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Dividend Policy, Managerial Ownership and Debt Financing: A Non-Parametric Perspective

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Dividend Policy, Managerial Ownership and Debt Financing: A Non-Parametric Perspective

Research Highlights

- The effect of managerial ownership on dividends is explored using a new approach.
- The dividend-ownership relation is non-linear with multiple turning points.
- It is increasing at high levels of ownership compatible with entrenchment.
- The relation is not increasing at ‘high’ ownership levels for high leverage firms.
- Dividends, ownership and debt are substitute mechanisms to reduce agency costs.

Dividend Policy, Managerial Ownership and Debt Financing: A Non-Parametric Perspective

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Abstract

This paper examines the relation between dividend policy, managerial ownership and debt-financing for a large sample of firms listed on NYSE, AMEX and NASDAQ. In addition to standard parametric estimation methods, we use a semi-parametric approach, which helps capture more effectively non-linearities in the data. In line with the *alignment effect* of managerial ownership, our results support a negative relationship between managerial ownership and dividends when managerial ownership is at relatively low levels. However, this negative relationship turns into a positive one at very high levels of managerial ownership. We also find that the nature of the relationship between managerial ownership and dividends may be more complex than it has been previously thought, and it also differs significantly across firms with different levels of debt/financial constraints. The results are consistent with the view that agency theory provides useful insights but cannot fully explain how firms determine their dividend policy.

JEL classification: G3; G32
Keywords: Dividends; Managerial Ownership, Semi-parametric Approach; Non-linearity, Capital Structure.

1. Introduction

The separation between ownership and control in large corporations creates fundamental conflicts of interest between managers and shareholders, which are commonly referred to as agency conflicts (Jensen and Meckling, 1976; Fama and Jensen, 1983). The main agency conflict centers around the use of *free-cash-flow* by managers; that is, the cash flow in excess of that required to fund all projects that have positive net present values (Jensen, 1986). The problem stems from self-serving managers who divert cash flow to benefit themselves (e.g. by increasing firm size to justify higher salaries, lavish expenses and excessive perks) at the expense of shareholders.

Various mechanisms have been proposed as potential solutions to the free-cash-flow problem.[1] Dividends, debt-financing and managerial ownership are three of the most important ones. Dividend payments have been interpreted as a "bonding" mechanism to resolve the conflict between managers and shareholders (Jensen and Meckling, 1976; Rozeff, 1982; Easterbrook, 1984; Jensen, 1986). This is because the payment/non-payment of dividends causes the firm to undergo a third-party audit (i.e. from equity markets), which results in lower agency costs. Debt-financing also works as a monitoring force for reducing agency-related problems (see Ross, 1977 and Stulz, 1990). The issuance of debt gives debt holders the option to take the firm into bankruptcy if managers default on their debt obligations.[2] Managerial ownership (at low levels) has been suggested as a third mechanism that helps align the interests of managers with those of shareholders. This is because managers who own equity in the firm will act as owners and reduce the degree of expropriation from outside investors (Jensen and Meckling, 1976) (*alignment effect*). At higher levels of managerial ownership, however, managers may exert insufficient effort, collect private benefits and entrench themselves at the expense of external shareholders (*entrenchment effect*).[3]

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[1] See Denis (2001) and Gillan (2006) for a comprehensive review of the literature on the different types of mechanisms available to firms.

[2] The "disciplinary" role of debt has been questioned by several researchers showing that debt facilitates expropriation when capital market institutions are ineffective (see e.g., Bunkanwanicha, Gupta and Rokhim, 2008).

[3] Demsetz and Lehn (1985), Stulz (1988) and Morck et al (1988), among others, have identified offsetting costs associated with high levels of managerial ownership. For example, by accumulating a large block of ownership and voting rights, a manager may have enough voting power and influence to guarantee his/her employment with the firm at an attractive salary (Morck et al., 1988). In an attempt to protect a managerial position, a manager may also impede the market for corporate control (e.g. act against a potentially beneficial acquisition for shareholders) by

This paper examines the relation between dividend policy, managerial ownership and debt-financing for a large sample of listed firms on NYSE, AMEX and NASDAQ. We build upon a large body of research showing that these mechanisms are not independent but are strongly related to each other, usually in complex ways (e.g. Jensen, 1986; Jensen, Solberg and Zorn, 1992; Schooley and Barney, 1994; Chen and Steiner, 1999; Farinha, 2003; Aggarwal and Kyaw, 2010; Lee, 2011; Belghitar and Khan, 2013). However, there is no consensus on whether these mechanisms work as substitutes or complements in reducing free-cash-flow problems. The purpose of this study is to provide further insights into this issue by adopting a semi-parametric perspective for examining how these mechanisms relate to one another. Our analysis contributes to the literature in the following three ways. First, in contrast to previous studies, we employ a semi-parametric approach, which helps capture more effectively non-linearities in the data. The implementation of semi-parametric estimation methods enables us to provide comprehensive evidence on the shape of the dividend-ownership curve and, in particular, to capture possible complex non-linear structures. Secondly, we examine whether the nature of the relationship between managerial ownership and dividends differs across firms with different levels of leverage/financial constraints. The fact that the latter investigation is conducted within a semi-parametric framework facilitates a better understanding of whether ownership, dividends and debt are substitute mechanisms in reducing agency costs of free-cash-flow. Thirdly, we re-assess the dividend-ownership relation under the prism of a large sample of US firms from 2001 to 2007, an interesting period followed by a sharp decline of dividend payments in the US. For example, Fama and French (2001) shows that firms paying cash dividends fell from 66.5% in 1978 to 20.8% in 1999, even after conditioning on firm characteristics. Our sample period also covers the 2003 dividend tax cut,[4] which increased dividend activity (mainly) through dividend initiations (see Brown, Liang, and Weisbenner, 2007).

requesting a high takeover premium (Stulz, 1988). High levels of managerial ownership also give management greater ability to control the board and undertake "manager-specific" investments, which makes it costly for shareholders to replace them (Shleifer and Vishny, 1989). Such manager-specific investments often involve opportunistic and risky projects that target to increase the size of the assets under their control, i.e., empire building (Stulz 1990).

[4] See the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of May 2003.

Our analysis reveals a number of interesting findings. First, in line with the *alignment effect* of managerial ownership, our findings support a negative relationship between managerial ownership and dividends when managerial ownership is at relatively low levels (i.e. <10%). This negative relationship turns into a positive one at very high levels of managerial ownership (i.e. >60%). This can be interpreted as evidence supporting the *entrenchment effect* of managerial ownership. However, the critical "entrenchment" level of managerial ownership estimated in our study (at around 60%) is significantly higher than the ones estimated in earlier studies by Schooley and Barney (1994) and Farinha (2003). Given that managers with equity stakes that exceed 60% are more likely to hold an underdiversified portfolio, the positive relation between dividends and managerial ownership is open to alternative interpretations. For instance, managers with undiversified wealth tied up to their own firm may place additional value on dividends for liquidity reasons (see Brown, Liang, and Weisbenner, 2007).

Second, our semi-parametric results suggest that there are more than one turning point in the managerial ownership-dividend relation. This does not support the U-shaped relationship suggested by previous literature and our parametric results. As explained below in more detail, such "complex" relationship cannot be adequately explained by any single theory, such as agency theory. In fact, one has to go beyond agency considerations and to consider signaling and tax clienteles theories to explain how firms determine their dividend policy (see e.g., Miller and Scholes, 1978; Lang and Litzenberger, 1989; Anderson and Kanatas, 1995; Allen, Bernardo and Welch; 2005) A close comparison between our parametric and semi-parametric results suggests that the semi-parametric model is more powerful to uncover the true link between dividends and ownership, and it is strongly preferred to the parametric non-linear model, which reflects a strict U-shaped relation.

Third, our findings suggest that the relation between ownership and dividends for high-leverage firms is different from that for low-leverage firms. Interestingly, we find that the substitution effect between dividends and managerial ownership is only observed in high-leverage firms. This goes against the notion that the negative relationship between managerial ownership and dividends should be more pronounced in low-leverage (or all-equity) firms, since they have greater free-cash-flows and lack a mechanism (i.e. debt) for controlling agency costs (see Agrawal and Jayaraman, 1994). We interpret this as further evidence that dividend policy cannot be fully explained in the context of agency theory.

The remainder of the paper is organized as follows. Section 2 provides a brief literature review. Section 3 outlines the semi-parametric approach employed in this study. Data and variables are discussed in Section 4. The empirical findings and their interpretation are provided in Section 5. Section 6 presents some robustness checks while Section 7 concludes.

2. Related Literature

Agency problems related to the use of free-cash-flow are commonplace in public firms. They arise from conflicts of interest between managers and shareholders (Jensen and Meckling, 1976). In an attempt to maximize their own welfare, managers may be tempted to build empires, collect private benefits, undertake manager-specific investment projects[5] and entrench themselves, usually at the expense of shareholders.[6]

Dividend payments, debt issuance and managerial ownership have been proposed as three of the most important mechanisms that can mitigate the free-cash-flow problem. Despite a large body of research that looks at the effectiveness of these mechanisms in resolving agency problems (see Denis, 2001 and Gillan, 2006 for comprehensive reviews of the literature), there is still no consensus on how these mechanisms relate to one another and whether they "work" in substitute or complementary ways. Furthermore, several studies demonstrate the existence of non-linearities of ownership structure with respect to debt and dividends (see e.g. Schooley and Barney, 1994; Farinha, 2003; Florackis and Ozkan, 2009). In particular, Jensen (1986) argues that debt and dividends are substitute mechanisms for reducing the discretionary resources under managers' control, which implies a negative relationship between the two. Several studies report evidence that supports a negative relationship between debt and dividends (see e.g. Jensen, Solberg and Zorn, 1992; Chen and Steiner, 1999). However, Eckbo and Verma (1994), De

[5] That is, opportunistic and risky projects that target to increase the size of the assets under their control, i.e., empire building (Shleifer and Vishny, 1989; Stulz 1990).
[6] See discussion in Footnote 3 and also Gadhoum, Y. (1999) and Florackis, Ozkan and Kostakis (2009) for details on the most common entrenchment strategies adopted by managers.

Miguel, Pindado and de la Torre (2005) and Aggarwal and Kyaw (2010) find a significant positive relationship between leverage and dividend payout ratios.

