (1988) conducted pioneering work, in which they used piecewise linear regressions to estimate the relationship between Tobin's Q and the shareholdings of the board of directors for 371 Fortune 500 firms in 1980. They found a nonlinear association between managerial ownership and firm value. McConnell and Servaes (1990) confirmed the nonlinear relationship in their investigation of the firms listed in either NYSE or AMEX in 1976 and 1986. Similar evidence of the nonlinear relationship was detected by Short and

Keasey (1999) in UK firms listed on the London Stock Exchange for the period 1988 to 1992, and by Miguel et al. (2004) on Spanish companies listed on the Madrid Stock Exchange.

Further research shows that agency relationship between managers and shareholders has the potential to influence financial decision making, which in turn impacts on firm value. Equities held by management could motivate managers to make financial decisions that are either only in their own interests, or happen to coincide with shareholders' benefit, thereby leading to lower or higher firm value. Cho (1998) applied a cross-sectional data set of Fortune 500 manufacturing firms in 1991 to explore the relationships among ownership structure, investment and corporate value. He found that insider ownership affected investment, which in turn influenced corporate value. Davies et al. (2005) reached a similar conclusion with research on publicly listed UK companies, asserting that investment decision making is a function of managerial ownership and accordingly, determines firm performance.

Leverage choice is another important financial decision in addition to investment policy, and has various effects on firm value. Since the inaugural literature by Modigliani and Miller (1963), the relationship between capital structure and firm performance has prevailed as a discussion topic in finance theory. It is often predicted that financial leverage influences agency costs and thereby affects corporate value because better leverage setting could help mitigate agency costs by the threat of acquisition and financial distress, which causes personal losses to managers of salaries, reputation, perquisites, etc. (Williams, 1987) This has been proved by Ross (1977) and Myers (1977) with respect to a signalling hypothesis and Jensen's (1986) free cashflow hypothesis.

Evidence about how managerial behavior arose from equity holding influences the choice of capital structure directly and indirectly has been put forward since the end of last century. Friend and Lang (1988) examined whether managerial entrenchment induced by insiders' equity holding "at least in part" motivates capital structure decisions. Berger et al. (1997) applied cross-sectional analysis and found evidence that firm leverage is affected by the degree of managerial entrenchment. Entrenched managers seek to avoid debt, and therefore protect themselves and the company from external threat. In an Australian sample, Brailsford et al. (2002) found a nonlinear relationship between the level of equity stake owned by management and the capital structure measured by a debt/equity ratio. However, the prior referenced literature usually focused on the relationships between either managerial ownership and firm value (Morck et al., 1988; McConnell and Servaes, 1990), or between managerial ownership and investment decision and firm value (Cho, 1998; Davies et al., 2005 etc.), or between managerial ownership and capital structure (Friend and Lang, 1988).

In contrast, our research is conducted from a new angle. Based on investigations of the relationships between managerial ownership and firm value, and managerial ownership and capital structure, we detected interactive effects among the three proxies. We also employed a relatively recent data set comprising S&P 500 firms observed in 2005. We examined whether the early findings by Morck et al. (1988) and Cho (1998) using Fortune 500 data could be verified by using S&P 500 data in a relatively recent market environment.

We obtained the following new findings. First, we used OLS regression, we replicated the nonlinear relationship between managerial ownership and firm value, which are discussed in research by Morck et al. (1988) and Cho (1998). However, we found that the turning points of managerial ownerships with respect to the firm value had moved upward. For example, the turning points in Morck et al. (1988) were 5% and 25%, and in Cho (1998) at 7% and 38% respectively. By contrast, in our regression results, they were 17% and 67%. We therefore argue that managers need more ownership to control the firm for their own benefit, or need motivations to align with shareholders' interest.

Second, we found that managerial ownership drove the capital structure as a nonlinear shape — also due to managerial entrenchment. However, we also found that the directions of the nonlinear shapes for managerial ownership and firm value, and for managerial ownership and capital structure, were oppositely related. Finally, the direct influence of managerial ownership on firm value became insignificant when capital structure was taken into consideration. The results from simultaneous regressions show that managerial shareholding significantly impacts capital structure, which in turn imposes effect on firm value. The results of simultaneous equations also demonstrate that capital structure is endogenously determined in equilibrium.

The remainder of this paper is organized as follows. Section 2 contains the theoretical predictions about the relationships between managerial ownership, debt policy, and firm value. Section 3 explains the data sample and interprets the statistics. Section 4 describes the empirical specifications and results, and also discusses the methodology and models employed in this study. Section 5 concludes this research.

2 Theoretical predictions

Much of the literature indicates that managerial ownership affects corporate value because equity holding by management could motivate managers to make financial decisions in their own benefit or for shareholders' interest, thereby leading to decreased or increased firm value (Morck et al., 1988; McConnell and Servaes, 1990; Short and Keasey, 1999; Miguel et al., 2004), and according to Davies et al. (2005), "The effectiveness of these incentives is potentially a function of the level of managerial ownership in the firm". When low levels of managerial ownership exist,

external discipline and internal monitoring dominate management behavior to promote maximization of corporate value, so we would expect a positive relationship between managerial ownership and firm value. At intermediate levels of managerial ownership, with greater power coming from greater ownership, managers may pursue their personal wealth at the expense of corporate value. As managerial ownership reaches a certain level, management interest converges to that of shareholders, which produces a positive relationship between managerial ownership and firm performance.

