CEO Tenure, Managerial Myopia, and Innovation Efficiency

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Abstract

This study investigates the effects of top managers' myopic behavior on R&D inefficiency. In other words, this study examines whether long tenure CEOs hurt firm innovation efficiency. The sample was drawn from US manufacturing companies during the period 2003 to 2012. The results are consistent with the notion that a firm's under-spending R&D inefficiency is positively associated with the tenure of its CEO. This thus implies that the presence of a long-tenured CEO is indicative of a preference for an unusually low level of R&D investment. In addition, this study also finds there to be a positive relationship between inefficiency in the form of under-investment in R&D and the beginning of tenure when CEOs attempt to avoid reporting small earnings surprises. Therefore, at the beginning of their tenure, they are more likely to engage in cutting R&D investment to avoid reporting unexpected bad earnings and thus protect their job security.

Keywords: CEO tenure, Upper-echelons perspective, R&D, Managerial myopia
JEL Classifications: M12, M21, G31, O32.

I. Introduction

In general, Chief Executive Officers (CEO, hereafter) have extensive decision-making power and the ability to significantly influence their firm's research and development (R&D, hereafter) decisions (Bantel and Jackson, 1989). Organizational outcomes, strategic choices, and performance levels are all reflections of the values and cognitive biases of top managers, based on the upper-echelon perspective (Hambrick and Mason, 1984). For example, the upper-echelons literature relates top management team (TMT) demographics to various organizational processes and outcomes related to corporate financial disclosure (Bamber et al., 2010), firm performance (Weinzimmer, 1997) and innovation performance (Barker and Mueller, 2002). Innovation performance as well as the diversity and educational level of the top management team (TMT) have traditionally been considered features that promote or limit an orientation toward innovation (Daellenbach et al., 1999; Kor, 2006; Chen et al., 2010; Lin et al., 2011). Studies have also shown that stock-based compensation increases managers' implementation of several risky policies, including high R&D spending (Barker and Mueller, 2002; Coles et al., 2006; Kang et al., 2006; Fabio, 2016). However, there is no consistent evidence suggesting a relevant CEO tenure variable affecting innovation performance (Hambrick and Fukutomi, 1991; Chen, 2013). In this context, it is also noted that few studies have considered R&D efficiency with regard to the upper echelon perspective. In fact, Jaruzelski et al. (2011) noted that Booz & Company's annual Global Innovation 1000 study indicated that R&D spending does not always correlate with market value or growth. Obviously, the amount of R&D spending cannot reveal how a company might assess what kind of return it will get from this investment or how much more or less it should be spending (i.e., what the optimal level of R&D spending is). Consistent with the prediction of short-sightedness perspective, this study explores the related issue whether long tenured CEOs engage in short term investment behavior (e.g., inefficiency in the form of under-investment on R&D).

In addition, new CEOs begin with a knowledge deficit and then steadily learn more about their jobs, organizations, and environments. Therefore, short-tenured CEOs may tend to invest less in innovation activities. Chen (2013) provided empirical evidence that such CEOs indeed tend to invest less in R&D. However, some studies argue that prospector strategies,

emphasizing product/market innovations, tend to be led by shorter-tenured CEOs (Chaganti and Sambharya, 1987; Thomas et al., 1991), which implies that these CEOs will invest more in R&D. Prior studies provide contradictory results that suggest there may be wide variations in the behavior of short-tenured CEOs. This paper thus is an attempt to explore the association between short-tenured CEOs and R&D decisions by including important factors such as managerial myopic behavior. Based on signaling theory, this study investigates whether short-tenured CEOs may be likely to behave in an overly risk-averse manner in terms of R&D investment when they need to meet short-term earnings targets.

Myopic investment behavior (or managerial myopia) refers to under-investment in long-term, intangible projects such as R&D, advertising, and employee training for the purposes of meeting short-term goals (Porter, 1992). Theories regarding managerial myopic behavior are based on signaling models, as first introduced by Spence (1973) and provide a theoretical framework that demonstrates how myopic outcomes can occur. Trueman (1986), Bebchuk and Stole (1993) and Bizjak et al. (1993), for example, developed such models. In a signaling framework, firms face either good or bad prospects that are unobservable by the market, and firms with good prospects want the stock market to know about their better prospects because this will improve expectations related to their future performance and firm valuation. Thus, the specifications of signaling models can yield situations where myopic behavior incentives lead to under-investment in a particular project type. Adams et al. (2010) indicate that CEO abilities at the beginning of their tenure were not viewed as being well-known to the market since performance perceptions rely primarily on a CEO's current performance. The board is also likely to consider operating profitability as a valuable signal of a CEO's managerial abilities (Parrino, 1997; Warner et al., 1988). When firm performance is poor at the beginning of tenure, operating losses are likely to reinforce the board's concerns about a CEO's abilities, thereby increasing the probability of CEO turnover. Therefore, this study investigates whether short-tenured CEOs tend to invest less in inefficient, under-spending on R&D when they attempt to meet short-term earnings targets.