Dividends also relate to managerial ownership in a statistically significant way. If dividends and managerial ownership are substitutes for reducing free cash flow–related agency costs, then their relation should be negative (see e.g. Jensen, Solberg and Zorn, 1992; Chen and Steiner, 1999; Lee, 2011). Several authors, however, have argued that the dividend-ownership relation may not be strictly negative; it may actually turn positive above a certain ownership level due to entrenchment. Entrenched managers do not treat dividends and debt as substitutes at high ownership levels, and thus increase dividends as ownership levels increase. This suggests a U-shaped dividend-ownership relation, which captures both the alignment and entrenchment effects. Empirical studies, have found evidence of this shape for US and UK firms (see Schooley and Barney, 1994 and Farinha, 2003).

Regarding the relationship between debt and managerial ownership, the evidence is mixed too. Several studies document a positive relationship between debt and managerial ownership (e.g. Kim and Sorensen, 1986; and Mehran, 1992). Such a positive relationship is justified by managerial preferences to maintain their control within the firm and avoid the agency costs of external equity (see Florackis and Ozkan, 2009). Another strand of research reports a negative link between debt and insider ownership (see Friend and Lang, 1988; Chen and Steiner, 1999; De Miguel, Pindado and de la Torre, 2005). De Miguel, Pindado and de la Torre (2005) interpret the negative relationship as evidence of managerial risk aversion; that is, managers diversify away their (excessive) risk exposure to their own firm by selling their holdings when the probability of default is high. There have also been some studies that provide evidence for a non-linear relation between debt and managerial ownership (see, Florackis and Ozkan, 2009; Brailsford et al., 2002).

From a theoretical standpoint, one can go beyond agency theory to explain the drivers of corporate dividend policy and its relation to managerial ownership and debt. The pecking order theory of Myers and Majluf (1984) predicts that firms prioritize their sources of financing as follows: first they raise internal financing, then they issue external debt and finally they issue equity. This prioritization implies a positive relationship between debt and dividends. This is because a high dividend payout reduces the level of free-cash-flow (internal resources) and, as a result, increases the need for raising external debt in order to maintain an optimal capital structure (see also Aggarwal and Kyaw, 2010). Firms that pay dividends are also expected to have easier access to external capital (see Harford, Klasa, and Maxwell, 2014). The positive relationship between debt and dividends goes against Jensen's (1986) prediction of a trade-off between debt and dividends.

Companies also pay dividends for signaling purposes. Bhattacharya (1979) and Miller and Rock (1985) develop signaling models that account for asymmetric information between managers and shareholders. The role of a dividend payout in an imperfect information setting is to release private information to the market. Debt issuance (mainly in the form of short-term financing) may be also used as a signaling device (see Ross, 1977; Flannery, 1986). This implies that debt and dividends may be used as alternative signaling mechanisms by firms. However, several additional factors influence the propensity to signal quality through dividend payments as well as the overall propensity to pay dividends (e.g. a firm's life-cycle which determines the need to distribute or retain free-cash-flow (see DeAngelo, DeAngelo and Stulz, 2006)).

Finally, following the studies of Miller and Modigliani (1961), Miller (1977) and Miller and Scholes (1978), there are several tax-related explanations for debt and dividend policies. Elton and Gruber (1970) find that a change in dividend policy affects shareholder wealth. In their framework, shareholders in higher tax brackets prefer capital gains over dividends relative to those in lower tax brackets. More recently, Allen, Bernardo and Welch (2000) develop a theory based on the assumption that institutional investors have a tax advantage relative to individual investors. This induces "dividend clientele" effects (e.g. the increase the propensity of institutions to invest in dividend-paying stocks).[7] An important implication of Allen, Bernardo and Welch's (2000) model for our study is that debt and dividends play a similar monitoring role but they cannot be treated as perfect substitutes. This is because institutions that hold equity (and hence receive dividends) can influence management through exit (e.g. selling their equity stakes) or

[7] On the empirical side, there are several studies supporting the existence of tax-based dividend clienteles, both for the case of institutional and retail investors. For example, Desai and Jin (2011) show that institutional investors do care about the tax consequences of firm payout policy and, as a consequence, firms adjust their payouts based on their investors' tax preferences. Graham and Kumar (2006) confirm the existence of tax-induced dividend clienteles for retail investors.

through formal involvement in the corporate governance process. However, institutions that hold firms' debt instruments have limited influence over manager until a company files for bankruptcy.

3. Methodology

Prior studies consider dividend policy, denoted by *DIV*, to be a function of managerial ownership, *MAN*, and a set of other control variables collected in vector *X*. A common representation of this relationship is the following linear parametric model:

$$E(DIV \mid \mathrm{MAN}, X) = \alpha + \beta' X + \gamma MAN \quad (1)$$

This parametric specification is quite restrictive and it is not based on solid theoretical foundations. To the contrary, we allow for a non-parametric dividend-ownership relationship to be estimated from the data.[8] These methods let data determine an appropriate model rather than imposing a specific parametric assumption on the data generating process. In this way, non-parametric methods are not subject to severe misspecification problems (see Racine, 2008).[9]

Misspecification is a particularly important concern when the examined relationship is non-linear. To address this concern using parametric techniques, power transformations of the variables are typically used (e.g., quadratic models). Apart from the difficulty in choosing the correct power transformation, these are global rather than local fits. Using a global fit, one assumes that the relationship between *DIV* and *MAN* does not vary over the entire range of *MAN*. This is again a rather strict assumption, since the relationship between these two variables can be specific to local regions of *MAN*. Non-parametric techniques avoid this issue as they are flexible enough to provide local estimates of the relationship (see Keele, 2008).

Local fit is particularly desirable when the examined relationship is highly non-linear, exhibiting multiple turning points. Parametric techniques try to capture such a relationship using

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[8] The fundamental advantage of non-parametric estimation methods over parametric ones is that they do not require the specification of a functional form for the relationship between the variables under examination.

[9] It is also important to recall that testable theories typically indicate the direction (sign) of a relationship between two or more variables rather than the exact functional form of the relationship (see Beck and Jackman, 1998, for a critical overview of this issue). Therefore, relying solely on parametric techniques could prove inappropriate to test such hypotheses.

piecewise regression models or adding higher order polynomials in equation (1) above.[10] However, this approach is suboptimal as one has to exogenously impose the turning points of the relationship and then estimate these models. Non-parametric techniques avoid this problem, as the local fit endogenously produces these turning points.

While non-parametric estimation methods are much more flexible than parametric ones, they become rather computationally intensive as the number of regressors increases. Estimating multidimensional non-parametric models is a cumbersome task. The solution to this problem is the use of semi-parametric techniques that combine a non-parametric estimation with respect to the variables for which we suspect a highly non-linear relationship while assuming a parametric approach for the rest control variables (see Keele, 2008, for an overview of semi-parametric estimation methods).

To this end, we also use a semi-parametric model, which relaxes the functional form on *MAN* but still controls for the other variables that determine dividends in a parametric way. In this case, the conditional mean of the model is given by:

$$E(DIV \mid \mathrm{MAN}, X) = \alpha + \beta' X + f(MAN) \tag{2}$$

where $\alpha + \beta' X$ represents the parametric component and $f(MAN)$ the non-parametric one. The non-parametric component, $f(MAN)$, is estimated using splines with optimal basis functions, a method discussed analytically in Keele (2008). The logic behind a spline is to estimate separate regression lines that are joined at the corresponding knots. An important advantage of the splines methodology, in comparison to the commonly used piecewise regressions, is that it does not pre-specify ad hoc cutoff points. The employed methodology in this study minimizes the following objective function:

$$\min\left\{\frac{1}{n}\sum_{i=1}^{n}(DIV_i - f(MAN_i) - \alpha - \beta' X)^2 + \lambda J\right\} \tag{3}$$

where *J* represents the roughness of the function *f* and *n* denotes the number of observations.[11]

[10] See, for example, the studies of McConnell and Servaes (1990) and Sueyoshi, Goto and Omi (2010).
[11] Equation (3) is equivalent to minimizing the sum of squared residuals in the case of ordinary least squares (OLS). The main difference here is the presence of the term λJ.

The previous expression describes the trade-off between fitting perfectly the data (i.e. minimizing the squared residuals) and having the smoothest possible approximating function *f*. This trade off is controlled by parameter λ. As $\lambda \rightarrow \infty$, the penalty assigned to the roughness of the function is so high that the optimal function, f, is of linear form, since, by definition, a linear function has zero roughness for the whole range of the dependent variable values. In this case, the minimization problem becomes identical to least squares. On the other extreme, if $\lambda \rightarrow 0$, then this methodology will provide a very rough approximating function *f* that essentially fits each individual observation. [12]

Previous studies that employ a non-parametric approach use smoothing splines (e.g. Engle et al., 1986). In this study, instead of smoothing splines we employ penalized regression splines. Even though these two approaches yield similar results in practice, penalized regression splines use fewer parameters and, therefore, are computationally more efficient. This choice implies that the objective function becomes:

$$\min\left\{\frac{1}{n}\sum_{i=1}^{n}(DIV_i - f(MAN_i) - \alpha - \beta' X)^2 + \lambda \int f''(MAN_i)d(MAN)\right\} \tag{4}$$

where $f(MAN)$ is a thin plate regression spline and f'' stands for the second derivative of f. This spline is constructed by starting with the basis for a full thin plate spline and then truncating this basis in an optimal manner to obtain a low rank smoother. Details of this procedure are provided in Wood (2006). The roughness of the function $f(MAN)$ is captured by its curvature $\int f''(MAN)d(MAN)$. [13]

The above methodology essentially refers to a penalized likelihood maximization problem solved by Penalized Iteratively Reweighted Least Squares (P-IRLS) (see Keele, 2008, ch. 5, for a description of the procedure). The selection of the optimal smoothing parameter λ is integrated

[12] We minimize the expression in equation (3) and subsequent equations with respect to *i)* the parametric coefficients α and β; *ii)* the optimal smoothing parameter λ and *iii)* the determinants of the spline f(MAN) (e.g. slopes of piecewise regression lines, location of knots).