Also important is the issue of how managerial ownership affects corporate value. Brailsford et al. (2002) argue that corporate managers and external block owners are two key groups of shareholders with a powerful influence on the decisions in a firm's resource allocation. Cho (1998) found that managerial ownership affects firm value because shareholding motivates management to make investment decisions to their own or to the shareholders' benefit, which consequently affects firm performance. Leverage choice is another important financial decision, and has various effects on firm value. Debt increases the bankruptcy risks of a firm, and self-interested managers have incentives to reduce corporate debt to a level that is less than optimal. However, from the managerial perspective, the capital structure decision is not only determined by the basic concerns of risk and controls — the values, goals, preferences and desires of managers are also important inputs in finance decision making.

At low levels of managerial ownership, managers have limited voting power and influence; while external related beneficiaries, such as block holders and creditors, have the ability to monitor and restrict opportunistic behavior by managers. Managerial ownership is negatively related to a firm's debt ratio because of managers' risk averting possibility. However, with high levels of managerial ownership, external related beneficiaries may not have the ability to prevent self-interested managers from indulging in non-maximizing behavior. Debt is increased as managers begin to use leverage as an entrenchment tool to avert being acquired or purchased. Thus, we would expect a positive relationship between capital structure and managerial ownership in this interval. With managers having effective control in terms of a very high proportion of managerial shareholding, they seek to reduce their risks by decreasing the use of debt. Brailsford et al. (2002) provide empirical evidence for this scenario in their documenting of a nonlinear relationship between the level of equity stake owned by managers and capital structure measured by debt/equity ratio, which supports the findings of Friend and Lang (1988) and Berger et al. (1997).

Many variables related to financial decision, firm value and managerial ownership are likely to be determined simultaneously, which may result in an even more complex relationship. The previous

discussions propose that managerial ownership affects capital structure choice, and the capital structure is determined by many other factors. The resultant leverage affects how ownership is structured. Hence, questions arise over the possible endogeneity of ownership (Demsetz and Lehn, 1985; Cho, 1998). Cho (1998) used OLS regressions to test whether insider ownership affects investment, and therefore, corporate value. However, simultaneous regressions reveal that investment affects corporate value which, in turn, affects managerial ownership, but not vice versa. In contrast, Berger and Patti (2006) employed a simultaneous equation model to study the possibility of reverse causality from firm value to capital structure in the banking industry.

On the basis of theoretical analyses and empirical evidence, the following hypothesis are discussed in this study:

H1: A nonlinear relationship exists between managerial ownership and firm value, where: firm value first increases and, after a certain breakpoint, decreases, and then increases again as managerial ownership rises.

H2: A nonlinear relationship exists between managerial ownership and capital structure, where: capital structure first falls, then rises, and finally continues to fall as managerial ownership increases.

H3: Managerial ownership affects capital structure, which in turn, affects firm value. Managerial shareholding and leverage choice are endogenously determined.

3 Data and statistics

The sample was constructed from S&P 500 firms in 2005. We extracted the data of board ownership from the RiskMetrics database. The financial structure and other data are collected from the database of COMPUSTAT North America. After rejecting firms with insufficient data items for our modeling, the final sample consisted of 353 S&P 500 firms. In the robustness test, we used the one-year lagged variables of managerial ownership in 2005 to study its effect on in 2006. There is not any missing value of calculating Tobin's Q and capital structure for the 353 sample firms in 2005.

We mainly applied Tobin's Q as the measure of firm performance, which is the ratio of firm's market value to the book value of total assets (Kaplan and Zingales, 1997). The market value of assets was calculated as the book value of assets plus the market value of common stock, less the sum of book value of common equity and deferred taxes. Holderness (2003) investigated the US evidences on equity ownership by insiders and blockholders, where insiders are defined as the officers and directors of a firm. Cho (1998) defines "insider ownership as the fraction of shares, not including options, held by officers and directors of the board." Davies et al. (2005) use the managerial ownership stake of all board members to represent managerial shareholding. After a considered reading

of the various definition, we've decided to use the ownership stake of all board members as a proxy for managerial ownership.

Table 1 describes managerial ownership, Tobin's Q, and capital structure for the sample of 353 S&P 500 firms in 2005. The mean combined ownership of all board members is 4.6%. The median ownership, however, is only 1.3%, suggesting that the distribution is skewed. The Tobin's Q values in 2005 range from 0.878 to 13.024, with a mean of 2.199. Capital structure ranges from nearly zero leverage ratio of 0.084 to an over-leveraged ratio of 1.153. The mean capital structure is 0.572; that is, almost the same as the median value of 0.575.

[Table 1 here]

Table 2 reports the distribution of the number of firms, values of Tobin's Q and capital structure, as classified by different ranges of managerial ownership. "MANA" indicates the proportion of managerial ownership. The distribution of firm number in the sample is skewed towards low levels of managerial ownership. In 282 firms, comprising 80% of the sample firms, board members owned less than 5% of the firms. In 28 firms, total board holdings constituted an equity in the range of 5% to 10%. In 13 firms (4% of the sample firms) board members had ownership levels in of between 10% and 15%. However, the managerial holdings did span a wide range in the remaining 25 firms. This distribution is consistent with the findings of Demsetz and Lehn (1985) and Morck et al. (1988), "suggesting the prevalence of significant management ownership in the US" (Cho, 1998).