The sample used in this study is composed of US manufacturing firms (SIC 2, 3) during the period 2003 to 2012. After controlling for firm characteristics and macro-economic factors that determine R&D inefficiency, the empirical results (1) show a positive relationship between long-tenured CEOs and under-spending R&D inefficiency and (2) indicate that a small positive earnings surprise negatively moderates the link between CEO tenure and inefficiency as under-spending on R&D. An important contribution of this study is that short-tenured CEOs will engage in opportunistic reductions in R&D expenditures as they attempt to show their ability to the board in the early stages of their careers.

The remainder of this paper is organized as follows: Section 2 reviews the prior literature and presents the hypotheses, while Section 3 describes the research method. Section 4 then presents the empirical results, and Section 5 provides the conclusions of this work.

II. Prior Literature and Hypotheses

A. Prior literature

Prior studies suggest that certain features of CEOs impact their orientation toward innovation (Daellenbach et al., 1999; Barker and Mueller, 2002; Kang et al., 2006; Kor, 2006; Chen et al., 2010; Lin et al., 2011). These characteristics include career experience, education level, age, and compensation. Most studies have found CEOs experienced in output functions (i.e., technical- or marketing -oriented) (Daellenbach et al., 1999; Barker and Muller, 2002; Lin et al., 2011), with higher educational levels (Barker and Mueller, 2002) and stock-based

compensation (Barker and Muller, 2002; Coles et al., 2006; Kang et al., 2006; Chen et al., 2010; Lin et al., 2011; Fabio, 2016) in younger age ranges (Barker and Mueller, 2002) to be positively related to R&D investment. Regarding CEO tenure, Chen (2013) provided empirical evidence that both long- and short-tenured CEOs may tend to invest sparingly in R&D. However, some studies have also argued that prospector strategies emphasizing product/market innovations tend to be adopted by shorter-tenured CEOs (Chaganti and Sambharya, 1987; Thomas et al., 1991), which implies that such CEOs might invest more in R&D. These contradictory results suggest there may be wide variations in the behavior of short-tenured CEOs.

In fact, over the past 30 years, the average CEO tenure has decreased from about eight to less than four years (e.g., Khurana, 2003; Miller and Le Breton-Miller, 2005), and consequently the pressure on CEOs to deliver quick results has increased dramatically. Changes in risk-taking and willingness to embrace strategic risk, as seen in R&D decisions, are likely to occur over the course of a CEO's tenure. Therefore, the relationship between CEO tenure and R&D decision-making has long interested strategic management researchers. Previous researchers who studied the simple main effects of tenure on R&D have observed that longer-tenured CEOs may lose touch with their organizational environment and hence may not make the changes and risky investments needed to keep the firm evolving over time (Miller, 1991; Barker and Mueller, 2002; Kor, 2006). However, as is now generally acknowledged, the relationship between tenure and R&D decisions is much more complex than was originally thought (Hambrick and Fukutomi, 1991). In particular, researchers are now analyzing mechanisms that might govern the tenure-R&D relationship by focusing on the effects of board capital (Chen, 2013). Consistent with this idea, this paper examines how myopic investment behavior might moderate the tenure-R&D inefficiency association in firms.

B. Hypotheses

The theoretical mechanism linking CEO tenure and R&D decisions may be explained by the agency theory. According to this theory, short-sightedness may lead CEOs to reduce R&D spending to serve their own interests at the expense of shareholder wealth. This managerial behavior may generate problems regarding the efficient allocation of firm resources (Jensen and Meckling, 1976). Regarding the problem of managerial short-sightedness, cash flow timing creates an agency problem between managers and shareholders. Shareholders will tend to be concerned with all future cash flows of the company into the indefinite future and will thus tend to favor risky projects, such as R&D. However, given their limited remaining tenure, long-tenured managers show preferences to make investment decisions that maximize short-term earnings and consequently enable them to increase their compensation, which is generally based on short-term accounting measures (Jensen, 1986). For example, Dechow and Sloan (1991) examined R&D expenditures as top executives approached retirement and found that they tended to decline. In addition, because of their high power in the firm and legitimacy among stakeholders, long-tenured managers often have the liberty to pursue strategies they like, even if they are not profit-maximizing choices (Singh and Harianto, 1989; Zajac and Westphal, 1996; Cannella and Shen, 2001).

In addition, long-tenured CEOs will have a greater commitment to the status quo of their firms and greater difficulty in grasping new ideas and learning new behavior, and their innovation-related investments will thus be more conservative. Prior studies have found that CEOs usually make fewer changes in strategy as their tenure increases (Grimm and Smith, 1991), which limits the possibility of significant strategic changes and leads to a reduced

commitment to innovation. This may be because longer tenured CEOs tend to decrease their commitment to learning, narrow their information searches (Finkelstein and Hambrick, 1996; Audia et al., 2000; Kroll et al., 2000), exhibit an increased ability to ignore or only symbolically comply with external pressures (Miller, 1991), and may also have little interest in pursuing innovation through higher levels of R&D investment (Barker and Mueller, 2002; Kor, 2006). Conversely, Murphy and Zimmerman (1993) and Conyon and Florou (2006) examined R&D spending by the same CEOs over time and found no evidence that CEOs reduce their spending as they approach retirement. Long-tenured CEOs thus tend to have less interest in pursuing innovation strategies through higher R&D spending, and they might therefore be under-spending on R&D. Summarizing the above arguments lead to the following hypothesis:

Hypothesis 1: There will be a positive relationship between under-spending R&D inefficiency and the length of CEO tenure.