[13] The logic behind the use of the integrated squared second derivative of *f*(.) is fairly intuitive. The second derivative measures the rate of change of the slope for a function or curvature. A large value for the second derivative means high curvature and vice versa. Through the use of the squared integral, the term sums a measure of curvature along the entire range of the nonparametric estimate, in essence giving us a measure of curvature along the range of the nonparametric estimate. When it is large, *f*(.) is rougher, and when it is small, *f*(.) is smoother.

in this procedure using the Generalized Cross Validation (GCV) criterion. According to this criterion, the optimal λ minimizes the following expression:

$$GCV(\lambda) = \frac{RSS(\lambda)}{\left[1 - n^{-1} tr\left(S(\lambda)\right)\right]^2} \tag{5}$$

where $RSS(\lambda) = e'e$ is the sum of squared residuals of the estimated model for a given λ and $tr\left(S(\lambda)\right)$ is the trace of the projection matrix $S(\lambda)$ that satisfies $\hat{DIV} = S \times DIV$. For each of the models estimated in this study, the corresponding minimized GCV scores are also reported.[14]

This methodology also allows us to construct confidence bands for the fitted spline $\hat{DIV} = S \times DIV$. Its covariance matrix is given by $\mathrm{cov}(DIV) = SS'\sigma^2$, where σ^2 is the residuals' variance. Given an unbiased estimator for this variance and a large sample size, we can form approximate 95% pointwise confidence interval bands, using ± 2 times the square root of $SS'\sigma^2$.

Furthermore, this methodology enables us to test the statistical significance of the non-parametric component in the specified semi-parametric model. This is done via an F-test that compares the sum of squared residuals (RSS) of the semi-parametric model (unrestricted) with the RSS of the restricted model that excludes the non-parametric component altogether. The corresponding F statistic is given by:

$$F = \frac{\left(RSS_{restricted} - RSS_{unrestricted}\right) / \left(tr\left(S\right) - 1\right)}{RSS_{unrestricted} / df_{res,unrestricted}} \tag{6}$$

where $df_{res} = n - tr(2S - SS')$. This test statistic under the null hypothesis of equal RSS follows an approximate F-distribution with $df_{res,restricted} - df_{res,unrestricted}$ and $df_{res,unrestricted}$ degrees of freedom.

Similarly, we are also able to test whether the semi-parametric model has superior explanatory power in comparison to a fully parametric model. Since we employ P-IRLS, a Likelihood Ratio test can be used as follows:

$$LR = -2\left(LogLikelihood_{restricted} - LogLikelihood_{unrestricted}\right) \tag{7}$$

[14] For the estimation procedure, this study uses the *gam* function of the mgcv package in *R*.

This test compares the log-likelihood of the fully parametric model (restricted) with the log-likelihood of the semi-parametric model (unrestricted). The test statistic under the null hypothesis of equal likelihoods follows an approximate χ^2 distribution with degrees of freedom given by the difference in the number of parameters across the two models.

4. Data and Variables

The dataset employed in the present study covers the period 2001-2007 and it is carefully compiled from different sources. Data on dividends, leverage (external debt) and other accounting and market variables are collected from *Thomson DataStream*. For managerial ownership, board structure, and several other board and director characteristics (see Table 1 for the complete list of variables), information is obtained from *Board Analyst*. We match *Board Analyst* data at the company level with accounting and market data obtained from *Thomson DataStream*. We impose several screening criteria to our dataset. First, we exclude firm-year observations with missing values. Second, we exclude firm-year observations that lie outside the *1st* and *99th* range for each variable. Third, we remove from the dataset all non-US firms that are listed on NASDAQ, NYSE and AMEX, and also exclude ADRs, REITs, subsidiaries and OTC firms, because of their different regulatory, reporting and administrative regimes. Data for all variables are reported in financial year end. These criteria lead to a final sample that comprises of 7,376 firm-year observations.

Following Michaely and Roberts (2012), the dependent variable in our study, dividends, is defined as total dividends to total assets. We also use the ratio of dividends to profits to ensure the robustness of our results.[15] The main explanatory variable is managerial ownership defined as the percentage of shares held by the management and directors, as reported in the company's most recent proxy statement. A set of controls is used in our empirical models to "partial out" the effect of other variables on dividends. For instance, earlier research has shown that dividend payout is significantly associated with firm size, profitability, leverage and investment ratios (see Fama and French, 2001; Benito and Young, 2003 and Michaely and Roberts, 2012). Accordingly,

[15] Similar definitions have been employed by other authors (see e.g. Farinha, 2003 and Khan, 2006; Farinha and Foronda, 2009). All unreported results are available upon request by the authors.

our list of control variables includes commonly used accounting measures (investment, cash holdings, leverage and firm size) and a performance measure (Tobin's Q).[16] We also control for governance quality through a series of corporate governance measures (board structure, board size and a plethora of other board and director characteristics). Controlling for the impact of governance is important because earlier research has shown that *(i)* governance quality significantly affects critical corporate decisions such as dividend policy (see Jiraporn, Kim, and Kim, 2011) and *(ii)* the relation between payout and corporate governance is contingent upon the relative sizes of agency and external financing costs (see Chae, Kim and Lee, 2009).[17] Industry dummies have also been used as explanatory variables. Our complete list of control variables with their respective definitions is provided in Table 1. Table 2 presents descriptive statistics for all variables used in our analysis.

[Tables 1&2 about here]

5. Results

5.1 The Nature of the Dividend-Ownership Relation

Table 3 and Figure 1 present the parametric and the semi-parametric findings based on the full sample of 7,376 observations. The parametric estimation reveals that both the managerial ownership and the squared managerial ownership terms are statistically significant. Thus, the parametric findings support a U-shaped relationship between dividends and managerial ownership. In addition, control variables that are also significant include firm size, leverage, Tobin's Q, board size, the percentage of independent directors and outside directors (among others). The R-squared is equal to 0.11 and the GCV score is 0.000617.

[Table 3 about here]

[16] Our list of control variables does not include cash flow and sales growth due to the high correlation of these variables with Tobin's Q.

[17] Our specification controls for corporate governance through a series of board- and director-specific characteristics rather than through the indexes GINDEX and OINDEX as in Chae, Kim and Lee (2009). An advantage of our approach is that our governance proxies are updated yearly while data on GINDEX and OINDEX are not available on a yearly basis.

Turning to the semi-parametric results, we observe that nearly all of the control variables that are found to be statistically significant under the parametric model are also significant under the semi-parametric model, including the corporate governance indicators. The R-squared (equal to 0.112) is marginally higher than the one under the parametric estimation, and the GCV score, defined in (5), is now lower. On the basis of the *F*-test, defined in (6), the non-parametric term is strongly statistically significant (*p*-value <0.01). Importantly, the *p*-value of this *F*-test is lower than the *p*-value of the test for the significance of the ownership squared term in the parametric specification. Comparing the parametric and the semi-parametric specifications using the LR test, defined in (7), we obtain a test statistic with *p*-value of 0.00. This finding suggests that the semi-parametric model has superior explanatory power in comparison to the fully parametric model and thus, the former is preferred to the latter.

The relation between managerial ownership and dividends, which is obtained from the semi-parametric specification, is illustrated in Figure 1 along with the 95% confidence bands. This figure reveals that the relation is likely to have more than one turning point, as it would be the case under the U-shaped hypothesis. Two obvious turning points are at 10% and 60% levels of managerial ownership. Therefore, the relation is non-linear and the nature of non-linearity is more complex than has been previously considered. In particular, in line with the *alignment effect* of managerial ownership, our findings support a negative relationship between managerial ownership and dividends when managerial ownership is at relatively low levels (i.e. <10%-see Region A of Figure 1). For ownership levels between 10% and 60%, the relation appears to be largely flat with possibly minor turning points (see Region B). The relationship turns into a positive one at very high levels of managerial ownership (i.e. >60%-see Region C). As discussed below in detail, these findings suggest that one need to go beyond agency theory to explain the relation between dividend policy, managerial ownership and debt-financing.

[Figure 1 about here]

5.2 The Dividend-Ownership Relation for Low-Leverage Firms

We next consider two groups, namely the low-leverage and the high-leverage firms. Companies are assigned into each group according to their (industry-adjusted) leverage ratio using the 33th and 67th percentiles as cut-off points.[18] This analysis allows testing for potential interactions between dividends, managerial ownership and debt financing.

Panel A of Table 4 and Figure 2a report the results for low leverage firms as obtained from the parametric and the semi-parametric specifications. The parametric results reveal that the ownership and ownership squared terms are now insignificant, suggesting that for this group of firms, there is no significant relation between managerial ownership and dividends. On the basis of the F-test, the semi-parametric specification reveals that ownership is statistically significant (F-test = 2.00, p-value=0.04). In addition, the R-squared of the semi-parametric specification is larger that that of the parametric model. Thus, for low-leverage firms, the semi-parametric model is capable of revealing a significant dividend-ownership relation which is not detected by the parametric approach. The significant relation is likely to be driven by the positive relationship between dividend and managerial ownership for ownership levels greater than 60%. The relation between managerial ownership and dividends that is obtained from the semi-parametric specification is illustrated in Figure 2a.

[Table 4 about here]

[Figures 2a & 2b about here]

5.3 The Dividend-Ownership Relation for High-Leverage Firms

Panel B of Table 4 and Figure 2b contain the corresponding results for the group of high-leverage firms. The parametric results reveal evidence of linearity only, since the coefficient of the squared ownership term is not significant. The semi-parametric specification indicates that the non-parametric term is now not significant (F-test = 1.27, p-value = 0.28). In addition, the R-squared and the GCV score of the semi-parametric model are very close to the corresponding statistics of the parametric model. The LR test fails to indicate the semi-parametric model as

[18] The results remain qualitatively similar when the 45th and then 55th percentiles are used as cut-off points.

superior to the parametric one. These results are markedly different from those obtained for all firms and for the group of low-leverage firms. They suggest that for high-leverage firms the dividend-ownership relation is much simpler, in the sense that the non-parametric term is not needed. More specifically, the results suggest a negative relationship between dividends and managerial ownership, which holds only at low levels of managerial ownership and is not followed by any turning point.

Given the potentially important implications of this finding, we carry out further tests to shed light into the nature of the relation. In particular, we seek to examine if a decay function specification better characterizes the relation and to compare the linear specification with the decay specification. We parametrically transform the ownership variable using the function *exp(-MAN)*, where *MAN* is the managerial ownership variable, and estimate the following model:

DECAY MODEL: $$DIV = a + b_1 \exp(-MAN) + cX + u \quad (8)$$

where X is the vector of control variables. The above model, denoted as the DECAY model, contains the same explanatory variables as the parametric model except that the ownership variable is replaced by *exp(-MAN)*. We then compare this model with the linear specification, denoted as the LINEAR model, and the squared specification, denoted as the SQUARED model, using Davidson and MacKinnon (1981) *J*-test. The LINEAR and the SQUARED models are respectively:[19]

LINEAR MODEL: $$DIV = a + k_1 MAN + \phi X + u \quad (9)$$

SQUARED MODEL: $$DIV = a + \lambda_1 MAN^2 + \mu X + u \quad (10)$$

The results reported in Table 5 reveal that the DECAY specification is superior to both the LINEAR and to the SQUARED specification. The latter finding suggests that for the high-leverage group of firms, there in no turning point in the relation. This presumption is reinforced by the illustration of the relation in Figure 2b. The noteworthy difference between Figures 2a and Figure 2b is that dividends are not increasing at high levels of managerial ownership for the case of high-leverage firms.

