When does managerial ownership affect firm performance? Agency reconsidered

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Abstract
According to agency theory, the diverging interests of managers and shareholders can result in opportunistic behavior by managers that have an adverse effect on firm performance. One suggested solution to this problem is the use of equity ownership in compensation packages to align the interests of shareholders and managers. We develop a theoretical concept of shareholder preferences and firm performance and estimate financial alignment as the relationship between firm performance and managerial ownership (MO). Our results, based on this new concept and its measurement, suggest a more nuanced framework of intervals of strong alignment and strong misalignment than what has been reported in previous studies. The intervals of the alignments and misalignments vary according to the proportion of MO in total equity ownership in ways that have not been tested in previous studies.

Key words: Ownership structure, Marginal Conditional Stochastic Dominance, Performance, Value, GMM.

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INTRODUCTION

This paper investigates the effect of managerial ownership (MO) on firm performance in the context of the principal-agent problem that pits the interests of shareholders against those of managers. The principal-agent problem, which has been a major issue in economics and management science for over seventy years,\(^1\) arises under conditions of incomplete and asymmetric information when company ownership is separate from company control. It recognizes that the diverging interests of managers and shareholders can result in opportunistic behavior by managers that have an adverse effect on company performance.\(^2\) One suggested solution to this agency problem is the alignment of managerial and shareholder interests through increased managerial equity ownership (e.g. Jensen and Meckling, 1976; Morck, Shleifer and Vishny, 1988; Holderness, Kroszner and Sheehan, 1999). The argument is that increased equity ownership will increase the financial alignment of managers and shareholders with a corresponding effect on managerial preferences that make managers’ actions more consistent with shareholder interests. However, besides the alignment of managerial and shareholder interests, the amount of ownership may also affect other aspects of managerial self-interest, such as underdiversification and advantages associated with entrenchment, that can cause managers to make decisions that differ from what is optimal from the shareholders’ perspective.

The managerial ownership argument has gradually gained acceptance in the business world over time to the point where more and more companies have introduced equity-based compensation schemes. For example, Hall (2003) reports that

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\(^1\) There is a huge and growing literature on the principal-agent conflict. For some of the best original work, see: Berle and Means (1932), Coase (1937), Cyert and March (1963) Williamson (1964), Machlup (1967), Alchian and Demsetz (1972) and Jensen and Meckling (1976).

\(^2\) See, for example, Denis et al. (1999) and Dalton et al., (2007). More generally, Eisenhardt (1989) and Nyberg et al. (2010) show how agency theory can help us gain a better understanding of organizational behavior.
prior to 1985, median equity-based managerial compensation in US-based corporations was only 1 percent. By 2001 that figure had grown to 66 percent. Core and Larcker (2002) report that several corporations have even introduced ownership programs that require executives to hold a minimum amount of firm stock.

As professional acceptance has increased, however, recent management research is beginning to cast doubt on the effectiveness of increased managerial ownership as a tool for manager-shareholder interest alignment. For example, Tosi et. al. (2000) report that: “Incentive alignment as an explanatory construct for CEO pay is weakly supported at best” (p. 329). Similar conclusions are reached by Tosi (2005) and Dalton et. al. (2003 and 2007) among others. Other recent management research suggests that managerial ownership actually affects corporate strategy in a direction opposite to that predicted by theory. For example, Bryan et. al. (2000), Sanders (2001), and Devers et. al. (2008) report that managerial stock ownership decreases CEO risk taking. One possible explanation for this result is that stock ownership does not introduce limited downside risk (Sanders 2001). As such, this may intensify the non-diversification of managers’ human capital and consequently affect their tolerance for additional risk and drive them to invest in less risky projects to protect their human capital (Lambert,1986).

Thus, there is mounting evidence that financial alignment may be inadequate as a solution to the agency conflict, which is revealing itself as much more complex than previously thought. However, although financial alignment may only be part of the agency conflict story, there is reason to believe that it nevertheless remains an important part of it. For example, using a novel measure of alignment based on the correlation of CEO and shareholder returns, Nyberg et al. (2010) find results that

3 Devers et. al. (2007) provide an extensive literature review on the effect of managers-owners financial alignment on strategic decisions such as acquisitions and divestitures.
suggest a stronger alignment than what has been reported in previous work. Furthermore, the meta-analytic studies (Dalton et al., 2003; Tosi et al., 2000) that have reported weak alignment relationships have some serious limitations that call into question their conclusions.\(^4\) Thus, rather than abandoning financial alignment as a viable solution to the management/shareholder agency conflict, more research and a more nuanced approach may lead to a deeper understanding of the problem and its solution. Accordingly, the purpose of this study is to provide a nuanced view of managerial financial alignment and firm performance. First, we analyze how to conceptualize and measure financial alignment. Second, we examine the implications of alignment on managerial preferences and actions and how they affect firm performance. We go beyond the broad prediction that managerial equity ownership should align managerial interests with those of other shareholders. When we explore the relationships linking managerial ownership, preferences and performance, our approach recognizes that the relationships can be multi-dimensional and can vary with different levels of ownership.

Thus, we combine the new theory with empirical data to provide evidence based insights into managerial ownership, financial alignment and the manager/shareholder agency conflict. More specifically, we recognize that although managerial ownership makes managers co-investors along with shareholders, they are a special type of co-investor that possesses insider information. They are also employees with the power to influence their employee based benefits as well as the performance of the firm. We introduce a new concept of firm performance that includes stock returns but that also considers other issues that are important to risk averse investors. We argue that assessing the relationship between managerial

ownership and this new concept of firm performance is the appropriate way, both conceptually and empirically, to assess financial alignment. Further, we also use this conceptual framework to distinguish between financial alignment and other phenomena, such as profit-chasing motivated by inside information and entrenchment. Our results indicate that financial alignment varies with the percentage of ownership. One of the strongest and most important findings, which is at odds with much of the extant literature, is that at very low levels of ownership, there is no alignment. On the contrary, there is mis-alignment and the causality runs from managerial ownership to stock performance. At intermediate levels there is alignment, but there is also profit or performance chasing. This conclusion is based on bi-directional causality: managerial ownership Granger causes stock performance and stock performance Granger causes managerial ownership. At higher levels there is evidence of mis-alignment and entrenchment where causality is one-directional, running from managerial ownership to stock performance. At very high levels the managers themselves become the shareholders and alignment ceases to be an issue.

THEORY, EMPIRICAL EVIDENCE AND HYPOTHESES

The Concept of Financial Alignment

The focus of our study is the capacity of managerial ownership of firm equity to offset the manager/shareholder agency conflict by aligning the financial interests of shareholders and managers. These financial interests depend on the preferences of shareholders. Thus, a correct representation of the relationship between managerial ownership and financial alignment requires a correct understanding and measurement of shareholder preferences.
The initial thrust of the literature that analyzes the effect of managerial ownership on financial alignment defines financial alignment in terms of wealth and assumes that investors prefer more wealth to less wealth. For example, Jensen and Meckling (1976), Morck, Shleifer and Vishny (1988), Stulz (1988) and Tosi, Katz and Gomez-Mejia (1997) consider firm value. Others, such as Kirchmaier and Grant (2005), Zhang (2009), Ruenzi and Lilienfeld-Toal (2010) and Nyberg et al. (2010) use stock returns. However, wealth, measured by firm value or stock returns, is only one aspect of shareholder preferences. Expected utility maximization, which lies at the heart of modern investment science theory and practice, recognizes other types of preferences as well. For example, mean-variance (MV) optimization, the special case of expected utility maximization that is most widely accepted throughout the investment profession, considers wealth volatility.\(^5\) In this framework, risk averse investors\(^6\) prefer higher levels of wealth and lower levels of volatility. Studies, such as Chen and Steiner (1999) Eisenmann (2002), Gadhoum and Ayadi (2003) and Acharya and Bisin (2009) look at alignment in terms of the volatility of the wealth proxy.