The theoretical mechanism linking short-tenured CEOs and R&D decisions moderated by myopia behavior is based on signaling theory. Firms face either good or bad prospects that are unobservable by the market, and short-tenure CEOs with good prospects (i.e., those engaging in under-spending R&D inefficiency in order to boost short-term reporting earnings) want the stock market to know about their better prospects because this will improve expectations related to their future performance and firm valuation. Given that their wealth is tied to firm performance over their short tenure, such managers tend to prefer making investment decisions that maximize firm short-term earnings when faced with reporting small earnings surprises in order to enhance their reputations more rapidly in the job market.

Moreover, and as noted above, Hambrick and Fukutomi (1991) suggested that new CEOs begin with a knowledge deficit and then steadily learn about their jobs, organizations, and environments over time. During the initial phase of their tenure, CEOs thus have a relative lack of internal and external networks, experience, and knowledge about their firms and industries (Wu et al., 2005), which limits their performance and ability to effectively notice, assess, and execute risks (Simsek, 2007). Accordingly, new CEOs' efforts to promote R&D activities may be less than optimal, even if these CEOs willingly take risks and invest in R&D in an effort to achieve successful outcomes for their stakeholders. For example, R&D expenses decreased by 3% (a reduction of about $2 billion) in 2011 compared with 2010 when Pfizer Inc. appointed a new CEO.

Healy (1985, p86) argued that managers have incentives to further reduce current earnings by deferring revenues or accelerating write-offs, a strategy known as "taking a bath," if earnings are so low that regardless of which accounting procedures are selected, target earnings will not be met. The short-tenured CEO can take a "big bath," which is a strategy implemented by the management team to manipulate the company's income statement to make poor results look even worse and thus to blame the former CEO for poor past performance, thereby creating a favorable platform for positive earnings development in subsequent years (Healy, 1985; Holthausen et al., 1995; Guidry et al., 1999). In contrast, some short-tenured CEOs might want to enhance their reputation more rapidly in the job market (Narayanan, 1985; Hirshleifer, 1993). A short-term earnings target is seen as very important for U.S. firms (Burgstahler and Dichev, 1997; Graham et al., 2005), where various stakeholders, such as lenders and suppliers, are more likely to view this as indicating profitability. As such, myopic investment behavior is a type of earnings management that is most likely to occur when

managers face a trade-off between meeting short-term earnings targets and maintaining R&D investment. Moreover, with regard to the issue of job security (Engel et al., 2003), at the beginning of a CEO's tenure, the board is likely to consider operating profitability as a valuable signal of the new CEO's managerial abilities. Therefore, an earnings surprise is an important moderating effect that should be considered in the relationship between short-tenured CEOs and R&D decisions. It is therefore expected in this study that short-tenured CEOs will choose income-increasing strategies when they have a greater probability of meeting current earnings' targets.

When firm performance is poor at the beginning of a CEO's tenure, operating losses are thus likely to reinforce the board's concerns about this CEO's abilities, thereby increasing the probability of CEO turnover (Warner et al., 1988; Parrino, 1997). It is therefore expected that CEOs with shorter-tenure will focus on short-term earnings targets (i.e., earnings surprises), and may not consider the long-term benefits of R&D in order to prevent being seen as having inferior abilities. Hypothesis 2 attempts to test whether there is a positive association between short-tenure CEOs and inefficient under-spending R&D strategies when firms attempt to meet short-term earnings targets. This study uses the same measure of length of CEO tenure for both hypotheses 1 and 2, with a lower number of the tenure of its CEOs indicating a shorter tenure. Hypothesis 2 is as follows:

Hypothesis 2: The relationship between maintaining an inefficient, under-spending R&D investment and the tenure of a firm's CEOs will be negative when a firm attempts to meet short-term earnings targets.

III. Research Method

A. Sample

The sample of CEOs for this study was drawn from US manufacturing companies (SIC 2, 3) during the period 2003 to 2012 since most prior studies have also used the past ten-year period (Coles et al., 2006; Lee et al., 2012). The source for firm financial data and R&D data was S&P's *Compustat*, while S&P's *ExecuComp* database was the source for the CEO tenure and compensations. Data for independent board of directors were obtained from the *RiskMetrics* (IRCC) database. There were 2,970 firm-year observations available for analysis. Table I reports the sample distribution by industry, with each manufacturing industry reported by name, along with the number of sample firms in each SIC (by 2-digit SIC). The three largest industries under consideration in this study were electronic and other electrical equipment and components, excluding computer equipment (about 22.90% of the firm-year observations), chemicals and allied products (about 19.87%), and industrial and commercial machinery and computer equipment (about 16.84%).