[19] Industry dummy variables are also included as explanatory variables in (8), (9) and (10).

[Table 5 about here]

5.4 Discussion of Results

The U-shaped relationship between dividends and managerial ownership supported by our parametric results can be interpreted through the managerial entrenchment hypothesis. According to Jensen and Meckling (1976), when managers hold little equity and shareholders are too dispersed to take disciplining action, insiders deploy corporate assets to obtain personal benefits. As insider ownership increases, managers bear a larger share of agency costs. However, according to Demsetz (1983) and Fama and Jensen (1983), managers holding a substantial portion of equity obtain enough voting power to ensure that their position is secure and thus, they become insulated from external disciplining forces. This entrenchment hypothesis has important implications for the dividend-ownership relation, suggesting a U-shaped relation. Specifically, below a certain ownership level, dividend and ownership are substitutes and thus, they are negatively related. However, this negative relation may be reversed due to the fact that in higher ownership firms dividends do not play an important role in mitigating agency problems. Rather, managers with significant ownership stakes are more likely to be entrenched, which significantly increases their propensity to pay dividends (see Hu and Kumar, 2004; Jo and Pan, 2009). Empirical evidence of this hypothesis has also been reported by Schooley and Barney (1994) for US firms, and Farinha (2003) for UK firms.

Our semi-parametric estimates support a more complex relation between managerial ownership and dividends, which is characterized by more than one turning point. Two obvious turning points are at 10% and 60% levels of managerial ownership. In particular, at low ownership levels (below 10% approximately), there is a negative dividend-ownership relation. This is in line with the hypothesis that managerial ownership and dividends are substitute mechanisms for reducing agency costs. For ownership levels between 10% and 60%, the relation appears to be largely flat (with possibly minor turning points that cannot be identified for certain due to the large confidence bounds observed in the curve). The flat relationship may be explained by the existence of multiple clienteles (e.g. managers holding a substantial amount of shares *vs.*

large institutional investors), which may be subject to heterogeneous dividend tax rates and differential preferences for free-cash-flow (see Eckbo and Verma, 1994).[20] It may also be explained by the fact that managers with relatively large ownership stakes (>10%) may refuse to further cut dividends for diversification purposes. A high ownership stake in their own firm usually renders managers' portfolios under-diversified (see Florackis, Kostakis and Kanas, 2014). These managers may place additional value on dividends for liquidity reasons, an action stemming from their inability to hedge their portfolio positions by selling short their own firm's stock.[21] A third, although not mutually exclusive explanation, is as follows. A relatively high level of managerial ownership (>10%) works by itself as a signal of good quality and governance. This may attract large, activist, institutional, tax-exempt shareholders, who are especially reluctant to cut dividends (see Allen, Bernardo and Welch; 2005). This is consistent with the presence and stickiness of dividends. The flat relationship between managerial ownership and dividends turns into a positive one at very high levels of managerial ownership (i.e. >60%). This seems consistent with the entrenchment hypothesis of Hu and Kumar (2004) and Jo and Pan (2009), suggesting that managers with very large shareholdings become entrenched and increase their propensity to pay dividends. However, the second turning point is observed at particularly high ownership levels (at around 60%). This suggests that alternative interpretations are also possible. For example, managers who have undiversified wealth with large company stock ownership (>60%) are likely to place additional value on dividends for liquidity reasons (see also Brown, Liang, and Weisbenner, 2007)). As a result, they are willing to retain or even increase dividends to satisfy their liquidity needs. Taken together, our semi-parametric results reject the strict U-shaped non-linearity suggested by previous literature (see Schooley and Barney, 1994; Farinha, 2003). It seems that dividend policy of US firms over the period 2001-2007 cannot be adequately explained by agency theory. In fact, one has to also consider alternative and possibly complementary theories such as signalling and tax clientele.

[20] In support of this view, Garcia-Cestona and Surroca (2008) show that outside and inside shareholders of Spanish saving banks have materially different goal priorities.

[21] Hedging through selling shares is costly (or even prohibited) due to regulatory and reputational issues associated with insider trading (see Florackis, Kostakis and Kanas, 2014 & Leland, 1992)

Our findings on the relation between dividends and managerial ownership for high/low leverage firms lead to several interesting inferences. The substitution effect between dividends and managerial ownership is only observed in high-leverage firms (i.e. only at low levels of managerial ownership). This finding in accordance with Crutchley and Hansen (1989), who concluded that there exist substitution effects between dividend payments and two other control mechanisms, namely managerial ownership and leverage. However, this is inconsistent with Agrawal and Jayaraman's (1994) view that the negative relationship between managerial ownership and dividends should be more pronounced in low-leverage (or all equity) firms, since they have greater free-cash-flows and lack a mechanism (i.e. debt) for controlling agency costs. This constitutes further evidence that one has to go beyond agency theory, and consider signaling and tax clientele theories, to adequately explain dividend policy.

Another interesting finding that emerges from the analysis of high-leverage firms is that there is no upward sloping relation, indicating that entrenched managers fail to pay more dividends at high levels of ownership, supporting the "entrenchment irrelevance hypothesis". Conversely, dividends are an increasing function of managerial ownership at ownership levels exceeding 60% for the case of low-leverage firms. In other words, our results suggest that there exists a link from debt to managerial ownership, as was also supported by Friend and Lang (1988). This finding suggests that high leverage exercises a negative effect upon entrenchment-related agency costs which are consequently largely mitigated. This is in line with the view that leverage may negatively affect entrenchment and mitigate entrenchment-related agency costs through monitoring. High debt increases the level of monitoring by capital markets, and higher monitoring possibly entails reduced entrenchment-related agency costs (see Rozeff, 1982; Easterbrook, 1984). This is also in accordance with Jensen's (1986) argument that leverage reduces agency costs. According to this argument, debt commits firms to disgorge cash and constrains managers from driving 'free' cash flow to pursue personal goals.[22] Furthermore, according to Zwiebel (1996), debt increases the likelihood of bankruptcy, which in turn reduces entrenchment effects. In such an environment, paying dividends reduces cash holdings thereby

[22] This argument underlies models by Grossman and Hart (1982), Stulz (1990) and Hart and Moore (1990).

leaving the firm more vulnerable to takeovers and further increasing the likelihood of bankruptcy and the effects of entrenchment. Thus, our results for high leverage firms is in line with Zwiebel (1996), who argues that debt restricts managerial empire-building.

6. Robustness Checks

6.1 Leverage vs. Financial Constraints

To examine whether these results are driven by the definition of leverage, we alternatively classify firms into different groups according to their degree of financial constraints. After controlling for industry effects, we use the index of financial constraints proposed by Kaplan and Zingales (1997) (KZ-index) and divide firms into two groups, namely a group of firms that are more financially constrained and a group of firms that are less financially constrained.[23] Since high levels of debt are related to severe financial constraints, we seek to examine whether the relation for the group comprising of firms with high KZ-index values is similar to the relation documented for high-leverage firms. The corresponding results are reported in Table 6.

As shown in Panel A of Table 6, the non-parametric term is strongly statistically significant for the group of the least constrained firms. Furthermore, the *R*-squared (GCV score) of the semi-parametric model is much higher (lower) than the *R*-squared (GCV score) of the parametric model. The LR test suggests that the semi-parametric model is superior to the parametric one, in line with the results reported for low-leverage firms. For the most constrained firms (Panel B), the non-parametric term is not significant, and the semi-parametric model is not superior to the parametric, a result also obtained for high-leverage firms. The corresponding graphs illustrating the dividend-ownership relation are reported in Figure 3a for the least-constrained firms and in Figure 3b for the most-constrained firms. Although for the least constrained firms the relation is likely to contain more than one turning point, for most constrained firms the relation is very similar to that for high-leverage firms.

[Table 6 about here]

[Figures 3a&3b about here]

[23] See Table 1 for details on how the KZ-index is constructed.

6.2 A System-based Semi-Parametric Approach

As a second robustness check, we use a system-based semi-parametric approach. Aggarwal and Kyaw (2010) and Jensen et al. (1992) considered a simultaneous equations framework consisting of a system of structural linear (parametric) equations to model the relation between dividend and financial policies. Here, we consider the approach proposed by Smith and Kohn (2000), which is a non-parametric system approach and can be seen as a system generalization of the semi-parametric model (2). This approach uses a Bayesian hierarchical framework where each regression function is represented as a linear combination of a large number of basis terms and ensures increased efficiency. We consider the following system of structural equations:

$$E(DIV / MAN, X) = \alpha_1 + \beta_1^{'} X \ + f_1(MAN) \tag{11}$$

$$E(MAN / DIV, X) = \alpha_2 + \beta_2^{'} X \ + f_2(DIV)$$

where X is the set of control variables that enter the model specification in a parametric way. Based on the approach outlined in Smith and Kohn (2000), the representation of $f_1(MAN)$ is given in Figure 4a for low leverage firms, in Figure 4b for high leverage firms, in Figure 4c for the least constrained firms and in Figure 4d for the most constrained firms.[24] These results are similar to the benchmark results previously discussed. In particular, it seems that the alignment effect of managerial ownership is only present for firms that are subject to monitoring by debt holders, i.e. high leverage or most constrained firms, while the entrenchment effect disappears for these firms. Overall, our findings are robust to a system-based semi-parametric approach.

[Figures 4a, 4b, 4c and 4d about here]

7. Conclusion

This study examines the relation between dividend policy, managerial ownership and debt-financing using a semi-parametric estimation approach. The semi-parametric approach brings flexibility and helps capture more effectively non-linearities in the data. Our analysis is based on a large sample of firms listed on NYSE, AMEX and NASDAQ. To examine whether debt also

[24] These estimations were conducted using the VGAM package in R.

plays an important role in mitigating agency problems, we also examine whether the impact of managerial ownership on dividends differs across firms with different levels of leverage/financial constraints. This analysis is an important step in our evolving understanding of whether dividends, managerial ownership and debt are substitute mechanisms in reducing agency costs of free-cash-flow.