Advances in the field of expected utility maximization and the preferences of risk averse investors show that moments of the utility function higher than the first two are also important determinants of investors behavior (Kimball, 1990 and Eeckhoudt and Schlesinger, 2006) and that higher moments of the wealth variable do matter to investors. For example, risk averse investors show a preference for positive

\(^5\)In spite of its popularity, the mean-variance (MV) framework is extremely limited in scope. Preferences determined solely by the first and second moments (mean and variance) are only appropriate for quadratic utility maximizers or normally distributed returns. However, quadratic utility functions have many shortcomings and it is a well documented fact since Mandelbrot (1963) that asset distributions are generally not normally distributed.

\(^6\) The representative, non-satiating, risk averse investor has a utility function \(u(w)\) satisfying 
\[ u'(w) \geq 0, \quad u''(w) \leq 0, \quad \forall w, \]  
where primes denote first and second derivatives with respect to wealth, noted as \(w\). The investor prefers more to less but the first unit has more utility than the second unit, the second unit more than the third unit, etc.
skewness, the third moment of the probability distribution of the wealth variable, and an aversion to kurtosis, the fourth moment (see, Kraus and Litzenberger 1976; Athayde and Flôres, 1999; Fang and Lai, 1997; Dittmar, 2002; Post, Vliet and Levy, 2008). Skewness measures the asymmetry of the probability distribution of the wealth variable and positive skewness indicates that the tail on the right side of the probability density function, the positive side, is longer than the left side. Kurtosis measures how much of the variance of the probability distribution of the wealth variable is the result of infrequent extreme deviations from the mean as opposed to frequent, modestly sized deviations.

Of course, including higher moments of the probability distribution of the wealth variable to reflect an overall set of preferences complicates how the overall set of preferences can be measured in practice. A set of preferences is determined jointly across all moments. For example, in mean-variance (MV) space, there is the trade-off between wealth and its volatility. A lower (higher) level of wealth can be offset by a lower (higher) level of volatility. Including more moments means considering more trade-offs. In mean-variance-skewness space there are three trade-offs to be considered: wealth versus volatility, wealth versus skewness, and skewness versus volatility. The Bowman Paradox, for example, of a negative relationship between risk and return (Bowman, 1980) is only paradoxical in the context of mean-variance space. When skewness is included in the set of preferences, the paradox can be explained by trade-offs between skewness, volatility and mean. 

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7 The Bowman paradox has generated a large literature confirming the result and offering a wide range of explanations. For a complete overview, see Rueffli, Collins, and Lacugna (1999), Bromiley, Miller, and Rau (2001), and Nickel and Rodriguez (2002).

8 Henkel (2009) did exactly this, albeit in an attempt to fit the paradox into mean-variance space.
As more and more moments are considered, potential trade-offs become more and more numerous. Failure to include trade-offs such as this across moments when estimating preference based performance for empirical work on the relationship between managerial ownership and financial alignment would call into question the results and conclusions. No studies on the relationship between MO and financial alignment have taken these trade-offs into consideration. In a first step to fill this gap, we construct a performance proxy that reflects these trade-offs over the whole range of shareholder preferences embedded in the return distribution. Using this novel measure provides a comprehensive estimate of financial alignment that can be used as a tool for investigating the forces that drive the relationship between shareholder and managerial preferences.

To this end, we employ the concept of Marginal Conditional Stochastic Dominance (MCSD) developed by Shalit and Yitzhaki (1994) and the methodology in Clark, Jokung and Kassimatis (2011) to develop a performance proxy, called the total stock performance (TSP) statistic, that reflects the whole range of shareholder preferences embedded in the return distribution. The concept of Marginal Conditional Stochastic Dominance gives the conditions under which all risk-averse individuals will prefer to increase the share of one risky asset over another when presented with a given portfolio. MCSD makes no assumptions about the return distributions and the only assumptions on the utility functions are that investors are risk averse, expected utility maximizers. In other words, the first derivative of utility with respect to wealth is positive and the second derivative is negative. The idea behind MCSD is that if one stock dominates another in the MCSD sense, then increasing the share of that stock at the expense of the other increases utility for all

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9 When \( n \) moments are considered the number of trade-offs is equal to \( \frac{n \times (n - 1)}{2} \).

10 The construction of TSP is explained in detail in the next section.
risk averse investors. \(^{11}\) Since a stock to stock application of this rule is difficult in practice because it requires infinite pair-wise comparisons of alternative probability distributions, we follow an alternative application suggested by Shalit and Yitzhaki (1994) where individual assets are compared to the market portfolio. If the market portfolio dominates one security, increasing the share of all other securities in the portfolio and reducing the proportion of the dominated security improves the portfolio for all risk-averse investors. The opposite also applies: if a security dominates the market portfolio, increasing its proportion in the market portfolio and reducing the proportion of all other securities, improves the portfolio for all risk-averse investors. Since for binary relations, the transitivity property for MCSD applies, that is, if stock A dominates stock B which in turn dominates stock C, then A also dominates stock C, we can use MCSD with respect to the market to measure and compare overall stock return distributions. Thus, our first hypothesis is:

*Hypothesis 1. Total stock performance (TSP) reflects the range of shareholder/investor preferences embedded in the return distribution.*

**Interest alignment and entrenchment**

The financial alignment hypothesis suggests that firm performance improves as management ownership rises. On the other hand, there are two competing arguments to this thesis. The first is based on the principle of diversification. It argues that managers typically hold a disproportionately higher fraction of their wealth in the firm than a well diversified outside shareholder and also have human capital closely tied to the firm’s performance. Thus, because of under-diversification, higher levels of managerial ownership increase the misalignment between managerial and shareholder

\(^{11}\) In the appendix we provide a more rigorous description of MCSD
The second argument is based on the entrenchment hypothesis, whereby managers who own enough of the company use their voting power and influence to pursue their own agendas at the expense of the other shareholders. It suggests that the relationship between MO and firm performance is non-linear. All of these hypotheses have been the object of interest in the literature.

The initial thrust of the literature that analyzes the effect of managerial ownership on firm performance was that greater managerial ownership benefits shareholders because it increases managers’ incentives to increase firm value (e.g. Jensen and Meckling, 1976; Morck, Shleifer and Vishny, 1988; Stulz, 1988; Tosi, Katz and Gomez-Mejia 1997). Other studies pointed out, however, that if managers own a substantial percentage of a firm’s shares, they may try to entrench themselves in the company they manage by over-investing (empire building) and accepting negative present value projects that reduce corporate wealth (e.g. Demsetz, 1983; and Fama and Jensen, 1983). As such, this literature suggests that the relationship between firm value and managerial ownership is not monotonic and that there is an optimal level of ownership. Tobin’s Q, equity returns and firm volatility have been used to test these propositions.