[Table 2 here]

Table 2 also suggests that there is a nonlinear relationship between levels of managerial ownership and Tobin's Q. The mean Tobin's Q increases from 2.14 in the first range of managerial ownership to 2.42 and 2.93 in the second and third ranges. Then the mean value of Tobin's Q declines to 2.51, 2.32, and 1.98, until reaching 1.47 in the last range of managerial ownership of over 60%. This distribution is consistent with the descriptions in Cho (1998), where Tobin's Q has a similar inverse relationship with the level of managerial ownership. The association between the levels of equity stake owned by board members and capital structure measured by the debt/asset ratio is also non-monotonic, as shown in Table 2. At the level of managerial ownership below 5%, the mean leverage ratio is 0.59. The leverage ratio subsequently decreases from between 5% and 10% managerial ownership to between 10% and 15%. Thereafter, the leverage ratio increases as managerial ownership increases. The leverage ratio approaches its highest level of 0.58 when managerial ownership is over 60%. Therefore, quadratic curves do exist between managerial ownership and Tobin's Q, and

between managerial ownership and capital structure. The directions of the relationships between managerial ownership and Tobin's Q, and between managerial ownership and capital structure are opposite.

4 Empirical specifications and results

4.1 Managerial ownership and firm value

In order to model the relationship between Tobin's Q and managerial ownership (MANA) and determine two extremum turning points of managerial ownership when Tobin's Q changes direction, we specify a cubic function²⁸ as follows:

$$Q = a + \beta_1 \text{MANA} + \beta_2 \text{MANA}^2 + \beta_3 \text{MANA}^3 + \varepsilon \quad (1)$$

MANA stands for the proportion of managers' stock ownership, Q stands for Tobin's Q, namely firm value. The regression results are:

$$Q = 1.993798 + 10.51822 \text{MANA} - 38.59188 \text{MANA}^2 + 30.55766 \text{MANA}^3$$

(19.84) (3.25) (-2.84) (2.40)

Adj. R2 = 0.023, F-statistic = 3.751, N = 353

The intercept coefficient, which is an estimate of Tobin's Q in firms with no managerial holdings, is 1.99, which is similar to the 1.85 recorded in Davies et al. (2005). Each coefficient is of the expected sign, and statistically significant at the 1% level for constant, MANA and MANA², and at the 5% level for MANA³. Although the adjusted R square is low, it is similar to those found in other relevant papers (for example, Morck et al., 1988; McConnell and Servaes, 1990; Cho, 1998; Himmelberg et al., 1999; Davies et al., 2005). We then calculated turning points by differentiating Tobin's Q with respect to MANA. The two turning points are:

$$\text{MANA} = 0.171 \text{ and } \text{MANA} = 0.671$$

As expected, Tobin's Q first increases when managerial ownership is less than 17.1%, and then declines until managerial shareholding reaches to 67.1%. Tobin's Q rises again slightly as managerial ownership reaches over 67.1%. This result validates Hypothesis 1, discussed in the section on theoretical predictions. At low levels of managerial ownership, an increase in management equity holding closely aligns

²⁸ For the number of turning points of managerial ownership to firm value, Morck et al. (1988) found two points; McConnell and Servaes (1990) model the relationship between managerial ownership and firm value as a quadratic function, which has only one turning point; Cho (1998) and Miguel et al. (2004) have two points, following Morck et al. (1988); while Davies et al. (2005) used a quintic equation and generated four turning points. The number of points probably does not matter; however, significance is of most importance, and determining how to explain the significance of each turning point. Considering the theoretical predictions and results of the descriptive statistics of this study, we decided to use a cubic model, which involves two extremum points and three intervals of managerial share ownership.

with the interests of managers and shareholders, thereby increasing corporate value. However, at relatively high levels of managerial ownership, an increase in management equity shareholding makes management more entrenched and less subject to market discipline, thereby reducing corporate value (Cho, 1998). When managerial ownership rises to a considerably high level, managers' interests fully align with shareholders' interests. In this situation, management pursue best firm performance and firm value is maximised.

This nonlinear tendency is consistent with results from Morck et al. (1988), Cho (1998) and so on; however, the turning points are different. Morck et al. (1988) used a piecewise regression on a sample of Fortune 500 firms and found two extremum values of managerial ownership: 5% and 25%. Cho (1998) used a grid searching technology with a sample of Fortune 500 firms also, and found the turning points of managerial ownership at 7% and 38%. Miguel et al. (2004) used unbalanced panel data of 135 Spanish companies and found two turning points of 35% and 70%.

The sample differences in firms and markets may be one possible reason for the variation in pairs of turning points. However, we suspect that the sample differences in time are the main explanation for the differing turning points. For example, the study by Morck et al. (1988) used evidence based on 1980 data. Cho's (1998) finding resulted from 1991 observations. The data time horizon in Miguel et al. (2004) was from 1990 to 1999. Our finding was generated from the data for 2005. The turning points of managerial ownership with respect to firm values move upward as the sample time approaches the present. We strongly argue that, due to the evolution of corporate governances and regulations, the thresholds of managerial ownership for either self-interested decision making or interest alignment between managers and shareholders have moved up. In other words, managers need more ownership to obtain sufficient voting power to make decisions that are in their own interest. Furthermore, more managerial ownership is required for a full interest alignment between managers and shareholders.

4.2 Managerial ownership and capital structure

Based on the analysis of the theoretical predictions, we here examine the relationship between managerial ownership and capital structure. For the convenience of a further comparison, and according to the description in Table 2, we modified model (1) into model (2):

$$CS \text{ (capital structure)} = a + \beta_1 \text{ MANA} + \beta_2 \text{ MANA}^2 + \beta_3 \text{ MANA}^3 + \epsilon \quad (2)$$

where MANA = the proportion of managerial ownership, and CS = capital structure, which is

defined as total debt divided by total assets.