In contrast to the results based on parametric methods, which suggest a U-shaped relation between dividend and managerial ownership, our semi-parametric results supports a more complex relation that is characterized by more than one turning point. In particular, we find a negative relationship between managerial ownership and dividends when managerial ownership is at relatively low levels (i.e. <10%), which is consistent with the *alignment effect* of managerial ownership. We also find a positive relationship between dividends and managerial ownership at very high levels of managerial ownership (i.e. >60%). This can be interpreted as evidence supporting either the *entrenchment effect* of managerial ownership (see Hu and Kumar, 2004; Jo and Pan, 2009) or the existence of strong managerial preferences over dividends for liquidity reasons (see Brown, Liang, and Weisbenner, 2007). Interestingly, the relationship appears to be largely flat for ownership levels between 10% and 60%, which contradicts previous evidence by Schooley and Barney (1994) and Farinha (2003) and can only be explained in the context of signaling and tax clientele theories. Furthermore, we find that the relationship between managerial ownership and dividends differs significantly across firms with different levels of debt/financial constraints. In particular, we find that that dividends and ownership are substitute mechanisms to reduce the agency costs of free-cash-flow, but this argument holds only for firms that are subject to monitoring by debt-holders (e.g. high-leverage/most constrained). We also find that low leverage firms, which lack an additional mechanism (i.e. debt) for controlling agency costs, may be exposed to entrenchment problems at higher levels of managerial ownership. Last but not least, our analysis shows that semi-parametric methods are very effective in capturing complex non-linear relations and, as a result, may prove particularly useful for subsequent studies on the subject.

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TABLE 1
Variable Definitions

This table provides analytical definitions for all variables used in our analysis. It also provides detailed information on the data items (from *Thomson DataStream* and *Board Analyst*) used for the variable construction.

Variable Name	Definition	Data Items used
DIVIDEND (%)	The ratio of total dividend to total assets	DataStream items: *WC18192, WC01701, WC02999*
MANAGERIAL OWNERSHIP	The percentage of shares held by the management and directors, as reported in the company's most recent proxy statement	Board Analyst item: *InsidersPctg*
LEVERAGE (%)	The ratio of total debt to total assets	DataStream items: *WC03255, WC02999*
KZ-Index	$-1.002 \times Cash\ Flow + 0.283 \times Q + 3.139 \times Leverage - 39.368 \times Dividends - 1.315 \times Cash\ Holdings$ where *Cash Flow* is the ratio of cash flow to total assets; *Q* refers to Tobin's Q as defined below; *Leverage* is the ratio of total debt to total assets; *Dividend* is the ratio of total dividend to total assets and *Cash Holding* is the cash holdings to total assets.	DataStream items: *WC18191, WC02999, MV, WC03501, WC03451, WC18192, WC01701, WC03255, WC02001*
FIRM_SIZE	The natural logarithm of MV	DataStream items: *MV*
INVESTMENT (%)	The ratio of capital expenditures to total assets	DataStream items: *WC04601, WC02999*
CASH HOLDING (%)	The ratio of cash holdings to total assets	DataStream items: *WC02001, WC02999*
TOBIN'S Q	Ratio of the book value of assets minus the book value of equity plus the market value of equity to the book value of assets	DataStream items: *MV, WC03501, WC03451, WC02999*
BOARDSIZE	The total number of directors on the board	Board Analyst items: *DirectorsOutsideTotal, DirectorsInside*
STAGGERED_BOARD (%)	A dummy variable indicating a classified board voting structure where directors stand for re-election on a staggered schedule	Board Analyst item: *BdClassified*
ACTIVE_DIRECTORS (%)	The ratio of the number of directors on a board who are active CEOs of other public or private companies to the total number of directors on the board	Board Analyst item: *DirectorsActiveCEOs, DirectorsOutsideTotal, DirectorsInside*
INDEPENDENT_DIRECTORS (%)	The ratio of the number of all fully independent directors on a given board to the total number of directors on the board.	Board Analyst item: *DirectorsOutside, DirectorsOutsideTotal, DirectorsInside*

(continued on next page)

TABLE 1 (Continued)
Variable Definitions

BUSY_ DIRECTORS (%)	The ratio of the number of directors with more than 4 corporate (public) directorships on a given board to the total number of directors on the board.	Board Analyst item: *DirectorsOver4Boards, DirectorsOutsideTotal, DirectorsInside*
OUTSIDE_ DIRECTORS (%)	The ratio of the number of outside directors and the number of outside-related directors to the total number of directors on the board.	Board Analyst item: *DirectorsOutsideTotal, DirectorsInside*
OLD_ DIRECTORS (%)	The ratio of the number of all directors over the age of 70 on a given board to the total number of directors on the board.	Board Analyst item: *DirectorsOver70, DirectorsOutsideTotal, DirectorsInside*
WOMEN_ DIRECTORS (%)	The ratio of the number of all female directors to the total number of directors on the board	Board Analyst item: *DirectorsOutsideTotal, DirectorsInside*
EXPERIENCED_DIRECTORS (%)	The ratio of all directors with tenure exceeding 15 years on a given board to the total number of directors on the board.	Board Analyst item: *DirectorsOutsideTotal, DirectorsInside*

TABLE 2
Descriptive Statistics

This table presents analytical descriptive statistics for our dividend variable (dependent variable), managerial ownership (our key explanatory variable) and all control variables used in the analysis. Analytical definitions for all variables are provided in Table 1.

	Mean	Min	25%	Median	75%	Max
DIVIDEND	0.012	0	0	0.002	0.016	0.569
MANAGERIAL OWNERSHIP	0.154	0	0	0.081	0.231	0.798
FIRM SIZE	7.386	3.917	6.317	7.255	8.319	12.594
INVESTMENT	0.0529	0	0.021	0.038	0.066	0.484
LEVERAGE	0.227	0	0.049	0.219	0.347	1.000
CASH HOLDING	0.164	0	0.025	0.086	0.241	0.990
TOBIN'S Q	2.012	0.355	1.242	1.611	2.293	13.905
BOARD SIZE	8.950	3	7	9	10	21
STAGGERED BOARD	0.967	0	1	1	1	1
ACTIVE DIRECTORS	0.362	0	0.167	0.286	0.429	1
INDEPENDENT DIRECTORS	0.693	0	0.583	0.714	0.818	1
BUSY DIRECTORS	0.098	0	0	0.077	0.167	0.900
OUTSIDE DIRECTORS	0.797	0	0.75	0.833	0.889	1
OLD DIRECTORS	0.091	0	0	0	0.143	0.714
WOMEN DIRECTORS	0.096	0	0	0.100	0.143	0.667
EXPERIENCED DIRECTORS	0.151	0	0	0.111	0.250	1

TABLE 3
Parametric and Semi-parametric results for ALL firms

This table presents evidence on the impact of managerial ownership on dividends for all firms in the sample. *t*-values are in parentheses. ** and * indicate that the coefficient is statistically significant at the 1% and 5% level respectively. Industry dummies have been used as explanatory variables. GCV stands for the Generalized Cross-Validation score of each model. *F*-test (*p*-value) contains the *p*-value corresponding to the F-test for the statistical significance of the non-parametric (smooth) term in the semi-parametric model (the null hypothesis is that that the smooth term is not statistically significant). LR test (*p*-value) contains the p-value for the Likelihood Ratio test comparing the log-likelihoods of the semi-parametric model (unrestricted) and the fully parametric model (restricted). For the semi-parametric models, the partial impact of ownership on dividend is depicted in Figure 1.

	Parametric Results	*Semi-parametric Results*
MANAGERIAL OWNERSHIP	-0.014 * (-2.43)	**See Figure 1**
MANAGERIAL OWNERSHIP SQUARED	0.024 * (2.56)	
FIRM SIZE	0.002 ** (7.28)	0.001 ** (6.42)
INVESTMENT	0.009 (1.41)	0.009 (1.47)
LEVERAGE	-0.01 ** (-5.56)	-0.01 ** (-5.52)
CASH HOLDING	0.004 (1.88)	0.003 (1.82)
TOBIN'S Q	0.002 ** (5.87)	0.002 ** (5.99)
BOARD SIZE	0.0007 ** (4.55)	0.001 ** (4.64)
STAGGERED BOARD	0.001 (0.62)	0.001 (0.57)
ACTIVE DIRECTORS	0.001 (0.79)	0.001 (0.71)
INDEPENDENT DIRECTORS	-0.008 ** (-3.43)	-0.01 ** (-3.29)
BUSY DIRECTORS	0.002 (0.92)	0.002 (0.92)
OUTSIDE DIRECTORS	0.012 ** (3.25)	0.01 ** (3.28)
OLD DIRECTORS	0.001 (0.26)	0.008 (0.32)
WOMEN DIRECTORS	0.008 * (2.18)	0.007 (1.97)
EXPERIENCED DIRECTORS	0.008 ** (4.31)	0.008** (4.21)
Intercept	-0.013 ** (-4.71)	-0.013 ** (-4.83)
Observations	7376	7376
R^2 Adjusted	0.110	0.112
GCV Score	0.000617	0.000615
F-test [p-value]		3.17 [0.00] **
LR test [p-value]	[0.00] **	

TABLE 4

Parametric and Semi-parametric Results for low-leverage and high-leverage firms

This table presents evidence on the impact of managerial ownership on dividends for the low-leverage and the high-leverage firms. Companies are assigned into each group according to their (industry-adjusted) leverage ratio using the 33th and 67th percentiles as cut-off points. *t*-values are in parentheses. ** and * indicate significance at the 1% and 5% level respectively. Industry dummies have been used as explanatory variables. GCV stands for the Generalized Cross-Validation score. *F*-test (*p*-value) contains the *p*-value corresponding to the F-test for the significance of the non-parametric term in the semi-parametric model (the null hypothesis is that that the smooth term is not statistically significant). LR test (*p*-value) contains the *p*-value for the Likelihood Ratio test comparing the log-likelihoods of the semi-parametric model and the fully parametric model. For the semi-parametric models, the partial impact of ownership on dividend is depicted in Figures 2a for low-leverage firms and in Figure 2b for high-leverage firms.