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12 The evidence for this argument is ambiguous. Knopf, et al. (2002) and Brockman, Martin and Unlu (2010) document a negative relationship between managerial ownership and financial alignment while others, such as Liu and Mauer (2011), and Daniel et al. (2004) provide evidence of a positive relationship. Coles, et al. (2006) provide evidence for both types of relationship.  
13 Berger, Ofec and Yermack (1997 p. 1411) define entrenchment as: “The extent to which managers fail to experience discipline from the full range of corporate governance mechanisms, including monitoring by the board, the threat of dismissal or takeover, and stock or compensation-based performance incentives.”  
14 One manifestation of the entrenchment hypothesis is the choice by the CEO of a board of directors that cannot monitor him. For an empirical examination on the matter see: Coles, Lemmon and Wang (2008), Faccio and Lasfer (1999) and Guest (2008).  
15 Aggarwal and Samwick (2006) find that the empire-building hypothesis has been over-stated. Instead, they find that managers under-invest and that this problem can be addressed through properly designed incentive packages for the managers.  
16 The optimal level of managerial ownership may vary from country to country due to differences in the enforcement of the legal system (e.g. de Miguel, Pindado and de la Torre, 2003)
Many empirical studies find no relationship between managerial ownership and firm performance (e.g. Brick, Palia and Wang, 2005; Cho, 1998; Demsetz and Villalonga, 2001; Loderer and Martin, 1997; Seifert, Gonenc and Wright, 2005; and Vafeas and Theodorou, 1998). Faccio and Lasfer (1999) find that this relationship is only weak. Other studies have found that there is a relationship and that it is non-linear. For example, when Tobin’s Q is the performance measure, Morck, et al. (1988) find a positive relationship between Tobin’s Q and managerial ownership for ownership levels between 0 and 5 percent and above 25 percent. For intermediate levels, the relationship is negative. McConnell and Servaes (1990) find a similar relationship in their study, but identify the inflection point between 40 and 50 percent ownership. Holderness, Kroszner, and Sheehan (1999) examine this relationship for US firms from 1935 and reach the same conclusion. Hermalin and Weisbach (1991) find a positive relationship between firm performance and managerial ownership for ownership levels between 0 and 1 percent and between 5 and 20 percent and a negative relationship for other ownership levels. Other studies, such as Cebenoyan, Cooperman and Register (2000), Cui and Mak (2002), Davies, Hilier and McColgan (2005), and Kim, Kitsabunnarat and Nofsinger (2004), provide support for the non-linear relationship between managerial ownership and firm performance.

When measures other than Tobin’s Q, such as stock returns or accounting quantities, are used to proxy performance, results are also mixed. Kirchmaier and Grant (2005) use quarterly stock market returns from five European countries as a

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17 Although it is used extensively in financial research, Tobin’s Q has many practical drawbacks for use in studies on the manager/shareholder agency conflict. First of all, since it refers to the total value of the firm, it is not specific to shareholders such that a higher/lower Q does not necessarily reflect higher/lower shareholder value. Secondly, since nominal debt appears in both the numerator and denominator, it is an imperfect representation of the theoretical Tobin’s Q. Thirdly, as Dybvig and Warachka (2010) have pointed out, the denominator is endogenous, which could cause a misrepresentation of whether value is being created.


Evidence on the effect of managerial ownership on firm performance is also present when firm risk is used as the performance proxy. For example, Eisenmann (2002) finds a positive relationship between CEO ownership and risk for a sample of the US cable television industry. Chen and Steiner (1999) identify a positive, nonlinear relationship between risk and managerial ownership for a sample of US companies and Gadhoum and Ayadi (2003) find a similar relationship for their sample of Canadian companies. Acharya and Bisin (2009) find that an appropriate level of managerial ownership can serve to mitigate the moral hazard associated with managers’ inability to diversify their firm specific risk due to legal restrictions and that firms with high levels of managerial ownership also have high levels of firm specific risk. Other studies in the literature (e.g. Amihud and Lev, 1981; May, 1995; Denis, Denis and Sarin, 1997 and 1999; Goranova, Alessandri, Brandes and

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19 Monsen and Downs (1965) argue that there is asymmetry between risk and reward for managers and owners so managers will opt for less risk than the owners.
20 Acharya and Bisin (2009) argue that this type of moral hazard can explain the relationship between managerial ownership and firm performance found among others by Morck et. al. (1998), for low levels of managerial ownership.
Dharwadkar, 2007) also identify a relationship between firm diversification and managerial ownership, but the evidence they provide is inconclusive.\textsuperscript{21}

Given the foregoing mixed results and the argument that the relevant performance proxies do not accurately reflect shareholder preferences, we propose as a baseline hypothesis that when the performance proxy is constructed to reflect the whole range of preferences embedded in the return distribution, i.e. TSP, the empirical managerial ownership/financial alignment relationship is significant and non-linear, reflecting both alignment and entrenchment. However, common sense suggests that after a certain level of ownership, the agency costs of entrenchment would be tantamount to stealing from oneself. Therefore, we further hypothesize that the entrenchment effect will disappear at higher levels of ownership.\textsuperscript{22}

Formally:

\textit{Hypothesis 2. The relationship between managerial ownership and TSP is non-linear with at least one local maximum and one local minimum.}

Although the nonlinear relationship between firm performance and managerial ownership is consistent with the agency theory perspective, the implicit assumption of previous studies is that causality runs from managerial ownership to firm performance. However, a relationship between ownership and performance could reflect reverse causality. For instance, a positive relationship between managerial ownership and firm performance could be the result of managers aligning their interests to those of the shareholders. It could also be that managers of well performing firms increase their stake in the company they manage. Indeed, Kole (1996) argues that causality operates from performance to ownership.

\textsuperscript{21}Aggarwal and Samwick (2003), however, argue that managers diversify not to reduce exposure to risk but because their motives for empire-building change through time.

\textsuperscript{22}Using Tobin's Q as the performance proxy, other studies such as De Miguel et al. (2004), McConnell and Servaes (1990) and Morck et al. (1988) provide evidence for two turning points.
This brings up the question of whether or not there is a prime mover and if there is, is it MO or is it performance? Insights into this matter can be gleaned from Granger causality analysis. One standard requirement for causality is that changes in the cause variable should precede changes in the effect variable. Granger causality essentially tests for this condition. Consequently, although in and of itself Granger causality is only a necessary but not a sufficient condition for a true causal relationship, it does increase the probability that a proposed causal relationship does actually exist. Thus, given the plausible argument for endogeneity and the theorized non-linear relationship between MO and TSP, we offer these two hypotheses:

\textit{Hypothesis 3a. MO Granger causes TSP at each level of MO.}

\textit{Hypothesis 3b. TSP Granger causes MO at each level of MO.}

\section*{METHODS}

\subsection*{Measures}

TSP is calculated as the statistic in the test for MCSD proposed by Chow (2001):

\begin{equation}
Z^{k-j}(\tau_i) = \overline{\Phi}^{j}(\tau_i) - \overline{\Phi}^{j}((\tau_i)^s) \text{, for } i = 1, ..., m. \tag{1}
\end{equation}

where

\begin{equation}
\overline{\Phi}^{j}(\tau_i) = \overline{r_{pk}I(\tau_i)} - \overline{r_{mk}I(\tau_i)} \text{, } i = 1,2, ..., m \text{ and } k=1,2,...,K. \tag{2}
\end{equation}
and \( \Phi^k(\tau_i) \) is the mean excess conditional return of stock \( k \) relative to the market portfolio below a target rate of return \( \tau \). \( i \) denotes the set of prespecified target rates of return. \( S_{k-j}(\tau_i) \) is the estimated standard error of \( \Phi^k(\tau_i) - \Phi^j(\tau_i) \) and \( I(\tau_i) \) is an indicator variable such that \( I(\tau_i) = 1 \) if \( r_M \leq \tau \) and 0 otherwise.\(^{23}\) Following Chow (2001), we use deciles for each pair of stocks, (i.e. \( i = 1, ..., 10 \)), which gives 10 individual \( Z \) statistics. TSP is the average of these ten \( Z \) statistics. As a test for MCSD, the \( Z \) statistic tells us if the return distribution of stock \( k \) is “superior” or “inferior” compared to the return distribution of the market portfolio for risk-averse investors.

To understand how TSP is calculated, consider the following example. Suppose we examine a period of 50 working days which gives us 50 daily returns for the market portfolio (M) and stock \( i \). The first step is to rank the market returns from lowest to highest and to match them with the corresponding returns of stock \( i \). Thus, the return on stock \( i \) is conditional on the return on the market portfolio. The returns on the market portfolio are ranked in ascending order to reflect risk aversion where utility is higher at lower levels of wealth. Then, the sample is split into deciles; i.e. into groups of pairs of returns, each consisting of 5 pairs. Table 1 reports the 15 lowest hypothetical returns for the market portfolio and the corresponding returns for stock \( i \). For example, the 3\(^{rd} \) lowest return of the market portfolio during the 50 day period was -7.2\%. On that day the return of stock \( i \) was -7\%. The third step is to calculate the difference for each pair of returns, which is reported in the 4\(^{th} \) column of the table. Next, we calculate the average difference in returns for the first 5 observations, the first 10 observations, the first 15 observations, and so on, until we include the entire sample. We also calculate the standard deviation of the differences.