The results of model (2) are:

$$CS \text{ (capital structure)} = 0.617177 - 2.075245 \text{ MANA} + 7.052517 \text{ MANA}^2 - 5.691353 \text{ MANA}^3$$

(43.72) (-4.56) (3.69) (-3.19)

Adj. R2 = 0.055, F-statistic = 7.810, N=353

All the coefficients are of the expected signs and statistically significant at the 1% level. Then we calculate points of extremum and intersection via derivation. The two turning points are:

$$\text{MANA} = 0.192; \text{ and } \text{MANA} = 0.635$$

The results of model (2) show negative relationships between managerial ownership and leverage ratios when managerial ownership is in the range from 0% to 19.2% or beyond 63.5%; while a positive relationship between managerial ownership and leverage ratios exists when managerial ownership is in the range from 19.2% to 63.5%. This result validates our prediction and Hypothesis 2. First, when the level of managerial ownership is low, an increase in managerial ownership has the effect of aligning management and shareholders' interests (Brailsford et al., 2002). Consequently, the main objective of managers is to maximize shareholders' wealth and to achieve higher firm performance by using appropriate financial decisions to avert financial distress. Thus a negative relationship exists between managerial ownership and capital structure.

Second, as the increase of managerial ownership, external block holders may not have the ability to prevent self-interested managers from indulging in non-maximizing behavior. Board members become entrenched with significant voting power and influence and began to manipulate the debt ratio to achieve self-interest. For example, they may increase debt to obtain more cash, therefore make suboptimum investment decisions or build a "management empire." However, when corporate managers hold a significant proportion of a firm's shares (over 63.5%), managers have their own interests aligned with those of shareholders. The entrenchment effect decreases, resulting in reduced debt ratio as managers seek to reduce bankruptcy risks, or alternatively, the agency-related benefits from the use of debt are substituted through managerial ownership.

Brailsford et al. (2002) examined the relationship between ownership structure and capital structure with a sample of top 500 companies listed on the Australian Stock Exchange over the period 1989 to 1995. Their results indicate a nonlinear inverted U-shaped relationship between the level of managerial ownership and leverage ratios. The results of the present study could supplement the evidence from Brailsford et al. (2002).

[Figure 1 here]

The regression results of models (1) and (2) and the estimated turning points are shown graphically in Figure 1. The track generated by model (1) displays a

nonlinear relationship between managerial ownership and Tobin's Q, indicating that firm value increases as managerial ownership rises from zero to 17.1% of P1 at point A. Firm value then decreases as board ownership increases, until another value of 67.1% of P4 at point D is reached. Finally, firm value increases slightly again for managerial ownership levels above 67.1%. The relationship between capital structure and managerial ownership is also non-monotonic, as described by the track generated by model (2). The value of capital structure decreases in managerial ownership less than 19.2% as described of P2 at point B, then the value increases until managerial shareholding reaches 63.5% of P3 at point C; while the value of leverage goes down again when the stake of managerial ownership is over 63.5%. However, P1 could be explained as the coincidence of P2; while P3 and P4 could also be coincident. The occurrence of these small differences may be because of statistical error.

Figure 1 clearly shows the three levels of managerial ownership. At a low level of managerial ownership (less than 20%), external discipline and internal controls or incentives dominate managers' behavior (Fama, 1980; Davies et al., 2005). Managerial labor markets operate on the principal that poorly performing managers can be removed and appropriately disciplined (Davies et al., 2005). Board members have sufficient incentive to adopt financial policies such as debt decisions that avert financial distress and achieve better firm performance. As the level of managerial equity ownership rises beyond a certain level (approximately 20%), managerial objectives begin to be entrenched. Internal mentoring and external discipline become weak. This lack of disciplinary control over management may strengthen managers' ability to pursue their own benefits at the cost of decreasing firm value by using suboptimal corporate policies. As the level of managerial ownership reaches a considerably high value (approximately 65%), managers align their interests with those of other owners, which leads to value maximization management behavior, as predicted by Jensen and Meckling (1976). Managers use less debt to avert being purchased or increase financial risk.

According to the results of OLS regressions, we conjecture that managerial ownership affects capital structure, which in turn affects firm value. However, we could not confirm this transmitting association without a stricter test. Next, we estimate a simultaneous equations model to test this relationship.

4.3 Managerial ownership, capital structure and firm value

To capture the potential multiple relationship between managerial ownership, capital structure and firm performance, we applied a set of simultaneous equations using the two-stage least square (2SLS) method.

$$\text{Managerial ownership} = f(\text{firm value, capital structure, ROE, liquidity}) \quad (3)$$

$$\text{Firm value} = g(\text{managerial ownership, capital structure, investment, size}) \quad (4)$$

$$\text{Capital structure} = h(\text{managerial ownership, firm value, ROE, liquidity}) \quad (5)$$

We estimate the simultaneous equations with control variables²⁹. ROE in equation (3) and equation (5) is defined as earnings before interest and taxes divided by total common equity. Liquidity is the common equity minus liquidation value. Although this paper discusses the intermediate function of capital structure, investment is nevertheless an important financial policy, so we used investment as a control variable of equation (4) and capital expenditure as a variable of investment, following Cho (1998) and Davies et al. (2005). Table 3 reports the regression results of the simultaneous equations. First, for the multiple relationships between managerial ownership, capital structure and firm value, as Cho (1998) and Himmelberg et al. (1999) document, once endogeneity is controlled, the perceived impact of managerial ownership on corporate value disappears. The results of the firm performance equation of model (4) in Table 3 suggests that the levels of board shareholding do not influence firm value directly, which contrasts with the OLS results of model (1). This evidence reflects the complicated causality between firm value and managerial ownership, and other variables may act as intermediates to assist managerial ownership, in turn imposing effects on firm performance. Capital structure has a negative influence on firm value, as described by the results of equation (4) — evidence of its intermediate function. Managerial ownership also has significant effects on capital structure, as shown in the result of capital structure³⁰ equation (5) in the last column of Table 3. Therefore, the results address the influence of managerial shareholding on capital structure, which in turn affects firm value.