	Panel A: LOW-LEVERAGE FIRMS		*Panel B: HIGH-LEVERAGE FIRMS*	
	Parametric	Semi-parametric	Parametric	Semi-parametric
MANAGERIAL OWNERSHIP	0.015 (1.23)	**See Figure 2a**	-0.02 * (-2.08)	**See Figure 2b**
MANAGERIAL OWNERSHIP SQUARED	-0.02 (-1.03)		0.034 (1.86)	
FIRM SIZE	0.002** (3.05)	0.001 ** (2.90)	0.016 ** (3.42)	0.001 ** (3.51)
INVESTMENT	-0.008 (-0.54)	-0.01 (-0.56)	0.024 * (2.45)	0.025 * (2.46)
LEVERAGE	-0.04 * (-2.23)	-0.04 * (-2.23)	-0.02 ** (-4.46)	-0.02 ** (-4.46)
CASH HOLDING	0.008* (2.28)	0.01 * (2.25)	-0.01 ** (-2.95)	-0.01** (-2.95)
TOBIN'S Q	0.0005 (1.11)	0.0005 (1.09)	0.004 ** (6.89)	0.004 ** (6.96)
BOARD SIZE	0.001 ** (3.46)	0.001 ** (3.45)	0.0004 (1.53)	0.0001 (1.50)
STAGGERED BOARD	0.002 (0.70)	0.002 (0.53)	-0.002 (-0.42)	-0.001 (-0.401)
ACTIVE DIRECTORS	-0.001 (-0.56)	-0.001 (-0.56)	0.001 (0.79)	0.001 (0.71)
INDEPENDENT DIRECTORS	-0.02** (-4.00)	-0.02 ** (-3.91)	-0.01 (-1.91)	-0.01 (-1.86)
BUSY DIRECTORS	0.01 (1.80)	0.01 (1.77)	-0.003 (-0.76)	-0.003 (-0.73)
OUTSIDE DIRECTORS	0.02 * (2.13)	0.02 * (2.02)	0.02 ** (3.01)	0.02 ** (2.98)
OLD DIRECTORS	0.006 (1.18)	0.006 (1.25)	0.005 (1.19)	0.005 (1.18)
WOMEN DIRECTORS	-0.001 (-0.23)	-0.002 (-0.35)	0.01 (1.66)	0.01 (1.68)
EXPERIENCED DIRECTORS	0.01 ** (2.99)	0.01 ** (2.84)	0.001 (0.29)	0.0001 (0.28)
Intercept	-0.01 ** (2.73)	-0.013* (-2.55)	-0.001 (-1.68)	-0.01* (-1.98)
Observations	2445	2445	2433	2433
R^2 Adjusted	0.069	0.0725	0.173	0.173
GCV Score	0.000914	0.000912	0.000601	0.000601
F-test [p-value]		2.00 [0.04]		1.27 [0.28]
LR test [p-value]	[0.01]**		[0.08]	

TABLE 5
J-tests for alternative specifications

In this table we use Davidson and MacKinnon's (1981) J-test to compare which specification best fits the data. In panel A we compare the DECAY model ($DIV = a + b_1 \exp(-MAN) + cX + u$) with the SQUARED model ($DIV = a + k_1 MAN^2 + \phi X + u$). In Panel B we compare the DECAY model with the linear model ($DIV = a + \lambda_1 MAN \ + \phi X + u$).

Panel A: DECAY vs. SQUARED

	Estimate	Std. Error	t-value
DECAY+ fitted(SQUARED)	-188.94	104.509	-1.8079
SQUARED + fitted(DECAY)	5.09 *	2.517	2.0222

Panel B: DECAY vs. LINEAR

	Estimate	Std. Error	t-value
DECAY + fitted(LINEAR)	-26.171	14.118	-1.8537
LINEAR + fitted(DECAY)	22.670 *	11.205	2.017

TABLE 6

Parametric and Semi-parametric results for the least- and most-constrained firms

This table presents evidence on the impact of managerial ownership on dividends for the low financial constraints and the high financial constrained firms in the sample. Companies are assigned into each group according to their KZ index (see Table 1 for details) ratio using the 33th and 67th percentiles as cut-off points. *t*-values are given in parentheses. ** and * indicate significance at the 1% and 5% level respectively. GCV stands for the Generalized Cross-Validation score. *F*-test (*p*-value) contains the *p*-value corresponding to the F-test for the statistical significance of the non-parametric (smooth) term in the semi-parametric model (the null hypothesis is that that the smooth term is not statistically significant). LR test (*p*-value) contains the p-value for the Likelihood Ratio test comparing the log-likelihoods of the semi-parametric model (unrestricted) and the fully parametric model (restricted). For our semi-parametric models, the partial impact of managerial ownership on dividends is depicted in Figures 3a and 3b for the least- and most-constrained firms, respectively.

	LEAST-CONSTRAINED FIRMS		*MOST-CONSTRAINED FIRMS*	
	Parametric	Semi-parametric	Parametric	Semi-parametric
MANAGERIAL OWNERSHIP	0.008 (0.64)	**See Figure 3a**	-1.61 * (-2.37)	**See Figure 3b**
MANAGERIAL OWNERSHIP SQUARED	0.001 (0.04)		0.02 * (1.97)	
FIRM SIZE	0.0001 (1.63)	0.0007 (1.21)	0.003 (1.02)	0.0000 (0.25)
INVESTMENT	-0.01 (-0.71)	-0.012 (-0.66)	0.003 (0.43)	0.003 (0.42)
LEVERAGE	0.05 ** (7.31)	0.05 ** (7.13)	0.002 (1.14)	0.003 (1.13)
CASH HOLDING	-0.007 (-1.67)	-0.007 (-1.70)	-0.017 (-0.57)	-0.002 (-0.54)
TOBIN'S Q	0.008 ** (11.30)	0.008 ** (11.26)	0.007 * (2.19)	0.0001 * (2.14)
BOARD SIZE	0.0005 (0.14)	0.0001 (0.33)	0.0004 * (2.05)	0.0004* (2.03)
STAGGERED BOARD	0.0004 (0.09)	-0.0003 (-0.07)	0.0001 (0.05)	0.000 (0.04)
ACTIVE DIRECTORS	0.001 (0.51)	0.001 (0.45)	0.001 (0.66)	0.0001 (0.56)
INDEPENDENT DIRECTORS	-0.02 ** (-4.18)	-0.02 ** (-3.98)	-0.004 (-1.35)	-0.003 (-1.29)
BUSY DIRECTORS	0.015 ** (2.62)	0.01 * (2.55)	-0.002 (-0.47)	-1.19 (-0.41)
OUTSIDE DIRECTORS	2.39 ** (2.80)	0.023 ** (2.73)	0.0004 (0.92)	0.004 (0.89)
OLD DIRECTORS	0.005 (0.94)	0.006 (1.07)	0.001 (0.39)	0.001 (0.34)
WOMEN DIRECTORS	0.004 (0.05)	-0.0006 (-0.08)	-0.0001 (-0.02)	0.0001 (0.04)
Intercept	-0.01 (-1.54)	-0.007 (-1.5)	-0.001 (-0.316)	-0.002 (-0.75)
Observations	2346	2346	2327	2327
R^2 Adjusted	0.184	0.192	0.0512	0.0512
GCV Score	0.0010371	0.0010292	0.0002594	0.0002595
F-test [p-value]		3.55 [0.00] **		1.78 [0.162]
LR test [p-value]	[0.00]		[0.09]	

List of Figures

Figure 1
Semi-parametric estimate: The net effect of managerial ownership on dividends for **ALL FIRMS**

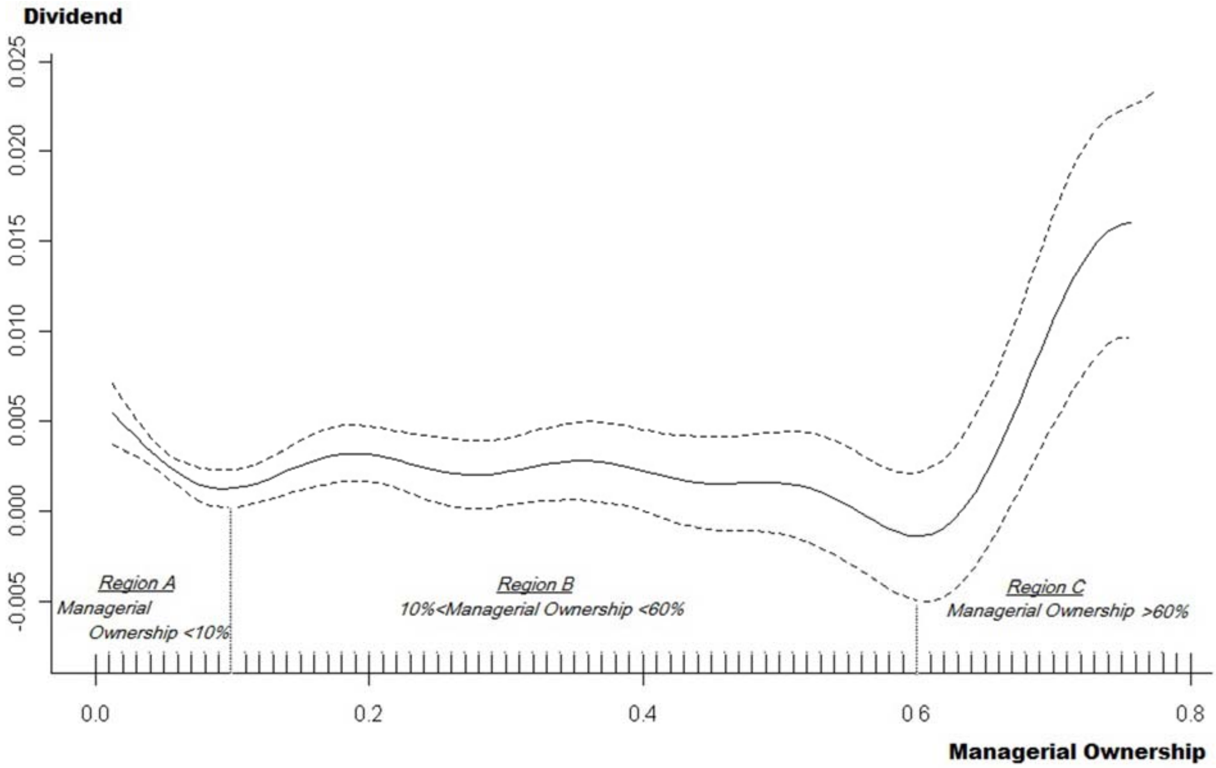

Figure 2a

Semi-parametric estimate: The net effect of managerial ownership on dividend for **LOW-LEVERAGE FIRMS**