\(^{23}\) For detailed information on the \( Z \) test, see Chow (2001).
in returns [St.Dev.\((R_i - R_M)\)] reported in column 5. Finally, we calculate the Z statistic which is the average difference in returns divided by the standard deviation of these differences for each sub-sample. The TSP statistic is the average of the ten Z statistics for the 50 day period.

The calculation of each average \((R_i - R_M)\) always begins from decile 1 to reflect risk aversion because risk averse investors weight returns at lower levels of wealth more heavily than at higher levels. If each average \((R_i - R_M)\) was calculated for each decile separately, TSP would give an equal weight on the average difference of returns between \(R_i\) and \(R_M\) across the entire distribution of returns, which would be inconsistent with risk aversion.

[INSERT TABLE 1 ABOUT HERE]

TSP reflects the relative performance of the stock with respect to the market, and, since higher TSP indicates better performance, with respect to the other stocks as well. In the stochastic dominance literature, if all the Z statistics are positive and at least one is statistically significant, then asset \(i\) not only performs better than the market portfolio but it also dominates it in the MCSD sense, which means that increasing the weight of that stock against all other stocks in the market portfolio increases the utility of all risk averse investors.\(^{24}\) For our analysis, we calculate TSP each year for each firm in our sample using daily stock returns and let it represent the measure of relative stock performance for risk averse utility maximizers. The advantage of this approach is that it measures differences in the entire distribution of asset returns.\(^{25}\)

\(^{24}\) See Chow (2001).

\(^{25}\) The results reported in Table 4 in the next section, verify this intuition.
Sample

The sample includes all listed non financial firms on three US exchanges - New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and Nasdaq - for the period 2002-2009. Specific firm data was obtained from Worldscope. Data on firm ownership structure was obtained from Thomson One Banker. Following Holderness et al. (1999), Helwege, Pirinsky and Stulz (2007), and Fahlenbrach and Stulz, (2009), managerial ownership, \( MO \), is measured as the percentage of total shares held by firm directors and officers.\(^{26} \)\(^{27} \) The market portfolio used to calculate TSP is proxied by the S&P 500.\(^{28} \)

To provide insight into the details of the ownership-performance relation, we consider individually the first four moments of stock performance with respect to the market portfolio: excess returns, returns, covariance, co-skewness and co-kurtosis. Excess returns (ERET) is excess returns measured as the difference between a firm’s raw return and the market return. COV is the covariance between a firm’s returns and the market portfolio’s returns. COSK is the co-skewness between a firm’s returns and the market portfolio’s returns. COKU is the co-kurtosis between a firm’s returns and the market portfolio’s returns. Table 2 reports the correlation coefficients for the sample data. It is interesting to note that TSP is positively correlated to excess return (ERET) and negatively to covariance (COV). This indicates that TSP increases with returns and decreases with systematic risk. Additionally, it is positively correlated to

\(^{26} \)Relevant data are available from 2002.
\(^{27} \)We use this measure for two reasons. First, since modern corporations are typically managed by a “team”, it corresponds best to the agency theory proposition. Second, it makes our results comparable with previous studies (also see, Thomsen and Pedersen, 2000).
\(^{28} \)The S&P 500 is a popular benchmark for professional investors. Shalit and Yitzhaki, (1994) point out that since there is no need to specify the utility functions, any monotone transformation of individual wealth is an appropriate proxy for the market portfolio.
co-skewness and negatively correlated to co-kurtosis. These correlations correspond to what would be expected of risk averse behavior.

To test hypothesis 2, we consider a number of control variables suggested in the empirical studies on the relationship between managerial ownership and stock performance. Given the dearth of theoretical analysis and empirical evidence relating the control variables to third and higher moments of the return distribution, we have no strong priors on the signs of the control variables with respect to TSP. The first control variable is the size effect (SIZE), measured as the log of total assets (see, e.g. Florackis, Kostakis and Ozkan, 2009). The second control variable is financial distress, represented by leverage (LEV), measured as total debt to total assets. The third control variable is dividend yield (DIV), measured as total cash dividend to total assets. The fourth control variable is institutional ownership (INST), measured as the percentage of the total number of shares held by financial institutions. The fifth and sixth control variables are firm age (AGE), defined as the number of years since firm creation, suggested by Bennett, Sias and Starks (2003), and auditing quality (AUD4) represented by a dummy variable that takes the value of one if the audit firm is from the Big 4 and zero otherwise. After excluding firms without the requisite ownership information and firm specifics, the final unbalanced sample consists of 2936 firms for the period 2002-2009. Table 3 reports descriptive statistics for the data series.

[INSERT TABLES 2 AND 3 ABOUT HERE]

**Techniques**

We test hypothesis 1, the hypothesis that total stock performance (TSP) reflects the range of shareholder preferences embedded in the return distributions by
regressing TSP on ERET, COV, COSK and COKU, the first four moments of the return distributions with respect to the market portfolio. In this way we control for market based effects while respecting that TSP is measured against the market portfolio. Thus, we offer the following specification where the coefficients’ standard errors are adjusted for the effects of non-independence by clustering on each firm:

\[
TSP_{it} = \kappa_0 + \kappa_1 ERET_{it} + \kappa_2 COV_{it} + \kappa_3 COSK_{it} + \kappa_4 COKU_{it} + \epsilon_{it}
\]  

(3)

where ERET, COV, COSK and COKU are the explanatory variables defined in the preceding section, the \( \kappa \)'s are estimated coefficients and \( \epsilon_i \) is the error term.

We test Hypothesis 2, the non-linearity of financial alignment, by estimating the relationship between MO and TSP. One important question to be addressed in the analysis is whether the empirical results are the interpretation of equilibrium or out-of-equilibrium phenomena. In equilibrium managerial ownership is likely to be endogenously determined (Demsetz and Lehn, 1985; Demsetz and Villalonga (2001). According to Core, Guay and Larcker (2003), the interpretation depends largely on the magnitude of adjustment costs in correcting suboptimal contracts. For example, when the costs of ownership adjustments are high, managerial ownership will change only occasionally. Demsetz (1983) argues that firms are not able to re-contract because they are hindered by the large adjustment costs. This implies that the optimal managerial ownership rests on the firm’s contracting environment that may change over time (Cheung and Wei, 2006).

To account for sub-optimal contracting, we examine the managerial-performance relation in a dynamic setting. The dynamic setting recognizes the possibility that firms adjust to their targeted managerial ownership levels gradually over time and sheds light on the dynamics of managerial ownership and its relationship to changes in firm performance.
We employ the following dynamic panel data specification:

\[ TSP_{it} = \gamma TSP_{it-1} + \varsigma MO_{it} + \delta X_{it} + n_i + \lambda_t + \xi_{it} \]  

(4)

where \( TSP \) is the estimated total stock performance,\(^{29}\) \( MO \) is a vector of managerial ownership measures, and \( X \) is a vector of control variables that include institutional ownership (\( INST \)), firm size (\( SIZE \)), leverage (\( LEV \)), dividends (\( DIV \)), and firm age (\( AGE \)). The parameter \( \gamma \) is a scalar, \( \varsigma \) and \( \delta \) are k-dimensional vectors of coefficients. The variables \( n_i \) and \( \lambda_t \) are respectively unobserved firm fixed effects and time effects that capture the effects of unobserved firm heterogeneity and economy-wide factors that are outside the firm’s control. Similarly, the lagged dependent variable in equation (4) is allowed to be correlated with unobserved heterogeneity.