[Table 3 here]

The results of equation (3) also suggest that the ownership of board directors is not significantly affected by Tobin's Q, which differs from the result found by Cho (1998), Kole (1994), and Davies et al. (2005), but is consistent with Demsetz and Villalonga (2001). In equation (3), ROE has an insignificant coefficient, which suggests that earnings have insufficient influence on managerial ownership. Cho

²⁹ This study also advances dummy variables representing industry effect, based on three-digit Standard Industrial Classification (SIC) codes. Because the variables of industry are not significant, we eliminated them.

³⁰ For the coefficients in the capital structure equation, each slope coefficient is of the correct sign and is statistically significant at the 5% level. The adjusted R square of model (5) is much higher than that of model (2). The extremum turning points of model (5) through a derivation are MANA = 20.8%, 61.9% — almost equal to that of model (2), which are 19.2% and 63.5%.

(1998) and Davies et al. (2005) used volatility in their managerial ownership equations and obtained similar results. Conversely, liquidity has a significant negative effect on managerial ownership in our model (3), while Cho (1998) found an insignificant effect and Davies et al. (2005) found positive effects from this variable. Thus, the relationship between managerial ownership and liquidity is controversial. Furthermore, the negative and significant coefficient of capital structure in model (3) suggests that board directors in firms with lower debt hold a larger fraction of their firm's shares.

The second column of Table 3 represents the coefficients of model (4). Capital expenditure, which is a proxy of investment in this study, slightly influences firm performance, but not quite significantly. This is consistent with the results of Cho (1998) and Davies et al. (2005)³¹ and to some extent represents evidence of relationship between investment and firm value. Relevantly, asset size is quite a significant determination of firm performance. Therefore, we also used company size as a control variable in equation (4). We measured firm size as the logarithm of the replacement cost of assets, following Cho (1998), to alleviate the possible size effect problem. As expected, firm value turns out to be a decreasing function of company size. McConnell and Servaes (1995) used the estimated replacement value of assets as a proxy for size, and found a negative relationship with Tobin's Q for all categories according to P/E ratios. However, the negative relationship is insignificant, which echoes the findings of McConnell and Servaes (1990), Miguel et al. (2004), and Berger and Patti (2006).

The significant negative coefficient of capital structure in equation (4) requires more discussion. Morck et al. (1988) found that leverage has a negative but insignificant impact on corporate value, and attributed this to the possibility that managers in highly leveraged firms might hold a higher than average level of ownership (Davies et al. (2005). However, contradicting these results, McConnell and Servaes (1990) report a positive significant coefficient for leverage ratio on firm performance. Leverage is one way of imposing external discipline on management and, if effective, leads to increased corporate value. Demsetz and Villalonga (2001) interpret the negative association between leverage and firm value as being due to the relative inflation between the current time period and the earlier time period when companies had issued much of their debt. In this study, the negative association between capital structure and firm value meets the requirement of being a transitional variable of managerial ownership on firm performance. Thus, we can take this negative relationship as indirect evidence of Hypothesis 2 and

Hypothesis 3, as discussed in theoretical predictions.

ROE measures a firm's efficiency at generating profits from every dollar of shareholders' equity. It shows how well a company uses investment dollars to generate earnings growth. ROE was found to be positive and significant related to the level of capital structure for the results of model (5). This suggests that firms with higher earnings have a higher debt capacity due to lower bankruptcy risks. Noticeably, some of the literature uses the accounting profit rate to measure firm performance, such as ROE in Demsetz and Lehn (1985), and profitability in Chaessens and Djankov (1999). However, some critics might say that accounting profit rate is backward-looking and Tobin's Q is forward-looking (Demsetz and Villalonga, 2001). Most of the more recent literature use Tobin's Q as a proxy for firm performance. Therefore, the negative influence (-0.06) of Tobin's Q on capital structure and the positive effect (0.05) of ROE on capital structure are consistent with our expectation. Firm liquidity has a positive influence on capital structure, but the effect is insignificant. Cho (1998) examined the relationship of liquidity and investment, and produced a significant positive coefficient. We viewed the other important result from the simultaneous equations as being the endogeneity of capital structure. The regression results of the last column in Table 3 also indicate that Tobin's Q negatively affects capital structure. Added to the effect of capital structure on firm valuation, firm performance and capital structure have a mutual influence, which reflects the endogenous character of capital structure. Taken together, the capital structure is not only an intermediate variable of influence between managerial ownership and firm value, but also an endogenous variable which should not be neglected in financial research practices.

Capital structure affects managerial ownership and firm value. Managerial ownership has an indirect influence on firm value, but has a significant effect on capital structure. Thereby, managerial ownership is not influenced by firm value, which is at odds with Cho (1998), Davies et al. (2005). The problem may rise from using different samples and data from former research. However, if the endogeneity of managerial ownership varies in different samples, it warrants further exploration and research. In summary, hypothesis 3 is partly proved by the results of the simultaneous equations. Managerial ownership affects capital structure, which in turn affects firm value. However, the endogeneity of capital structure is confirmed, while the endogenous managerial ownership is still controversial.