Refer Table I

B. Empirical model

Following prior studies, the empirical regression model (1) used in this work is as follows:

$$\text{RDIE} = \beta_0 + \beta_1 \text{TENURE} + \beta_2 SUSPECT + \beta_3 \text{TENURE} \times SUSPECT + \beta_i Control\ Variable + \varepsilon \quad (1)$$

A methodological consideration impacted the modeling of the variable for R&D inefficiency. If the R&D inefficiency regression models failed to consider the potentially endogenous variables (i.e. earnings surprises), then these would be correlated with the error term, and the use of traditional ordinary least squares methods would cause an omitted variables bias. Thus, a two-stage instrumental variables (IV) regression method was used to eliminate this bias by

first regressing the endogenous variable (earnings surprise) on all the independent variables. This study includes a number of independent variables, such as *DEBT* (total debt to total equity), *ROA* (return on assets), *EQUITY* (the percentage of long-run incentive payments), *CAP* (log of market capitalization), *M_B* (market value to book value of equity), and industry and year effects, as taken from the earnings management literature (e.g., Healy and Whalen, 1999; Fuller and Jensen, 2002; Coffee, 2003, among others). Then, the predicted values of the endogenous variables in lieu of the observed values were used in the second stage, when R&D inefficiency was regressed on the predictor variables.

First, this study follows Chen et al. (2011) to measure R&D efficiency as a firm undertaking all and only projects with positive net present value. A parsimonious model for expected investment is viewed as a function of revenue growth (Modigliani and Miller, 1958), where the relation between investment and revenue growth can differ between revenue decreases and revenue increases (e.g., Eberly, 1997; McNichols and Stubben, 2008). The expected investment model is thus estimated cross-sectionally with at least eight observations in each industry. To mitigate the influence of outliers, all variables are winsorized at the 1 percent and 99 percent levels. A piecewise linear regression model is as follows:

$$Invest\_rd_{i,t} \quad \alpha + \alpha_1 NEG_{i,t-1} + \alpha_2 \%\,\mathrm{Re}\,vGrowth_{i,t-1} + \alpha_3 NEG_{i,t-1} * \%\,\mathrm{Re}\,vGrowth_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Consistent with prior research (e.g., Biddle et al., 2009; Chen et al., 2011), this study defines $Invest\_rd_{i,t}$ as the R&D expenditures scaled by lagged total assets for firm *i* in year *t*. $\%RevGrowth_{i,t-1}$ is the annual revenue growth rate for firm *i* in year *t*-1. The indicator variable $NEG_{i,t-1}$ takes the value of 1 for negative revenue growth, and 0 otherwise. The measures of R&D efficiency, as deviations from expected investment, are obtained using a model that predicts investment as a function of growth opportunities. Therefore, both under-investment (negative deviations from expected investment) and over-investment (positive deviations from expected investment) are considered inefficient R&D expenditures. Next, absolute values are taken for both under-investment and over-investment samples to measure R&D inefficiency (*RDIE_01)*.

This study also follows McNichols and Stubben (2008) in measuring R&D investment inefficiency *(RDIE_02)* as deviations from expected investment using a model that predicts investment as a function of growth opportunities. Therefore, both under-investment in R&D (negative deviations from expected investment) and over-investment in R&D (positive deviations from expected investment) are considered inefficient investments. This study takes absolute values for both under-investment and over-investment samples to measure *RDIE_02*. In other words, this study estimates the investment model separately for each industry and year.

$$\mathrm{RD}_{i,t} \quad \alpha + \beta_1 Q_{i,t-1} + \beta_2 Q\_QRT2_{i,t-1} + \beta_3 Q\_QRT3_{i,t-1} + \beta_4 Q\_QRT4_{i,t-1} + \beta_5 CF_{i,t-1} + \beta_6 GROWTH_{i,t-1} + \beta_7 INV_{i,t-1} + \varepsilon_{i,t}, \quad (3)$$

where $Q\_QRT2_{i,t-1}$ ($Q\_QRT3_{i,t-1}$, $Q\_QRT4_{i,t-1}$) equals $Q_{i,t-1}$ times an indicator variable that equals 1 if $Q_{i,t-1}$ is in the second, third, or fourth quartiles of its industry-year distribution. This study also allows the intercept to vary across the quartiles of $Q_{i,t-1}$. The tests assume that the ability of $Q_{i,t-1}$ and $CF_{i,t-1}$ to proxy for the firm's opportunity set does not vary through time. $CF_{i,t-1}$ is a measure of firm-level cash flows for firm *i* in year *t-1*. $GROWTH_{i,t-1}$ equals the natural log of total assets at the end of year $t-1$ divided by total assets at the end of year $t-2$. $INV_{i,t-1}$ is the level of capital expenditures for firm *i* in year *t-1* that are taken from the statement of cash flows when available.

This study follows Chen et al. (2011) and McNichols and Stubben (2008) to measure R&D inefficiency. In fact, the definition of investment efficiency in prior studies includes two major parts: new investment in fixed assets (including new investments in machinery, equipment, vehicles, land, buildings) and new R&D expenditure. Mishra and Gobeli (2003) suggest that (1) an investment in R&D earns an operating margin return much higher than the industry cost of capital, and (2) the effect of an investment in R&D on a firm's market value is about twice that of an investment in fixed assets. The importance of a dollar invested in R&D thus differs from that of a dollar invested in fixed assets. This study thus focuses on the effects of the R&D expenditure. The measure of the R&D inefficiency is based on deviations from expected R&D investment, using a model that predicts investment as a function of growth opportunities, and as stated earlier, both under-investment (negative deviations from expected R&D investment) and over-investment (positive deviations from expected R&D investment) are considered to be R&D inefficiency. Additionally, this study takes an absolute value for both under-investment and over-investment samples to measure under-spending or over-spending R&D inefficiency.