The problems of endogeneity outlined above suggest the use of an instrumental variables (IV) methodology to estimate equation (4), where the lagged dependent (\( TSP_{it-1} \)) variable and endogenous regressors (\( MO \)) are instrumented. The preferred estimator for equation (1) is the Generalised Method of Moments (GMM) system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) because: (a) the panel consists of few time periods (small \( T \)) and a large number of firms (large \( N \)); (b) the dependent variable (\( TSP \)) is dynamic, in the sense that it depends on past realizations;\(^{30} \) c) the GMM system explicitly allows for heteroscedasticity and autocorrelation within firms.

\(^{29}\) As argued in this paper the measure of choice for a firm’s performance is TSP, total stock performance, and hence, for the purpose of saving space, the dynamic specification results for other performance measures, such as stock returns and return volatility, are not reported but are available upon request.

\(^{30}\) This is intuitively true, as a firm’s performance is likely to experience time clustering (Magalhaes et al. 2008). Moreover, Bond (2002, p.1) argues that “even when coefficients on lagged dependent variables are not of direct interest, allowing for dynamics in the underlying process may be crucial for recovering consistent estimates of other parameters.”
Following Arellano and Bover (1995), the dynamic performance model is estimated by the forward orthogonal deviations transform in order to purge the data of unobserved firm heterogeneity.\textsuperscript{31} Thus, the GMM system estimator combines a set of orthogonal deviation equations with equations in levels, where instrumental variables are generated within the system. The consistency of the GMM estimates is subject to an optimal choice of instruments and the absence of higher-order serial correlation in the idiosyncratic error term, $\xi_{it}$.

For our third set of analyses, testing Hypotheses 3a and 3b, we use Granger causality tests. The Granger approach has some similarities with the fixed-effects panel data analysis employed for Hypothesis 2 since the lagged dependent variable captures firm-specific effects that do not change from year to year. Granger tests are also sensitive to assumptions on the time series structure of the data. With only nine observations per firm, we cannot be sure that these processes are stationary or that they do not differ from firm to firm. We are also limited in the number of lags that can be considered.

As discussed above, the evolution of managerial ownership and firm performance can be described as a two-dimensional process with more complicated interaction effects. To apply the standard Granger causality test, we consider the information sets $\Omega_t$, $t = 1, \ldots, 9$; with $\Omega_t = \{MO_t, TSP_t\}_{t=1}^9$. Restricting attention to linear prediction with squared error loss, the following models are considered:

\begin{align}
TSP_{it} &= \alpha_1 + \beta_1 TSP_{it-1} + \beta_2 MO_{it-1} + \epsilon_{1it} \\
MO_{it} &= \alpha_2 + \beta_1 TSP_{it-1} + \beta_2 MO_{it-1} + \epsilon_{2it}
\end{align}

\textsuperscript{31} The main advantage of orthogonal transformation over first differences is that the former reduces the loss of observations when the panel data is unbalanced (for more discussion, see Gorbachev (2011)).
The \( \alpha \)'s and \( \beta \)'s are parameters of the models, and \( \varepsilon_{i1t} \) and \( \varepsilon_{i2t} \) are uncorrelated error processes. If \( \beta_3 = 0 \) and \( \beta_2 \neq 0 \), we infer unidirectional Granger causality from MO to TSP. Similarly, if \( \beta_3 \neq 0 \) and \( \beta_2 = 0 \), we infer unidirectional Granger causality from TSP to MO. If \( \beta_3 \neq 0 \) and \( \beta_2 \neq 0 \), we infer bi-directional Granger causality between MO and TSP. Factors that influence both present and lagged values of MO and TSP are controlled for by including their lagged values as explanatory variables. In addition, it is possible to control for random time and firm effects as well as some relevant control variables.

RESULTS

The results for the test of hypothesis 1 are reported in Table 4. The adjusted \( R^2 \) is over 50% in both specifications, the four explanatory variables are highly significant in both specifications and have the right signs for risk averse investors. Average excess returns and coskewness have a positive coefficient while covariance and cokurtosis have a negative coefficient. This is strong evidence that TSP reflects the individual moments of the return distribution and that it is compatible with utility maximization for risk averse investors, which makes it a good proxy for firm performance.

[INSERT TABLE 4 ABOUT HERE]

The results of the GMM system of tests for non-linearity are reported in Table 5. The Sargan test of over-identifying restrictions is not significant, indicating that the instruments used in the GMM estimation are not correlated with the error term (i.e. valid instruments). As expected, the \( AR(1) \) and \( AR(2) \) tests confirm the existence of
serial correlation of order one, but not of order two. The results suggest that the
dynamic nature of firm performance is not rejected. Specifically, the estimated
coefficient of the previous year’s performance (TSP_{t-1}) is positive and significant. The
adjustment speed (which is given by 1 - \gamma) for model 1 is 0.575 and model 2 is 0.568.
This gives, on average, an adjustment speed of 0.571. This is equivalent to a Koyck
duration interval of 5.34 with p = 95%, where p is the percentage of the decay. This
implies that it requires 5.34 years to complete a 95% adjustment, suggesting that
adjustment costs are quite high.\textsuperscript{32} This finding along with the instrumented MO is
consistent with Demsetz’s (1983) argument which suggests that firms are not able to
re-contract because they face substantial adjustment costs when they wish to adjust to
the equilibrium level of managerial ownership, where the optimal level is not constant
over time and moves with the changes in the determinants of firm performance.

[INSERT TABLE 5 ABOUT HERE]

The quartic relationship (model 1) suggest that there are four distinct intervals
and three turning points. These turning points can be optimally derived by taking the
first derivative of

\[ \zeta_4 MO^4 + \zeta_3 MO^3 + \zeta_2 MO^2 \beta_1 + \zeta_1 MO \]  \hspace{1cm} (7)

and setting it equal to zero. This gives

\[ 4\zeta_4 MO^3 + 3\zeta_3 MO^2 + 2\zeta_2 MO + \zeta_1 = 0 \]  \hspace{1cm} (8)

Solving for MO gives turning points at 8.7%, 32% and 57.2%

\text{Since } \zeta_1 = -18.46 \text{, the interval between 0 and 8.7% is downward sloping and
8.7% is a local minimum. This result is evidence of the under-diversification theory of

\textsuperscript{32} The Koyck duration is calculated as [ln(1-p) / ln(1-\gamma)] (for more information see Koyck , 1954). The
Koyck duration interval measures the time lag between a change in managerial ownership and the
moment that p percent of its effect has decayed.
managerial misalignment with shareholder preferences, which contradicts agency theory and much of the outstanding empirical work. The most likely explanation is that at low levels of ownership, increased ownership increases the costs associated with under-diversification more than the potential gains from the shareholder friendly projects that would improve TSP. These costs can also be exacerbated by issues such as restrictions on short sales, restrictions on trading during blackout periods, and required minimum levels of stock ownership.

With $\varphi_2 = 151.0$, the interval between 8.7% and 32% is upward sloping with a local maximum at 32%. This is strong evidence supporting agency theory and managerial alignment. With the coefficient $\varphi_3 = -375.5$ negative, the interval between 32% and 57.2% is negative with a local minimum at 57.2%. This result supports the argument for entrenchment. The coefficient $\varphi_4 = 286.2$ is positive, which means that the fourth interval is positive. This result supports the argument that at high levels of MO, managerial and shareholder interests coincide.

The piecewise regression in table 5 (model 2) tests the relationship between TSP and MO over each interval. The results support the conclusion derived from model 1. Over the interval 0%-8.7%, MO has a negative, statistically significant (5% level) effect on TSP. This is further evidence of misalignment. It has a positive, statistically significant (5% level) effect over the interval 8.7%-32%, which is further evidence for alignment. Over the interval 32%-57.2%, the effect is negative and statistically significant, but only at the 10% level. This is weak evidence for the entrenchment hypothesis. After 57.2% of managerial ownership, the relationship between MO and TSP seems to break down, probably because at this level of ownership the managers own so much of the company that their preferences coincide.
with those of the normal shareholder to the extent that there is nothing to be gained from further increases.