4.4 Robustness tests

Firstly, this section discusses the lagged dependent variables for model (1) and model (2). We examined the relationship between managerial ownership and firm value above, as well as the relationship between managerial ownership and capital structure separately for S&P 500 firms in 2005. However, the function of

³¹ Both these papers discuss the relationship of ownership structure and investment, which in turn affects corporate value. Therefore, we used the capital expenditure on firm value equation in this study as a control variable.

managerial ownership on firm value and on capital structure may display a time effect. Therefore, we conducted estimations by using Tobin's Q and capital structure of S&P 500 firms in 2006 and managerial ownership in 2005. We assumed that the managerial ownership impacts mainly on the firm value and capital structure of the next year. The results are described in Table 4.

[Table 4 here]

We used the value of the leverage variable and Tobin's Q for data from 2006 to build up a relationship with the one-year advanced value of managerial ownership in 2005. In model (1) of Table 4, significant coefficients and the predicted slope look similar to those without a time lag consideration, which is discussed in Section 4.1. The extremum turning points of managerial ownership with respect to firm value are 0.1759 and 0.7016. In model (2) of Table 4, after considering the time lag, the coefficients are noticeably less significant than previously; also, all the coefficients for managerial ownership are still significant at the 10% significance level. In summary, the results indicate that time effects do not alter the influence of managerial ownership on firm value and capital structure.

We also use piecewise regression with simultaneous equations to explore whether considering different ranges of managerial ownership produces results with significant differences from those estimated via models (3), (4), and (5). The sample consists of 353 S&P 500 companies in 2005. The models are as follows, and the estimations are reported in Table 5.

$$\text{Managerial ownership} = f(\text{firm value, capital structure, ROE, liquidity}) \quad (6)$$

$$\text{Firm value} = g(\text{piecewise managerial ownership, capital structure, investment, size}) \quad (7)$$

$$\text{Capital structure} = h(\text{piecewise managerial ownership, firm value, ROE, liquidity}) \quad (8)$$

The piecewise managerial ownership (MANA) in the firm value model (7) is defined by the results of turning points (17.1%, 67.1%) from equation (1):

$$\text{MANA}_{\text{up to } 17\%} = \text{managerial ownership if } \text{managerial ownership} < 0.17, = 0.17 \text{ if managerial ownership of firm } > 0.17.$$

$$\text{MANA}_{17\% \text{ to } 67\%} = 0 \text{ if managerial ownership } < 0.17, = \text{managerial ownership minus } 0.17 \text{ if } 0.17 < \text{managerial ownership} < 0.67, = 0.67 \text{ if managerial ownership} > 0.67.$$

$$\text{MANA}_{\text{over } 67\%} = 0 \text{ if managerial ownership of firm } < 0.67, = \text{managerial ownership minus } 0.67 \text{ if managerial ownership } > 0.67.$$

In the capital structure model (8), the three levels of managerial ownership are defined by two breaking points of 19% and 64%, which resulted from model (2) of 19.2% and 63.5%:

$$\text{MANA}_{\text{up to } 19\%} = \text{managerial ownership if } \text{managerial ownership} < 0.19, = 0.19 \text{ if managerial ownership of firm } > 0.19.$$

$$\text{MANA}_{19\% \text{ to } 64\%} = 0 \text{ if managerial ownership } < 0.19, = \text{managerial ownership minus } 0.19 \text{ if } 0.19 < \text{managerial ownership} < 0.64, = 0.64 \text{ if managerial ownership} > 0.64.$$

$$\text{MANA}_{\text{over } 64\%} = 0 \text{ if managerial ownership of firm } < 0.64, = \text{managerial ownership minus } 0.64 \text{ if managerial ownership } > 0.64.$$

[Table 5 here]

The results in Table 5 show that most coefficients are similar to those in Table 3. Managerial ownership in model (7), using three piecewise variables, remained an insignificant influence on firm performance. For the results in model (8), the coefficients of managerial ownership over 64%, and in the range between 19% and 64%, are insignificant in the 5% significant level. This may be due to the limited sample of firms in this range, compared to the multitude of sample firms in the range of managerial ownership up to 19%. However, the significant coefficient of MANA up to 19% still offers powerful evidence for prior prediction.

The other robustness test is for the measurement of firm performance. Cheng (2008) used a proxy of industry-adjusted Q, defined as the difference between the firm's Q and the average Q of the firms in the same two-digit SIC code industry in the same year. We used a similar method for calculation of industry-adjusted Tobin's Q, which is applied in model (1), and produced the following results:

$$Q = 12.72270 \text{ MANA} - 46.80451 \text{ MANA}^2 + 37.09186 \text{ MANA}^3 \quad (4.48) \quad (-3.57) \quad (2.91)$$

$$\text{Adj. } R^2 = 0.031, \quad \text{F-statistic} = 4.365, \quad \text{N} = 353$$

We then calculated points of extremum and intersection via derivation. The two extremum points are: MANA = 0.170 and MANA = 0.671

For the simultaneous equations using industry-adjusted Q, we derived similar results, as shown in Table 3. This indicates that the relationship between firm value and managerial ownership is not affected by industrial diversity. Himmelberg et al. (1999) employed the data from Compustat firms over a three-year period from 1982 to 1984 to investigate the relationship between managerial ownership and firm performance. After controlling for fixed three-digit SIC effects for each regression, our results are almost the same after adjustment of industry effects.

5 Conclusions

This paper extends the previous research (Morck et al., 1988; Cho, 1998; Short and Keasey, 1999; Davies et al., 2005) by introducing capital structure as an intermediate variable between managerial ownership and corporate value. Through a sample of 353 S&P 500 firms in 2005, this study applied two cubic

equations to explore the relationship between managerial ownership and firm performance, and managerial ownership and capital structure. The study also applied simultaneous equations in order to detect the interrelationship between managerial ownership, firm value, and capital structure.