According to the upper-echelons perspective (Hambrick and Mason, 1984) CEO tenure typically has a positive relationship with experience gained in management positions. CEO tenure (*TENURE*) is measured as the log of the number of years since being appointed CEO, as in Daellenbach et al. (1999) and Barker and Mueller (2002). Third, the term myopic investment behavior (or managerial myopia) refers to under-investment in long-term, intangible projects such as R&D, advertising, and employee training for the purposes of meeting short-term goals (Bhojraj and Libby, 2005; Porter, 1992). Prior studies suggest myopic investment behavior is a type of earnings management that is most likely to occur when firms face a trade-off between meeting earnings targets and maintaining discretionary expenditures such as R&D (Burgstahler and Dichev, 1997). This study identifies a sample of firms that are likely to have managed earnings to meet earnings thresholds (Degeorge et al., 1999; Roychowdhury, 2006). The basic premise of the benchmark analysis is that firms manage earnings to avoid missing benchmarks. Earnings management is thus presumed to exist for firms that just meet the benchmark, but not for others. Therefore, this study compares the suspect firms (that is, firms that were just able to meet earnings benchmarks) with those of a set of *NON- SUSPECT* firms. Building on the work of Degeorge et al. (1999) and Gunny (2010), *ROA* is calculated as income before extraordinary items, divided by total assets at the beginning of the year. An indicator variable (*SUSPECT*) is used in this work, which takes the value of 1 if (a) the observation has an *ROA* in the interval between 0 (inclusive) and 0.01 (exclusive), or (b) the change in net income before extraordinary items, scaled by total assets between time t-1 and time t is between 0 and 0.01; if not, *SUSPECT* is set to 0. *JUST_MISS* is set to 1 if (a) a firm has net income before extraordinary items, scaled by total assets, that falls in the interval [-0.01, 0), or (b), and the change in net income before extraordinary items, scaled by total assets between time t-1 and time t is between -0.01 and 0; if not, *SUSPECT* is set to 0.

Following prior studies, this work includes the following control variables, as follows: CEO age (*AGE*) is measured as the log of CEO age; *SIZE* is the natural logarithm of a firm's total assets; *FIX* is the ratio of property, plant, and equipment to total assets; *LEV* is a firm's debt to assets ratio, and *SLACK* is the ratio of operating cash flow to total assets. In addition, according to agency theory, the risk aversion and short-sightedness of managers may lead them to reduce R&D spending to serve their own interests at the expense of shareholder wealth (Jensen and Meckling, 1976). Prior studies suggest that independent directors appear to play an important monitoring role (Farber, 2005; Chen et al., 2006; Fabio, 2016).

Therefore, this study also includes the percentage of independent directors (*INDE%*) in the model to see if this impacts the agency problem regarding R&D inefficiency. It is also hard to ignore the impact of compensation when examining CEO decisions, and thus there is a line of work examining the relationship between this and R&D. For example, Cheng (2004) provided evidence that firms adjust CEO pay to reduce manipulations of R&D spending when faced with the issue of managerial myopia. Both Balkin et al. (2000) and Fong (2010) also investigated the relationship between CEO pay alignment and R&D spending. These articles thus suggest that the current study should take into account CEO, TMT, and board of director compensation (*CEO_COMP*, *TMT_COMP* and *DIRECTOR_COMP*), as at least control variables. This study also includes the 1-year lag of R&D inefficiency to account for reverse causality concerns (*LAG_RDIE*). Finally, the industry effect is defined as a categorical variable using the two-digit SIC codes, while the year effect is defined as a categorical variable using the sample firm year. Table II summarizes the definitions of the key variables employed in this work.

Refer Table II

IV. Empirical Results

A. Descriptive statistics

Table III provides descriptive statistics for all the variables included in this study. The absolute value of the first indicator of R&D inefficiency (*RDIE_01*) is 0.144, and the absolute value of the second indicator of R&D inefficiency (*RDIE_02*) is 0.061. The CEOs in the sample have served as chief executives for a mean of about 9.6 years. These findings are similar to those in Barker and Mueller (2002), in which the average CEO tenure is 8.3 years. 9.5% of firms attempt to meet positive earnings or previous year earnings in any particular year (*SUSPECT*). In addition, the mean CEO age is approximately 55. The mean firm size (*SIZE*) is 7.811, the mean ratio of property, plant, and equipment to total assets (*FIX*) is 0.220; the mean debt to assets ratio is 0.480, and the mean ratio of operating cash flow to total assets (*SLACK*) is 0.112. Table III also shows the Pearson correlations among the variables. The highest correlation (absolute value) between the independent variables is 0.511 (the correlation between *AGE* and *TENURE*); the correlation matrix shows that all correlation coefficients are below 0.8, and thus collinearity is not expected to be a serious problem.