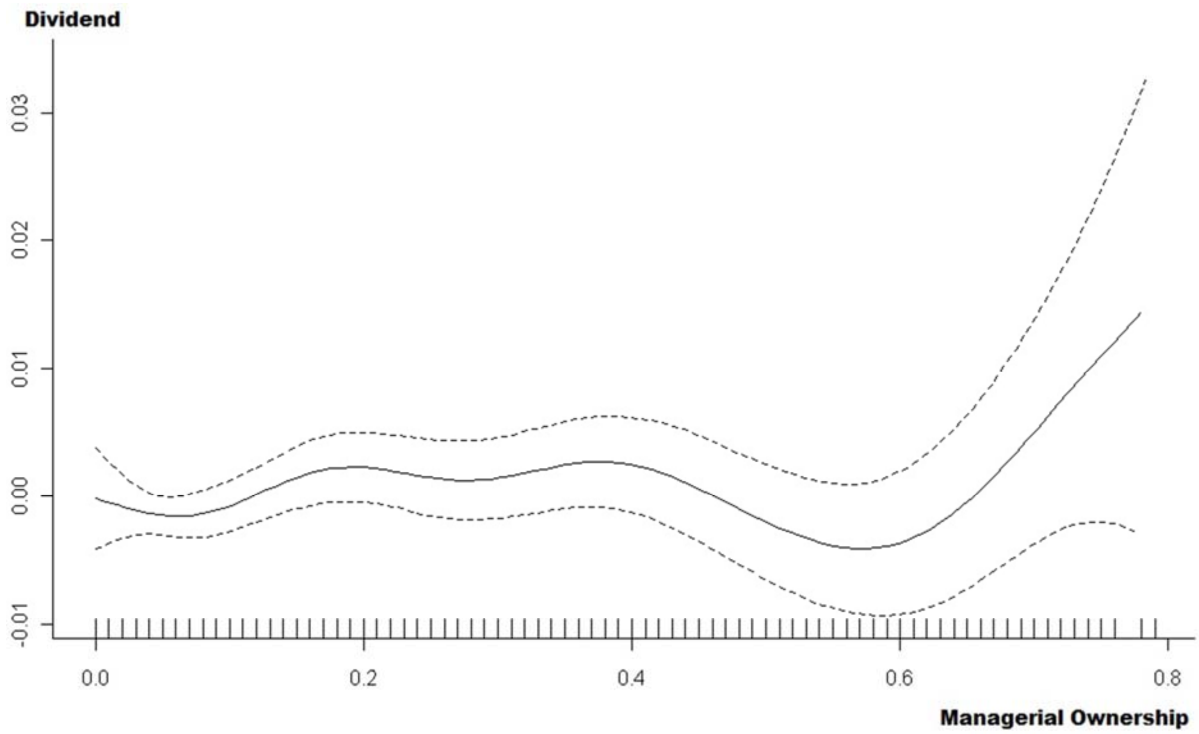

Figure 2b

Semi-parametric estimate: The net effect of managerial ownership on dividend for **HIGH-LEVERAGE FIRMS**

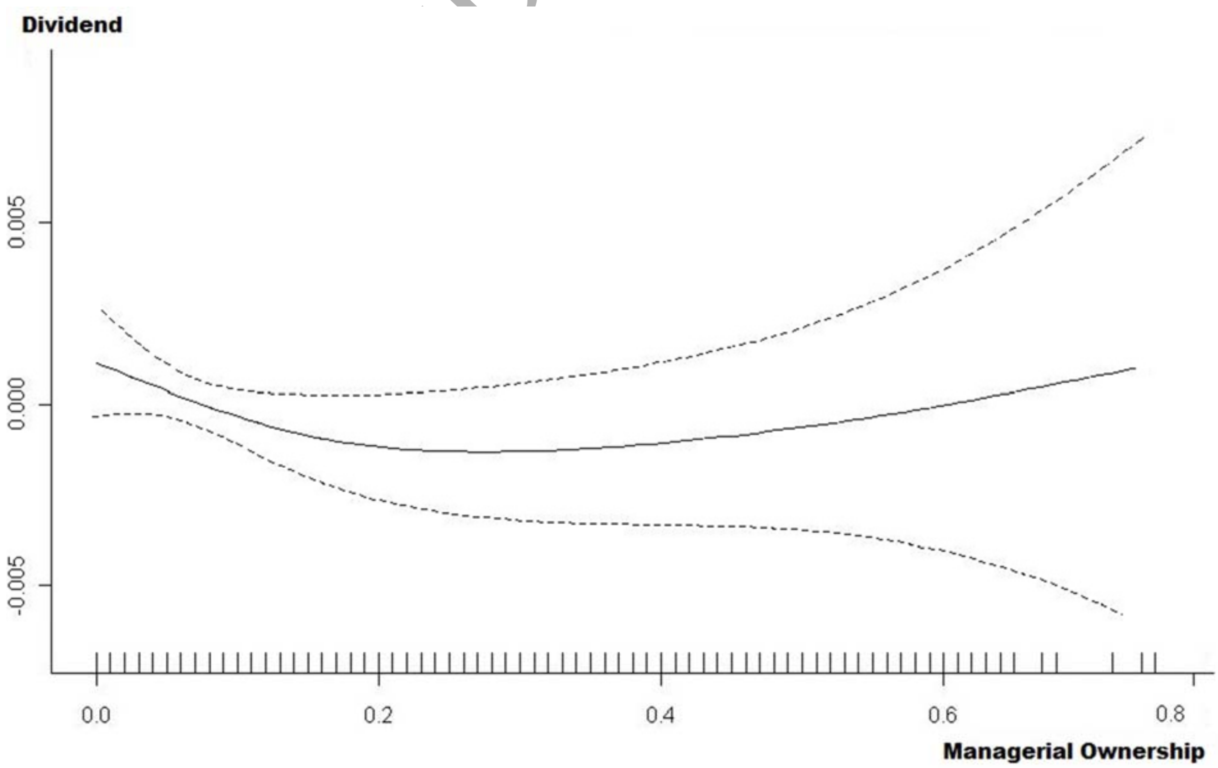

Figure 3a

Semi-parametric estimate: The net effect of managerial ownership on dividend for the **LEAST-CONSTRAINED FIRMS** (low KZ-index)

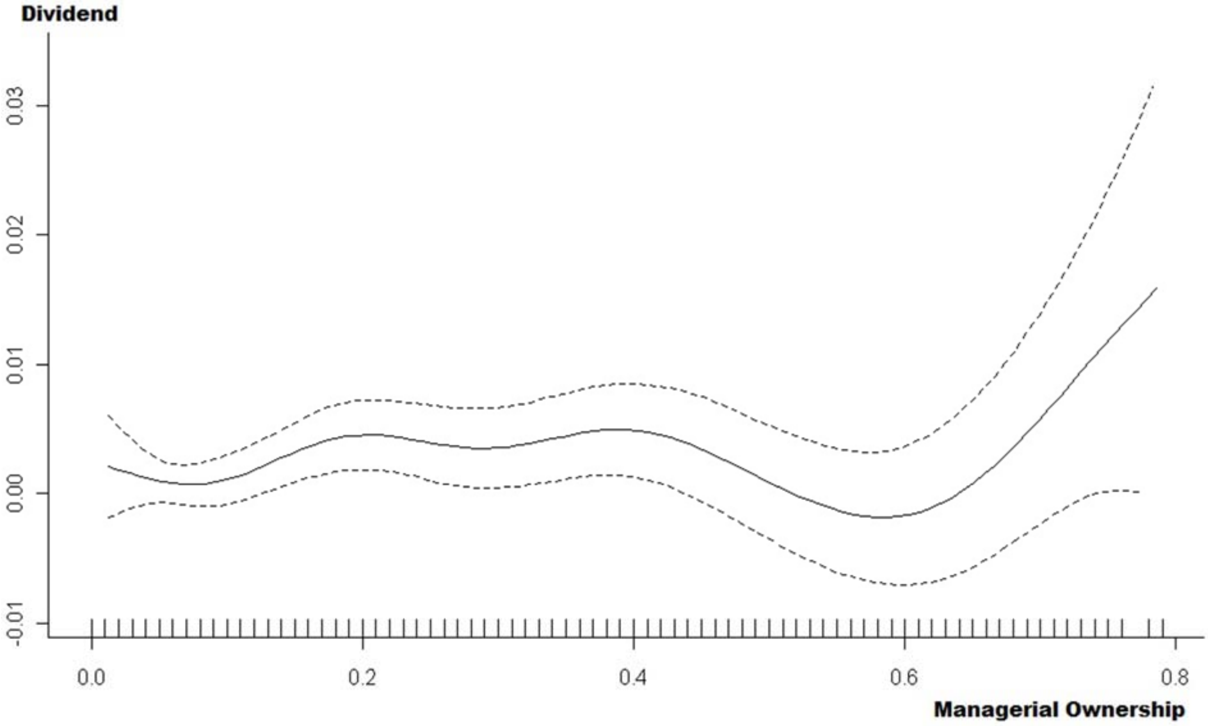

Figure 3b

Semi-parametric estimate: The net effect of managerial ownership on dividend for the **MOST-CONSTRAINED FIRMS** (high KZ-index)