First, we found a nonlinear relationship between Tobin's Q and the fraction of shares owned by a board of directors, which is consistent with the results of Morck et al. (1988), Cho (1998), Short and Keasey (1999), and Miguel et al. (2004). Tobin's Q, which is a proxy of firm performance, increases as managerial ownership grows until it reaches 17.1%. Thereafter, Tobin's Q declines with the decline in managerial ownership until it reaches 67.1%. Tobin's Q rises again slightly as managerial ownership increases higher 67.1%. We found that the two turning points were higher than those detected by Morck et al. (1988) and Cho (1998), using early period data from the Fortune 500. We strongly argue that, due to the evolution of corporate governance and changes of regulation, the managerial control for pursuing self-interest and alignment of interests between managers and other shareholders can only be approached by management holding more ownership than that in early time.

Second, the association between managerial ownership and capital structure is non-monotonic. A negative relationship exists between managerial ownership and leverage ratios when managerial ownership is below 19.2% or higher than 63.5%. Within the managerial ownership range 19.2% to 63.5%, the leverage ratio increases as the managerial ownership increases. These results imply that a transitional relationship exists between managerial ownership, capital structure, and firm value.

Third, by using a simultaneous equation regression, we found that managerial ownership does not influence firm value significantly when capital structure is added into the equation. However, managerial ownership significantly affects capital structure, and capital structure affects corporate performance directly. Meanwhile, capital structure is endogenously determined by both firm value and managerial ownership. Therefore, the results from this study address the influence of managerial shareholding on capital structure, which in turn affects firm value.

Furthermore, three intervals of managerial ownership exist, which have different effects on managers' financial decision making; namely, their selection of capital structure. Ultimately, the different capital structures have varying influences on firm value. When managerial ownership is less than 20%, managerial labor market and external discipline dominate managers' behavior. The incentive against firm value maximization can be removed. Managers are motivated to adopt financial policies (such as leverage ratio) to avert financial distress and acquire better firm performance. When managerial ownership is between approximately 20% and 60%, internal

monitoring and external discipline becomes less effective. The voting power of managers allows them to choose suboptimal capital structure for entrenchment and then decrease firm value. When managerial ownership exceeds a considerable level, perhaps 60%, management then has aligned interests with other shareholders, and managers choose optimal capital structure and thus increase firm value.

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Appendices

Table 1. Summary of main statistics

	Mean	Median	Maximum	Minimum	Std. dev	Skewness	Kurtosis
Managerial ownership	0.046	0.013	0.874	0.000	0.097	4.416	27.819
Tobin's Q	2.199	1.707	13.024	0.878	1.431	2.866	15.87
Capital structure	0.572	0.575	1.153	0.084	0.204	-0.062	2.621

Notes: Managerial ownership is the ratio of shares owned by all board members to total shares outstanding. Tobin's Q is the market value of assets divided by the book value of total assets. Capital structure is the ratio of total debt to total assets. The sample is 353 S&P 500 firms in 2005.

Table 2. Mean values of Tobin's Q and capital structure by managerial ownership levels

Managerial ownership	Number of firms	Mean Tobin's Q	Std. dev of Tobin's Q	Mean capital structure	Std. dev of capital structure
0 <= MANA < 5%	282	2.1352	1.419	0.5934	0.1976
5% <= MANA < 10%	28	2.4202	1.7988	0.4711	0.2039
10% <= MANA < 15%	13	2.9270	1.2600	0.4657	0.1395
15% <= MANA < 20%	12	2.5052	0.9719	0.4609	0.2794
20% <= MANA < 40%	7	2.3214	1.5675	0.5336	0.2331
40% <= MANA < 60%	4	1.9804	0.6132	0.5470	0.2152
60% <= MANA	2	1.4696	0.6575	0.5847	0.2303

Notes: MANA is the proportion of managerial ownership, which is the ratio of shares owned by all board members to total shares outstanding. Tobin's Q is the market value of assets divided by the book value of total assets. Capital structure is the ratio of total debt to total assets. The sample is 353 S&P 500 firms in 2005.

Table 3. Simultaneous regression analysis using two-stage least squares method

Variable	Managerial ownership (3)	Firm value (4)	Capital structure (5)
Constant term	0.099558 (4.46)***	7.135857(12.94)***	0.729157 (35.42)***
Tobin's Q	-0.004038 (-0.97)		-0.061894 (-8.75)***
ROE	0.004714 (0.76)		0.045399 (4.01)***
Liquidity	-7.60E-07 (-2.07)**		-3.22E-07 (-0.47)
Capital structure	-0.070173 (-2.48)**	-1.528850 (-4.09)***	
MANA		1.807075 (0.62)	-1.457348 (-3.46)***
MANA ²		-8.475954 (-0.70)	4.693926 (2.67)***
MANA ³		5.985242 (0.53)	-3.784003 (-2.31)**
Capital expenditure		5.74E-05 (1.59)	
SIZE		-1.027659 (-6.71)***	
Number of firms	353	353	353
Adj. R ²	0.019141	0.269374	0.227331

Notes: Tobin's Q is the market value of assets divided by the book value of total assets. ROE is earnings before interest and taxes, divided by total common equity. Liquidity is common equity minus liquidation value. Capital structure is the ratio of total debt to total assets. MANA is the proportion of managerial ownership — the ratio of shares owned by all board members to total shares outstanding. The quadratic and cubic terms of MANA are MANA² and MANA³. Size is the logarithm of total

assets. Managerial ownership is the ratio of shares owned by all board members to total shares outstanding. Capital structure is the ratio of total debt to total assets. The sample is 353 S&P 500 firms in 2005.