Refer Table III

B. Empirical results

Table IV presents the instrumental variables regression results for the hypotheses. Overall, CEO tenure (*TENURE*) has a strong positive association with the absolute value of inefficient R&D spending (coefficient=0.066, 0.080, p-value <0.01 and 0.01). In terms of Hypothesis 1, CEO tenure is a significant in the under-investment sample (negative deviations are from the expected R&D investment model, and absolute values represent under-spending in inefficient R&D expenditures) (coefficient=0.066 and 0.065, p-value <0.01 and 0.01). In addition, among the control variables, firm size (*SIZE*), the fixed assets ratio (*FIX*), the percentage of independent directors (*INDE%*), CEO compensation (*CEO_COMP*) and the 1-year lag of R&D inefficiency (*LAG_RDIE*) are all significant. The coefficients for the firm size (*SIZE*) and the fixed assets ratio (*FIX*) are all positive and significant, suggesting that larger firms with high fixed assets are more likely to engage in inefficient R&D spending. The coefficient for the percentage of independent directors (*INDE%*) is negative and significant, suggesting that having more independent directors can reduce the agency problem regarding inefficient R&D spending. The coefficient for CEO compensation (*CEO_COMP*) is negative and significant, suggesting that CEO pay alignment alleviates inefficient R&D spending. Overall, these results are consistent with Hypothesis 1, which posits that long-tenured CEOs might

engage in an overly risk-averse manner in R&D investment (e.g., inefficient under-spending on R&D).

Refer Table IV

To test Hypothesis 2, the interactions between CEO tenure and firms reporting meeting earnings targets (*TENURE ×SUSPECT*) were examined. Table IV shows the regression results regarding the full, under-investment, and over-investment samples. First, for the full sample, the coefficient for *TENURE ×SUSPECT* is negative and significant (coefficient=-0.092 and -0.058, p-value <0.01 and 0.01). In addition, the results for the under-investment sample are similar to those for the full sample, with the coefficient for *TENURE ×SUSPECT* being negative and significant (coefficient=-0.111 and -0.117, p-value <0.01 and 0.01). In contrast, for the over-investment sample, the coefficients for *TENURE ×SUSPECT* are both insignificant. The negative association supports Hypothesis 2, indicating that CEOs with short-tenure will have a greater incentive to show their abilities via their companies' financial reports and so will be more likely to opportunistically cut R&D spending in order to meet earnings targets. Thus, the results are consistent with CEOs myopia behavior that refers to short-tenured CEOs engaging in under-investment in R&D spending for the purposes of meeting short-term earnings goals.

C. Robustness Tests

First, a fixed effect regression is also employed here to deal with panel data (Bascle, 2008). Table V presents the fixed effect regression results for the hypotheses. The just meets earnings threshold sample indicates that, for the full sample, CEO tenure (*TENURE*) has a strong positive association with inefficient R&D spending (coefficient=0.046 and 0.102, p-value <0.01 and 0.01), where the coefficient for *TENURE ×SUSPECT* (coefficient=-0.069 and -0.183, p-value <0.05 and 0.01) are both negative and significant. The results for the under-investment sample are similar to those for the full sample, with CEO tenure (*TENURE*) being positive and significant (coefficient=0.046 and 0.116, p-value <0.01 and 0.01), and with the coefficient for *TENURE ×SUSPECT* being negative and significant (coefficient=-0.106 and -0.365, p-value <0.01 and 0.01). In contrast, for the over-investment sample, CEO tenure (*TENURE*) is positive and insignificant (coefficient=0.026 and 0.086, p-value > 0.05), and the coefficients for *TENURE ×SUSPECT* are both insignificant. These results are thus consistent with the prior findings.

Refer Table V

Second, Table V also shows the results for just missed earnings in the fixed effects regression model, with the expectation that firms with meeting earnings targets tend to avoid reporting negative surprises by opportunistically cutting R&D spending. In contrast, firms with missed earnings targets are those that have failed to meet the threshold. As such, these firms have less incentive to cut R&D spending in this manner. *JUST_MISS* is set to 1 if (a) a firm has net income before extraordinary items, scaled by total assets, that falls in the interval [-0.01, 0), or (b) the change in net income before extraordinary items, scaled by total assets between time t-1 and time t is between -0.01 and 0; if not, *SUSPECT* is set to 0. The Table V results show that for the full and under-investment samples, the coefficients for *TENURE× JUST_MISS* are all insignificant. Overall, after considering the interactive effects of *TENURE× JUST_MISS*, the empirical results only support the just meet earning samples.

V. Conclusions

Using a sample of US manufacturing firms, and consistent with hypotheses proposed in this study, the results show that CEO tenure is associated with inefficiencies in under-investment in R&D. First, in regard to contributing to both the agency theory and upper-echelons theory,

the results support the short-sightedness theoretical prediction positing that a longer CEO tenure increases the moral hazard problem by inducing the under-investment inefficiency in R&D investment. Second, the results have implications for management practice. With widely distributed ownership, firms typically hire CEOs as agents of the board of directors, and shareholders want CEOs to undertake every positive NPV project to maximize firm value. However, CEOs will consider their personal gains and costs from undertaking such projects. The findings of this study show that the longer CEOs remain in their position, they will be less responsive to innovation activities and more likely to pass up investment opportunities that would have positive NPV (i.e., under-spending inefficiency in R&D investment) due to the strong network of relationships within the firm and ability to negotiate lower levels of monitoring. Thus, boards should be aware of such dysfunctional behavior that causes their firms to forego positive NPV projects and so results in under-spending investments in R&D.