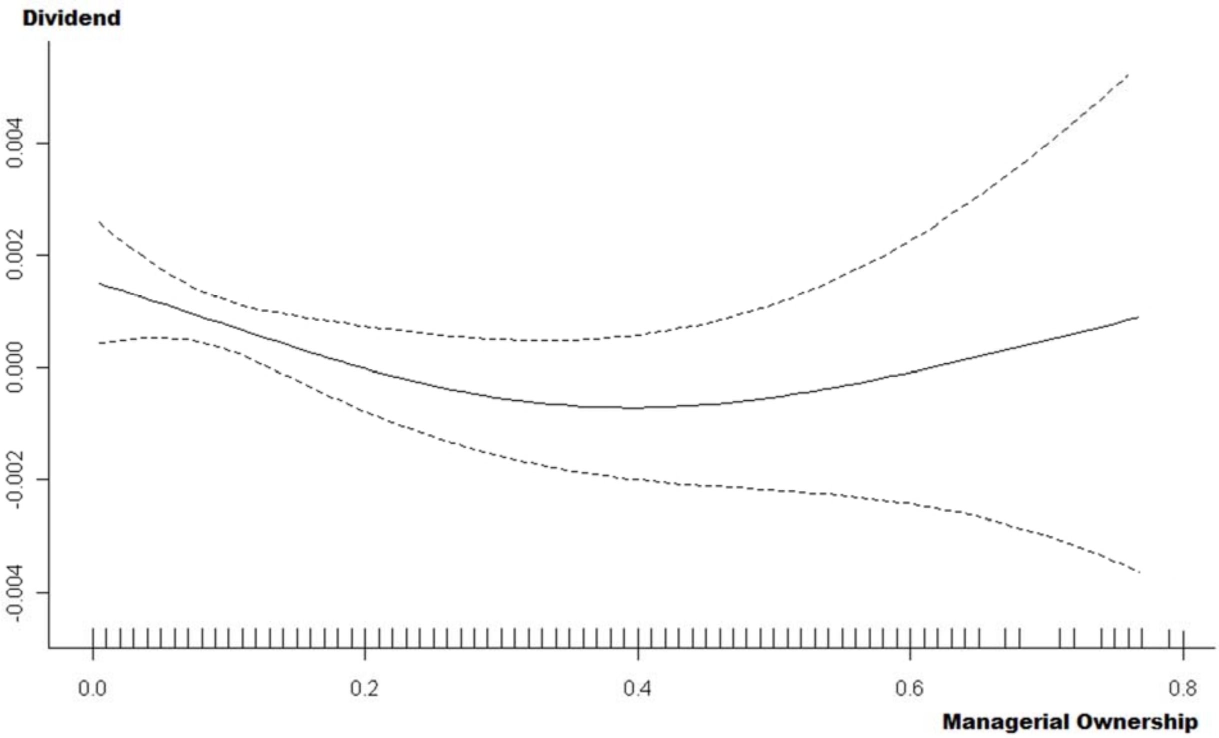

Figure 4a
System estimation- Semi-parametric estimate: The net effect of managerial ownership on dividend for **LOW-LEVERAGE FIRMS**

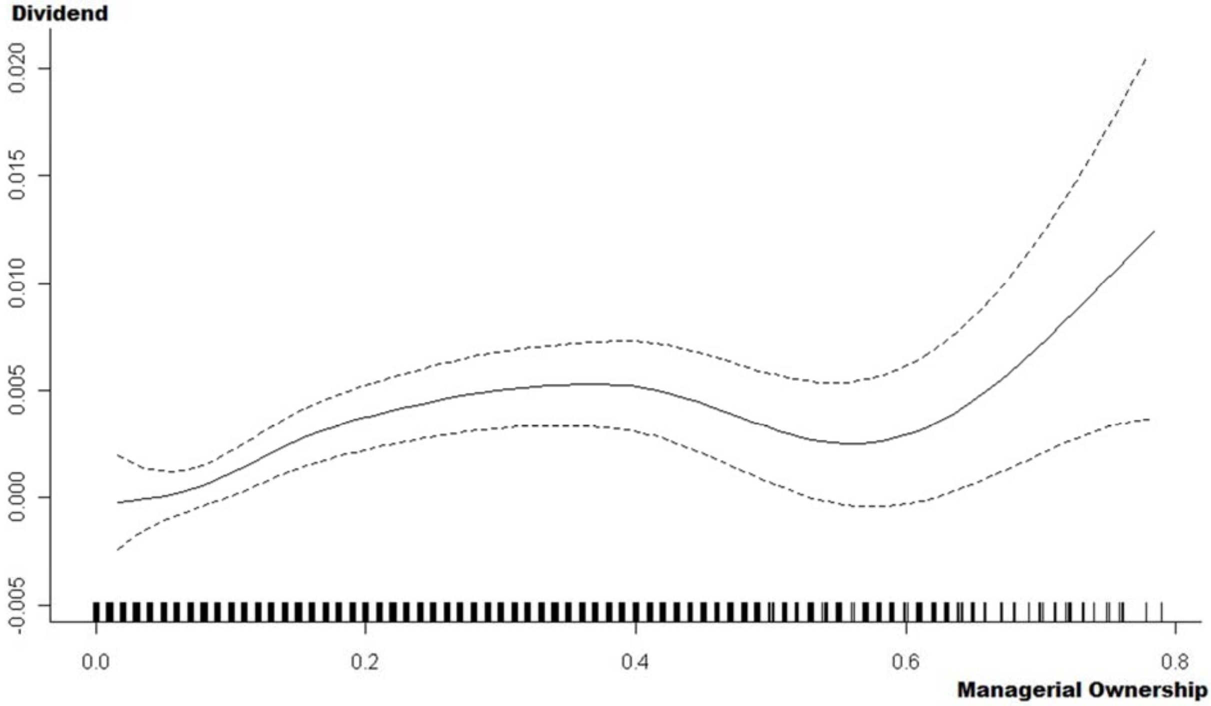

Figure 4b
System estimation- Semi-parametric estimate: The net effect of managerial ownership on dividend for **HIGH-LEVERAGE FIRMS**

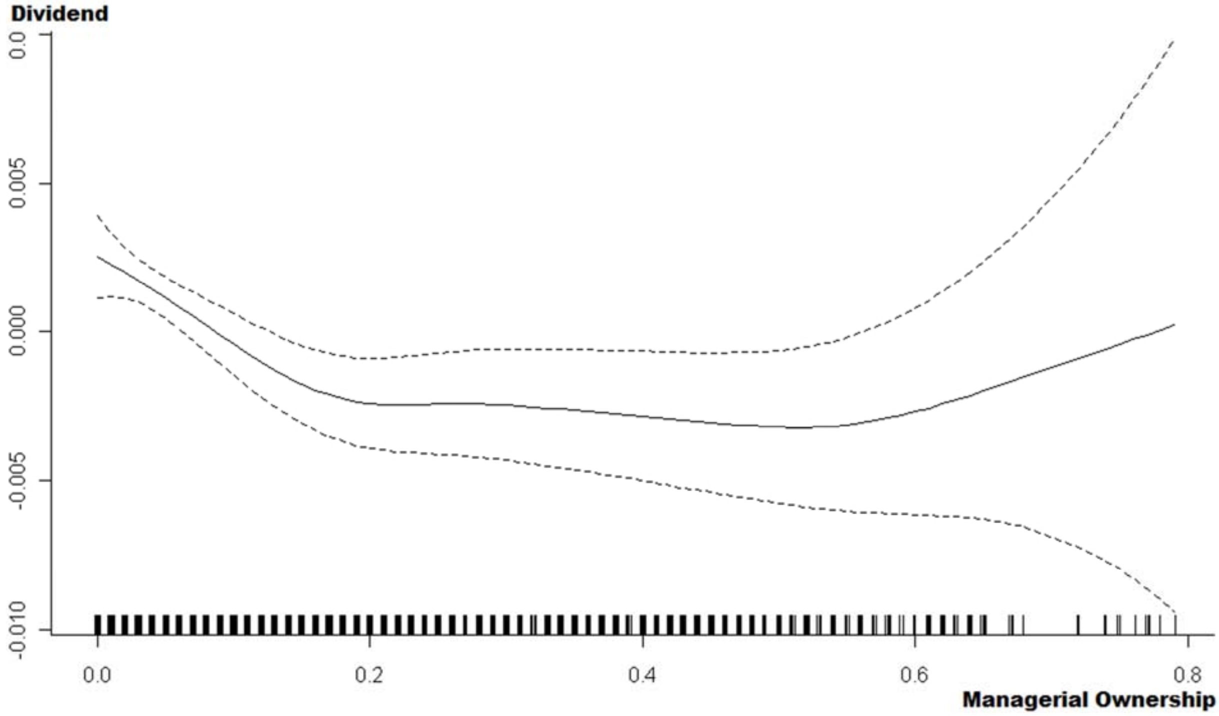

Figure 4c

System estimation- Semi-parametric estimate: The net effect of managerial ownership on dividend for the **LEAST-CONSTRAINED FIRMS**

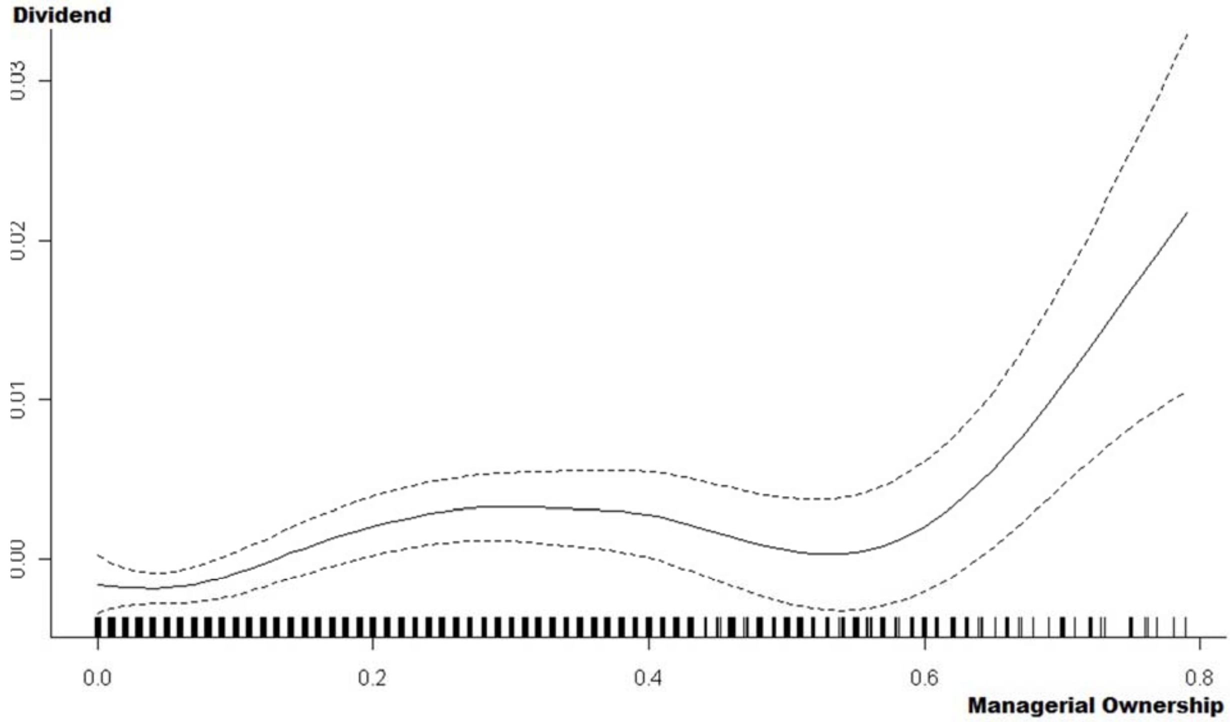

Figure 4d

System estimation- Semi-parametric estimate: The net effect of managerial ownership on dividend for **MOST-CONSTRAINED FIRMS**