*** and ** represent significance at 1% and 5% levels respectively.

Table 4. Results of model (1) and model (2) by one-year lagged managerial ownership

	C	MANA	MANA ²	MANA ³	Adjusted R-squared	Number of firms
Model (1) Tobin's Q of 2006	2.005261 (21.44)***	7.686971 (2.56)**	-27.32867 (-2.18)*	20.76365 (1.77)*	0.012911	353
Model (2) capital structure of 2006	0.592953 (41.58)***	-0.839774 (-1.83)*	3.511276 (1.82)*	-3.165457 (-1.75)*	0.001471	353

Notes: Tobin's Q is the market value of assets divided by the book value of total assets. Capital structure is the ratio of total debt to total assets. MANA is the proportion of managerial ownership, which is the ratio of shares owned by all board members to total shares outstanding. The quadratic and cubic terms of MANA are MANA² and MANA³. The sample is 353 S&P 500 firms in 2005.

***, ** and * represent significance at 1%, 5% and 10% levels respectively.

Table 5. Robustness test using simultaneous regression with two-stage least squares method

Variable	Managerial ownership (6)	Firm value (7)	Capital structure (8)
Constant term	0.099558(4.46)***	7.161043(13.19)***	0.720942(35.67)***
Tobin's Q	-0.004038(-0.97)		-0.062804(-8.87)***
ROE	0.004714(0.76)		0.045708(4.03)***
Liquidity	-7.60E-07(-2.07)**		-2.20E-07 (-0.32)
Capital structure	-0.070173(-2.48)**	-1.524488(-4.08)***	
MANA _{up to 17%}		0.854469(0.52)	
MANA _{17% to 67%}		-1.852596(-1.18)	
MANA _{over 67%}		1.125821(0.17)	
Capital expenditure		5.73E-05 (1.59)	
SIZE		-1.032152(-6.76)***	
MANA _{up to 19%}			-0.743853(-3.42)***
MANA _{19% to 64%}			0.293408(1.23)
MANA _{over 64%}			-0.971243(-0.94)
Number of firms	353	353	353
Adj. R ²	0.019141	0.269532	0.221598

Notes: Tobin's Q is the market value of assets divided by the book value of total assets. ROE is earnings before interest and taxes, divided by total common equity. Liquidity is common equity minus liquidation value. Capital structure is the ratio of total debt to total assets. Size is the logarithm of total assets. Managerial ownership is the ratio of shares owned by all board members to total shares outstanding. MANA up to 17% = managerial ownership if managerial ownership < 0.17, = 0.17 if managerial ownership of firm >= 0.17. MANA 17% to 67% = 0 if managerial ownership < 0.17, = managerial ownership - 0.17 if 0.17 < managerial ownership < 0.67, = 0.67 if managerial ownership > 0.67. MANA over 67% = 0 if managerial ownership of firm < 0.67, = managerial ownership - 0.67 if managerial ownership > 0.67. MANA up to 19% = managerial ownership if managerial ownership < 0.19, = 0.19 if managerial ownership of firm > 0.19. MANA 19% to 64% = 0 if managerial ownership < 0.19, = managerial ownership - 0.19 if 0.19 < managerial ownership < 0.64, = 0.64 if managerial ownership > 0.64. MANA over 64% = 0 if managerial ownership of firm < 0.64, = managerial ownership - 0.64 if managerial ownership > 0.64. The sample is 353 S&P 500 firms in 2005.

*** and ** represent significance at 1% and 5% levels respectively.

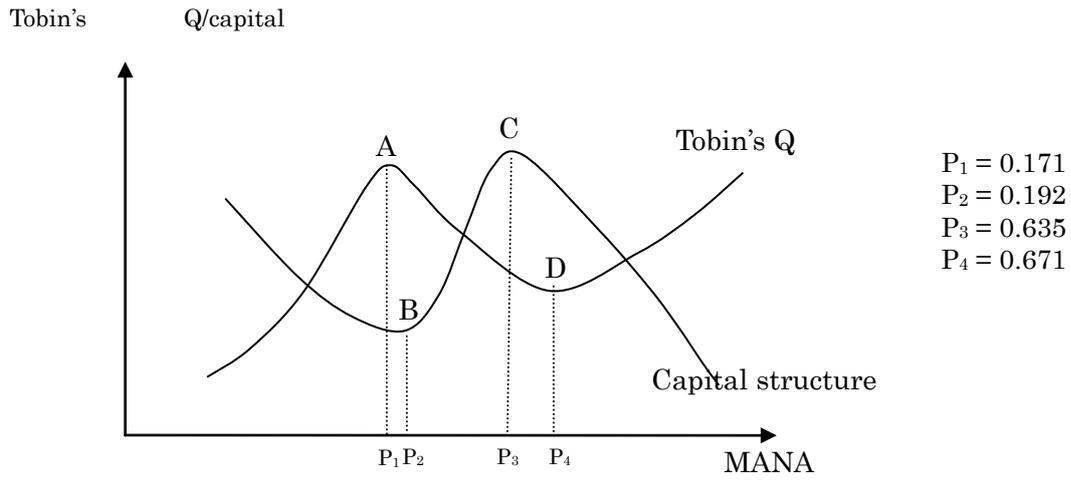


Figure 1. Relationship among firm value, capital structure and managerial ownership