In addition, the literature provides contradictory results regarding the association between short-tenured CEOs and R&D decisions. This study fills the gap by considering the important moderating effect of managerial myopia behavior and finds that shorter-tenured CEOs engage in under-spending R&D inefficiency to achieve current earnings targets and to prevent the board of directors or stock market from inferring that they have inferior abilities. Thus, the findings have two important implications for management practice. First, short-tenured CEOs might forego positive NPV projects, and so under-invest in R&D, in order to meet current earnings targets and to protect their job security. Boards might counteract this by structuring incentive plans to encourage more risky innovation investment in the early stages of CEO tenure. Second, a CEO's abilities are not well known to the market at the beginning of their tenure, and investors have to rely primarily on the firm's current performance to perceive them (Adams et al., 2010). Specifically, U.S. capital markets have a short-term accounting number focus, and this study evidences that this short-term earnings pressure discourages CEOs from engaging in long-term R&D investment. As such, financial analysts and investors should be cautious when evaluating the quality of financial statements from firms with short-tenured CEOs. This is because such firms have a greater incentive to opportunistically cut R&D spending, which can potentially harm future performance.

This paper has some major limitations. The above inferences should be taken with the following caveats. First, in order to maximize returns on R&D investments, it is necessary to cultivate an organizational culture or managerial capabilities necessary to manage processes related to innovation, and much of the works on firm innovation capabilities use survey data to investigate this issue (Johnson et al., 1997; Hurley and Hult, 1998; Calantone et al., 2002). However, secondary data analysis is used in this study, and so future studies could be enriched if researchers could collect more complete, in-depth survey data about the psychological attributes of top managers. Second, this study explores the association between short-tenured CEOs and R&D decisions by including the important moderating factor of managerial myopic behavior. However, there has been little study on how CEO network capital affects such associations. Relevant relationships of these findings for managerial network human capital or social capital is essential and worthy of continued research. Finally, this paper focuses primarily on how the tenure of CEOs affects firm R&D inefficiency, but the other top management team members, such as CFOs and vice CEOs, were ignored. The work of the top management team involves a significant amount of task interdependence, which in turn, requires cooperation among team members (Main et al., 1993). Future studies could expand this line of research by exploring whether and how TMT heterogeneity affects these critical associations.

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Table I Sample industry distribution

SIC Code	Industries	Observations	Percentage
20	Food and Kindred Products	210	7.07%
22	Textile Mill Products	20	0.67%
23	Apparel and Other Finished Products Made from Fabrics and Similar Materials	80	2.69%
25	Furniture and Fixtures	70	2.36%
26	Paper and Allied Products	110	3.70%
27	Printing, Publishing and Allied Industries	50	1.68%
28	Chemicals and Allied Products	590	19.87%
29	Petroleum Refining and Related Industries	60	2.02%
30	Rubber and Miscellaneous Plastics Products	80	2.69%
32	Stone, Clay, Glass, Concrete Products	30	1.01%
33	Primary Metal Industries	110	3.70%
34	Fabricated Metal Products, Except Machinery and Transportation Equipment	130	4.38%
35	Industrial and Commercial Machinery and Computer Equipment	500	16.84%
36	Electronic and Other Electrical Equipment and Components, Except Computer Equipment	680	22.90%
37	Transportation Equipment	250	8.42%
	Total	2,970	100.00%

Table II Definitions of variables

Variables	Definition
Dependent Variable	
RDIE_01	The first measure of R&D investment inefficiency (*RDIE_01*) is the residuals from the investment model proposed by Chen *et al.* (2011). Both under-investment (negative deviations from expected investment) and over-investment (positive deviations from expected investment) samples are considered inefficient R&D expenditure. This study takes an absolute values for both under-investment and over-investment samples to measure *RDIE_01*.
RDIE_02	The second measure of R&D investment inefficiency (*RDIE_02*) is the residuals from the investment model proposed by McNichols and Stubben (2008). Both under-investment (negative deviations from expected investment) and over-investment (positive deviations from expected investment) are considered inefficient R&D expenditure. This study takes an absolute values for both under-investment and over-investment samples to measure *RDIE_02*.
Independent Variables	
TENURE	CEO tenure (*TENURE*) is measured as the log of CEO tenure.
SUSPECT	*SUSPECT* set to 1 if (a) a firm has net income before extraordinary items, scaled by total assets, that falls in the interval [0, 0.01), or (b) and the change in net income before extraordinary items, scaled by total assets between time t-1 and time t is between 0 and 0.01; if not, *SUSPECT* is set to 0.
JUST_MISS	*JUST_MISS* set to 1 if (a) a firm has net income before extraordinary items, scaled by total assets, that falls in the interval [-0.01, 0), or (b) and the change in net income before extraordinary items, scaled by total assets between time t-1 and time t is between -0.01 and 0; if not, *SUSPECT* is set to 0.
AGE	CEO age (*AGE*) is measured as the log of CEO age.
SIZE	*SIZE* is the natural logarithm of a firm's total assets.
FIX	*FIX* is the ratio of property, plant, and equipment to total assets.
LEV	*LEV* is the ratio of total debt to total assets.