Overall, our results show that there is a statistically significant relationship between managerial ownership and firm performance. This relationship is non-linear, as suggested elsewhere in the literature based on other, less comprehensive measures of performance. We find that alignment occurs at ownership levels between 8.7% and 32% and above 57.2%. Between 32% and 57.2% we find evidence for misalignment and entrenchment. Interestingly and importantly, we find that at very low levels of MO (up to 8.7%) increasing managerial ownership actually exacerbates the agency conflict of manager/shareholder misalignment and reduces performance.

The results for Hypotheses 3a and 3b are reported in the Granger causality tests for each interval in columns 1 through 4 of table 6. Based on the significance level of 5% column 1 shows that over the interval 0%-8.7%, causality is uni-directional running from MO to TSP. This is further evidence of misalignment as managerial ownership precedes the decline in performance. Over the interval 8.7%-32%, causality is bi-directional. The causality running from MO to TSP is further evidence for alignment, while the causality running from TSP to MO suggests profit/performance chasing, based possibly on insider information. Over the interval 32%-57.2%, causality is uni-directional running from MO to TSP and is more evidence to misalignment and the entrenchment hypothesis. After 57.2% of managerial ownership, the causality relationship between MO and TSP seems to weaken, which is evidence that at high levels of ownership preferences of managers and shareholders align to the extent that there is nothing to be gained from further increases.
DISCUSSION AND CONCLUSION

This paper revisits the relationship between managerial ownership and firm performance in the framework of expected utility maximization for risk averse investors. It builds on the insight that performance criteria for risk averse investors should include the entire distribution of stock returns and the fact that the outstanding literature has not integrated this into its analysis. Our results show that MO does affect firm performance and that the effect is quartic non-linear rather than the quadratic and cubic relationships that have been used extensively in the literature. We provide strong evidence for alignment at levels of managerial ownership between 8.7% and 32% and for entrenchment at levels between 32% and 57.2%. However, at low levels of managerial ownership below 8.7%, increases in MO actually increase misalignment and reduce performance, which is evidence for the argument that low levels of managerial ownership may actually hinder firm performance due to managers’ personal costs associated with under-diversification. At very high levels of managerial ownership above 57.2%, the relationship between MO and TSP breaks down, which supports the argument that at high levels of MO, managerial and shareholder interests coincide. These results are robust with respect to a range of model specifications, conventional control variables and estimation techniques.

The Granger causality tests provide evidence that it is MO that is driving performance. Over the intervals 0%-8.7% and 32%-57.2%, Granger causality is unidirectional running from MO to TSP. Over the interval 8.7%-32% causality is bidirectional. The causality running from MO to TSP supports the argument for alignment, while the causality running from TSP to MO suggests profit/performance chasing, based possibly on insider information. After 57.2% of managerial ownership, the causality relationship between MO and TSP weakens, which is evidence that at
high levels of ownership preferences of managers and shareholders align to the extent that there is nothing to be gained from further increases.

Clearly, our results have important implications for management compensation practices. For example, the theoretical and practical implications of agency theory suggest that outside owners should encourage managers to increase their holdings of the firm they manage (Hoskisson and Hitt, 1994). Based on our results, however, there are levels of MO below which and above which increasing MO can damage firm performance. Considering some of the evidence in the empirical and theoretical literature, this is not surprising. Fahlenbrach and Stulz (2009) identify four motives for managers to hold stock in their firm: i) bonding, ii) control, iii) financing and iv) timing. As the firm matures and performs well, based on these motives, we expect managers to decrease their ownership in the firm because these motives are no longer relevant. If managers continue to hold large stakes in their firms, it is likely that they will avoid value-enhancing risky projects and become more risk averse (Benson and Davidson, 2009; Ross, 2004). Lambert (1986) and Sanders (2001) argue that stock ownership does not introduce limited downside risk, which may intensify the non-diversification of managers’ human capital and reduce their tolerance for additional risk to protect their human capital. Fahlenbrach and Stulz (2009) find that MO has recently declined in the US without any negative effect on firm performance. Acharya and Bisin (2009) present a model where managers with a high stake in the firm they manage may prefer projects with higher systematic risk and lower firm-specific risk because they can use the financial markets to hedge systematic risk in order to protect their personal wealth. Their model shows that this behavior reduces firm performance and the optimal ownership scheme is one where managers do not have a large stake in the firm. Further evidence on the misalignment
of managers’ and owners’ interests if managerial ownership is high is provided by the empirical relationship between CEO ownership and board quality. Several studies find that board quality (proxied by board size and proportion of external board members) is inversely related to managerial ownership for the US, at least until the implementation of the Sarbanes-Oxley Act (Denis and Sarin, 1999; Lasfer, 2006; Linck, Netter and Yang, 2008).

The implications of our results for managerial incentives are that if managerial ownership in a firm is very high or very low, remuneration in the form of company stock may hinder future firm performance and alternatives should be considered. Our findings suggest that “while executive compensation can be a powerful tool for reducing the agency conflicts between managers and the firm, compensation can also be a substantial source of agency costs if it is not managed properly” (Jensen, Murphy, and Wruck, 2004, p. 98). Future research should build on the work of Coles, Lemmon and Wang (2008) among others, and identify the firm characteristics that determine the level of the agency problem within a firm, and how these factors interact to determine the optimal managerial compensation structure.
Appendix

The concept of Marginal Conditional Stochastic Dominance gives the conditions under which all risk-averse individuals will prefer to increase the share of one risky asset over another when presented with a given portfolio.

Let $R$ be the rate of return of a given portfolio $P = \sum_{i=1}^{n} \alpha_i A_i$. That means

$$R = \sum_{i=1}^{n} \alpha_i X_i$$

with weights given by $\alpha_1, \alpha_2, \ldots, \alpha_n$ such that $\sum_{i=1}^{n} \alpha_i = 1$ and $X_i$ represents the return on asset $A_i$ measured as $\frac{A_i^{t+1} - A_i^t}{A_i^t}$. Let $f(x_1, x_2, \ldots, x_n)$ be the density function of the vector of random variables $(X_1, X_2, \ldots, X_n)$ and let $F_{X_1}, F_{X_2}, \ldots, F_{X_n}$ be the cumulative distribution functions of $X_1, X_2, \ldots, X_n$ respectively. The program to solve is the following:

$$\text{Max } E[u(R)]$$

(A1)

where $u$ is the utility function and $E$ stands for the expectation operator.\(^3\) The first-order condition is given by:

$$E[X_i u'(R)] = 0 \quad \forall i = 1, \ldots, n$$

(A2)

Let $d\alpha_k$ and $d\alpha_j$ be the marginal changes in holding asset $A_k$ and asset $A_j$ such that $d\alpha_k + d\alpha_j = 0$, the marginal change in expected utility will be:

$$dE[u(R)] = E[(X_k d\alpha_k + X_j d\alpha_j) u'(R)]$$

(A3)

\(^3\)For risk aversion the necessary and sufficient conditions are $u' > 0$ and $u'' < 0$.
It will be optimal to increase the weight of asset $A_k$ at the expense of asset $A_j$ if and only if this expression is non-negative. Or, equivalently if and only if:

$$\frac{dE[u(R)]}{d\alpha_k} = E[(X_k - X_j)u'(R)] \geq 0$$  \hspace{1cm} (A4)

Asset $A_k$ dominates asset $A_j$ according to the Marginal Conditional Stochastic Dominance (MCSD) if and only if the former expression is non-negative for all risk-averse individuals.
References


### Table 1 Steps in the calculation of TSP

<table>
<thead>
<tr>
<th>Obs.</th>
<th>R_M</th>
<th>R_i</th>
<th>R_i - R_M</th>
<th>Aver. (R_i - R_M)</th>
<th>St.Dev. (R_i - R_M)</th>
<th>Z (Aver/ St.Dev)</th>
</tr>
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<tr>
<td>1</td>
<td>-9.00%</td>
<td>-7.60%</td>
<td>1.40%</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-7.50%</td>
<td>-7.60%</td>
<td>-0.10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-7.20%</td>
<td>-7.00%</td>
<td>0.20%</td>
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<tr>
<td>4</td>
<td>-7.10%</td>
<td>-6.40%</td>
<td>0.70%</td>
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</tr>
<tr>
<td>5</td>
<td>-6.80%</td>
<td>-5.20%</td>
<td>1.60%</td>
<td>(obs.1 to 5) 0.76%</td>
<td>(obs.1 to 5) 0.737%</td>
<td>1.03</td>
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<tr>
<td>6</td>
<td>-5.50%</td>
<td>-5.10%</td>
<td>0.40%</td>
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<tr>
<td>7</td>
<td>-4.90%</td>
<td>-5.10%</td>
<td>-0.20%</td>
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<tr>
<td>8</td>
<td>-4.80%</td>
<td>-6.00%</td>
<td>-1.20%</td>
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<td></td>
</tr>
<tr>
<td>9</td>
<td>-4.70%</td>
<td>-5.20%</td>
<td>-0.50%</td>
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<tr>
<td>10</td>
<td>-4.10%</td>
<td>-3.50%</td>
<td>0.60%</td>
<td>(obs.1 to 10) 0.29%</td>
<td>(obs.1 to 10) 0.848%</td>
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<tr>
<td>11</td>
<td>-3.82%</td>
<td>-4.10%</td>
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<tr>
<td>12</td>
<td>-3.00%</td>
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<td>0.80%</td>
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<tr>
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<td>-1.80%</td>
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<tr>
<td>14</td>
<td>-1.96%</td>
<td>-2.25%</td>
<td>-0.29%</td>
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<tr>
<td>15</td>
<td>-1.70%</td>
<td>0.50%</td>
<td>2.20%</td>
<td>(obs.1 to 15) 0.38%</td>
<td>(obs.1 to 15) 0.884%</td>
<td>0.42</td>
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</table>

The table provides a hypothetical example for the construction of TSP (Total Stock Performance). \( R_M \) is the daily market return sorted in ascending order, \( R_i \) is the respective daily stock return, Aver. \((R_i - R_M)\) is the average difference between \( R_i \) and \( R_M \), St.Dev. \((R_i - R_M)\) is the standard deviation of \( R_i - R_M \) and \( Z \) is calculated as the average \((R_i - R_M)\) divided by the standard deviation of \((R_i - R_M)\). The table reports 3 of the 10 deciles in the hypothetical example. TSP is the average \( Z \) value over the 10 deciles.
Table 2: Correlation Matrix.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
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<tbody>
<tr>
<td>1.TSP</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td>2.COV</td>
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<td>1</td>
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<td>3.COSK</td>
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<td>4.COKU</td>
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<td>0.059</td>
<td>0.027</td>
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<td>5.ERET</td>
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<td>0.028</td>
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<tr>
<td>6.MO</td>
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<td>-0.037</td>
<td>0.014</td>
<td>0.012</td>
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<td>7.INST</td>
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<td>8.SIZE</td>
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<td>0.190</td>
<td>0.013</td>
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<td>0.019</td>
<td>-0.197</td>
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<td>0.030</td>
<td>-0.036</td>
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<td>10.DIV</td>
<td>0.161</td>
<td>0.0001</td>
<td>0.005</td>
<td>-0.010</td>
<td>0.039</td>
<td>0.012</td>
<td>-0.074</td>
<td>0.098</td>
<td>0.076</td>
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<tr>
<td>11.AGE</td>
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<td>0.034</td>
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<td>0.128</td>
<td>0.231</td>
<td>0.055</td>
<td>0.001</td>
<td>-0.007</td>
<td>1</td>
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</tbody>
</table>

The table reports correlations between our variables. TSP is the total stock performance statistic. COV is the covariance between the annual daily stock returns and the daily returns of the market portfolio. COSK is the co-skewness and COKU is the co-kurtosis between a firm’s returns and the market portfolio’s returns. ERET is the annual average excess daily stock returns including dividends. MO is the total number of shares held by firm directors to total number of shares. INST is the total shares held by financial institutions to total number of shares. SIZE is the natural logarithm of total assets. LEV is total debts to total assets. DIV is total cash dividends to total assets. AGE is the age of a company measured as the number of years since incorporation date. AUD4 is a dummy variable indicating whether a company is audited by one of the big four auditing companies. Bold texts indicate statistically significant at 1% level or better.
Table 3 Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
</tr>
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<tbody>
<tr>
<td>TSP</td>
<td>0.4436</td>
<td>1.857</td>
<td>0.3458</td>
<td>-3.4133</td>
<td>6.1127</td>
</tr>
<tr>
<td>ERET</td>
<td>0.0001</td>
<td>0.0022</td>
<td>0</td>
<td>-0.0255</td>
<td>0.027</td>
</tr>
<tr>
<td>COV</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0001</td>
<td>-0.0009</td>
<td>0.0029</td>
</tr>
<tr>
<td>COSK</td>
<td>-0.0126</td>
<td>0.0772</td>
<td>-0.0013</td>
<td>-1.2323</td>
<td>1.7069</td>
</tr>
<tr>
<td>COKU</td>
<td>0.0004</td>
<td>0.006</td>
<td>0</td>
<td>0</td>
<td>0.6626</td>
</tr>
<tr>
<td>MO</td>
<td>0.0464</td>
<td>0.118</td>
<td>0</td>
<td>0</td>
<td>0.62</td>
</tr>
<tr>
<td>INST</td>
<td>0.2125</td>
<td>0.2089</td>
<td>0.15</td>
<td>0</td>
<td>0.78</td>
</tr>
<tr>
<td>SIZE</td>
<td>12.8238</td>
<td>2.0838</td>
<td>12.7822</td>
<td>8.1155</td>
<td>17.7419</td>
</tr>
<tr>
<td>LEV</td>
<td>0.2167</td>
<td>0.2318</td>
<td>0.1549</td>
<td>0</td>
<td>1.0481</td>
</tr>
<tr>
<td>DIV</td>
<td>0.0102</td>
<td>0.0258</td>
<td>0</td>
<td>0</td>
<td>0.1811</td>
</tr>
<tr>
<td>AGE</td>
<td>26.4428</td>
<td>24.7105</td>
<td>18</td>
<td>1</td>
<td>111</td>
</tr>
<tr>
<td>AUD4</td>
<td>0.3985</td>
<td>0.4896</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

TSP is the total stock performance statistic. ERET is the annual average excess daily stock returns including dividends. COV is the covariance between the annual daily stock returns and the daily returns of the market portfolio. COSK is the co-skewness and COKU is the co-kurtosis between a firm’s returns and the market portfolio’s returns. MO is the total number of shares held by firm directors to total number of shares. INST is the total shares held by financial institutions to total number of shares. SIZE is the natural logarithm of total assets. LEV is total debts to total assets. DIV is total cash dividends to total assets. AGE is the age of a company measured as the number of years since incorporation date. AUD4 is a dummy variable indicating whether a company is audited by one of the big four auditing companies. All variables are winsorized at the 1% and 99% percentiles, respectively.
### Table 4 Determinants of total stock performance (TSP)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ERET</strong></td>
<td>240.4**</td>
<td>236.0**</td>
</tr>
<tr>
<td></td>
<td>(45.13)</td>
<td>(77.03)</td>
</tr>
<tr>
<td><strong>COV</strong></td>
<td>-7095.3**</td>
<td>-5178.2**</td>
</tr>
<tr>
<td></td>
<td>(-67.68)</td>
<td>(-96.27)</td>
</tr>
<tr>
<td><strong>COSK</strong></td>
<td>0.336**</td>
<td>0.451**</td>
</tr>
<tr>
<td></td>
<td>(2.14)</td>
<td>(4.50)</td>
</tr>
<tr>
<td><strong>COKU</strong></td>
<td>-8.392*</td>
<td>-8.353**</td>
</tr>
<tr>
<td></td>
<td>(-1.86)</td>
<td>(-7.27)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>2.005**</td>
<td>1.906**</td>
</tr>
<tr>
<td></td>
<td>(31.26)</td>
<td>(130.14)</td>
</tr>
<tr>
<td><strong>Year dummies</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Industry dummies</strong></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Firm-fixed effects</strong></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>14728</td>
<td>14728</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.547</td>
<td>0.501</td>
</tr>
</tbody>
</table>

The dependent variable is total stock performance (TSP). ERET is excess returns measured as the difference between a firm’s raw return and the market return. COV is the covariance between a firm’s returns and the market portfolio’s returns. COSK is the co-skewness between a firm’s returns and the market portfolio’s returns. COKU is the co-kurtosis between a firm’s returns and the market portfolio’s returns. The models are estimated using pooled OLS estimation. The coefficients’ standard errors are adjusted for the effects of non-independence by clustering on each firm (Petersen 2009). t statistics in parentheses. * p < 0.10, ** p < 0.05.
Table 5 GMM system results for TSP

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th></th>
<th>(2)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TSP</td>
<td></td>
<td>TSP</td>
<td></td>
</tr>
<tr>
<td>TSP&lt;sub&gt;-1&lt;/sub&gt;</td>
<td>0.425**</td>
<td>(17.03)</td>
<td>0.432**</td>
<td>(17.43)</td>
</tr>
<tr>
<td>MO</td>
<td>-18.46**</td>
<td>(-5.70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MO&lt;sup&gt;2&lt;/sup&gt;</td>
<td>151.0**</td>
<td>(4.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MO&lt;sup&gt;3&lt;/sup&gt;</td>
<td>-375.5**</td>
<td>(-3.57)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MO&lt;sup&gt;4&lt;/sup&gt;</td>
<td>286.2**</td>
<td>(2.99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MO[0-8.7%]</td>
<td></td>
<td>-8.767**</td>
<td>(-6.89)</td>
<td></td>
</tr>
<tr>
<td>MO(8.7%-32%)</td>
<td></td>
<td>4.709**</td>
<td>(4.37)</td>
<td></td>
</tr>
<tr>
<td>MO(32%-57.2%)</td>
<td></td>
<td>-3.181*</td>
<td>(-1.68)</td>
<td>-10.69</td>
</tr>
<tr>
<td>MO(57.2%-100%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INST</td>
<td>-0.597**</td>
<td>(-4.77)</td>
<td>-0.630**</td>
<td>(-5.04)</td>
</tr>
<tr>
<td>SIZE</td>
<td>-0.261**</td>
<td>(-9.69)</td>
<td>-0.267**</td>
<td>(-9.70)</td>
</tr>
<tr>
<td>LEV</td>
<td>1.860**</td>
<td>(7.17)</td>
<td>1.887**</td>
<td>(7.24)</td>
</tr>
<tr>
<td>DIV</td>
<td>3.777**</td>
<td>(2.30)</td>
<td>4.154**</td>
<td>(2.53)</td>
</tr>
<tr>
<td>AGE</td>
<td>0.0267**</td>
<td>(11.56)</td>
<td>0.0265**</td>
<td>(11.39)</td>
</tr>
<tr>
<td>AUD4</td>
<td>-0.398</td>
<td>(-1.56)</td>
<td>-0.317</td>
<td>(-1.20)</td>
</tr>
<tr>
<td>Constant</td>
<td>2.683**</td>
<td>(10.77)</td>
<td>2.736**</td>
<td>(10.79)</td>
</tr>
<tr>
<td>N</td>
<td>13017</td>
<td></td>
<td>13017</td>
<td></td>
</tr>
<tr>
<td>F-test</td>
<td>139.45**</td>
<td>(8.61)</td>
<td>139.89**</td>
<td>13.50</td>
</tr>
<tr>
<td>Sargan test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR(1)</td>
<td>-28.45**</td>
<td>(-5.70)</td>
<td>-28.72**</td>
<td>(-3.57)</td>
</tr>
<tr>
<td>AR(2)</td>
<td>0.57</td>
<td>(0.57)</td>
<td>0.58</td>
<td>(0.58)</td>
</tr>
</tbody>
</table>

The dependent variable is TSP, the total stock performance statistic. MO is the level of managerial ownership and is measured as the number of shares held by firm directors to total number of shares. MO<sup>2</sup> is the square term of MO and MO<sup>3</sup> is the cube term of MO. MO[0-8.7%], (8.7%-32%), (32%-57.2%) and (57.2%-100%) are sub-samples of MO based on the level of managerial ownership. SIZE is the natural logarithm of total assets. INST is the total shares held by financial institutions to total number of shares. LEV is total debts to total assets. DIV is total cash dividends to total assets. AGE is the age of the company. AUD4 is a dummy variable indicating whether a company is audited by one of the big four auditing companies. The models are estimated using GMM System and include year dummies. Columns (1) and (2) give the GMM system estimates where all the independent variables are treated as endogenous. Second lag period and earlier are used as instruments. F-test is a test of the joint significance of reported coefficient estimates under null hypothesis. Sargan test is a test of overidentifying restrictions under the null of instrument validity. AR(1) and AR(2) are tests for first and second order serial correlation in residuals. * p < 0.10, ** p < 0.05.
### Table 6: Granger Causality Tests

<table>
<thead>
<tr>
<th>MO intervals</th>
<th>(1) [0-8.7%]</th>
<th>(2) 8.7%-32%</th>
<th>(3) 32%-57.2%</th>
<th>(4) 57.2%-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP</td>
<td>TSP MO</td>
<td>TSP MO</td>
<td>TSP MO</td>
<td>TSP MO</td>
</tr>
<tr>
<td>TSP_{t-1}</td>
<td>0.600** (-0.00010*)</td>
<td>0.568** (0.0029**)</td>
<td>0.602** 0.002</td>
<td>0.680** -0.006</td>
</tr>
<tr>
<td></td>
<td>(116.14) (-1.71)</td>
<td>(35.85) (3.99)</td>
<td>(22.72) (1.58)</td>
<td>(14.04) (-1.49)</td>
</tr>
<tr>
<td>MO_{t-1}</td>
<td>0.429** 0.0132**</td>
<td>1.095** 0.164**</td>
<td>1.046** 0.042**</td>
<td>0.428* 0.0023</td>
</tr>
<tr>
<td></td>
<td>(3.67) (9.00)</td>
<td>(5.03) (16.34)</td>
<td>(5.20) (4.08)</td>
<td>(1.67) (0.96)</td>
</tr>
<tr>
<td>Cons</td>
<td>-0.0416** 0.0044**</td>
<td>-0.091** 0.161**</td>
<td>-0.158** 0.419**</td>
<td>-0.059 0.612**</td>
</tr>
<tr>
<td></td>
<td>(-4.07) (35.49)</td>
<td>(-2.53) (96.45)</td>
<td>(-2.34) (118.25)</td>
<td>(-0.49) (528.41)</td>
</tr>
<tr>
<td>N</td>
<td>19219 20497</td>
<td>2637 2856</td>
<td>875 942</td>
<td>298 323</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.413 0.004</td>
<td>0.328 0.086</td>
<td>0.372 0.016</td>
<td>0.397 0.005</td>
</tr>
<tr>
<td>F-test</td>
<td>13.46** 2.91</td>
<td>25.32** 15.88**</td>
<td>27.03** 2.48</td>
<td>2.79 2.21</td>
</tr>
</tbody>
</table>

TSP is the total stock performance statistic. MO is the level of managerial ownership and is measured as the number of shares held by firm directors to total number of shares. (1) refers to the sample subgroup where managerial ownership is below 9%. (2) refers to the sample subgroup where managerial ownership is between 9% and 32%. (3) refers to the sample subgroup where managerial ownership is between 32% and 57%. (4) refers to the sample subgroup where managerial ownership is above 57%.