SLACK	*SLACK* is the ratio of operating cash flow to total assets.
INDE%	*INDE%* is the percentage of independent board members.
CEO_COMP	*CEO_COMP* is the natural logarithm of CEO compensation.
TMT_COMP	*TMT_COMP* is the natural logarithm of the top management team compensation.
DIRECTOR_COMP	*DIRECTOR_COMP* is the natural logarithm of board of director compensation.
LAG_RDIE	*LAG_RDIE* is the previous (1-year lag) R&D investment inefficiency (*RDIE_01 or RDIE_02*).
DEBT	*DEBT* is total debt to total equity.
ROA	*ROA* is the return on average assets ratio.
EQUITY	*EQUITY is* the percentage of long-run incentive payments (stock options and other long-run incentives) in the CEO's total compensation.
CAP	*CAP* is a firm market value.
M_B	*M_B* is market value to book value of equity.
INDUSTRY	Industry effect is defined as a categorical variable using the two-digit SIC codes.
YEAR	Year effect is defined as a categorical variable using sample firm year.

Table III Descriptive statistics and correlations

Variables	Mean	Std. Dev	*RDIE_01*	*RDIE_02*	*TENURE*	*SUSPECT*	*AGE*	*SIZE*	*FIX*	*LEV*
RDIE_01	0.144	0.189								
RDIE_02	0.061	0.097	0.724[a]							
TENURE	9.564	7.438	0.117[a]	0.118[a]						
SUSPECT	0.095	0.293	-0.047[b]	-0.047[b]	0.005					
AGE	54.530	6.611	0.077[a]	0.077[a]	0.511[a]	0.020				
SIZE	7.811	1.601	-0.039[a]	-0.039[a]	-0.282[a]	0.034	0.014			
FIX	0.220	0.144	0.162[a]	0.162[a]	-0.026	-0.026	0.025	0.078[a]		
LEV	0.480	0.216	-0.019	-0.019	0.025	0.025	-0.035	0.442[a]	0.151[a]	
SLACK	0.112	0.072	0.036[b]	0.036[b]	-0.003	-0.032	-0.016	0.068[a]	0.023	-0.131[a]

Note: Definitions of variables appear in Table II. The sample includes 2,970 firm-year observations. [a], and [b] represent significance at the 1% and 5% levels using the two-tailed test, respectively.

Table IV CEO tenure, managerial myopia and R&D inefficiency by instrumental variables regression

Second stage by instrumental variable regression							First stage by instrumental variable regression					
Samples	Full Sample		Under-investment		Over-investment		Samples	Full Sample		Under-investment		Over-investment	
Measures	*RDIE_01*	*RDIE_02*	*RDIE_01*	*RDIE_02*	*RDIE_01*	*RDIE_02*	*Measures*	*SUSPECT*	*SUSPECT*	*SUSPECT*	*SUSPECT*	*SUSPECT*	*SUSPECT*
Independent Variables	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Independent Variables*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*
Intercept	0.774** (2.49)	0.046** (2.42)	1.167*** (3.26)	1.565*** (2.90)	0.184 (0.60)	0.398 (0.60)	*Intercept*	0.396*** (6.90)	0.445*** (7.55)	0.409*** (6.41)	0.402*** (5.01)	0.291** (1.57)	0.492*** (5.68)
TENURE	0.066*** (5.40)	0.080*** (4.70)	0.066*** (4.57)	0.065*** (2.99)	0.035 (1.06)	0.082 (1.23)	*DEBT*	0.001 (0.65)	0.007*** (3.28)	0.001 (0.74)	0.005 (1.81)	0.001 (0.40)	0.011** (3.09)
SUSPECT	0.345*** (2.64)	0.529*** (3.19)	0.352** (2.57)	0.554** (2.54)	-0.069 (-0.53)	0.153 (0.73)	*ROA*	-0.522*** (-6.77)	-0.534*** (-6.63)	-0.605*** (-6.71)	-0.495*** (-4.57)	-0.304*** (-2.01)	-0.544*** (-4.52)
TENURE × SUSPECT	-0.092*** (-10.11)	-0.058*** (-4.65)	-0.111*** (-10.43)	-0.117*** (-7.20)	0.018 (1.11)	0.010 (0.52)	*EQUITY*	-0.001 (-0.25)	-0.001 (-0.12)	0.007 (1.09)	-0.018** (-2.22)	-0.045** (-3.17)	0.020** (2.30)
AGE	0.033 (0.44)	0.111 (1.06)	0.007 (0.08)	0.020 (0.16)	0.022 (0.30)	0.237 (1.49)	*CAP*	-0.020*** (-3.25)	-0.023*** (-3.61)	-0.020*** (-2.88)	-0.016 (-1.83)	-0.016 (-1.09)	-0.032*** (-3.35)
SIZE	0.027*** (3.23)	0.043*** (3.73)	0.022** (2.36)	0.051*** (3.34)	0.014 (1.25)	0.020 (1.24)	*M_B*	-0.002** (-2.08)	-0.006*** (-3.86)	-0.003 (-1.95)	-0.005** (-2.88)	-0.002 (-1.04)	-0.006*** (-2.58)
FIX	0.409*** (5.79)	0.578*** (7.00)	0.450*** (5.78)	0.219 (1.81)	-0.128 (-1.38)	0.891*** (7.24)	*INDUSTRY*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
LEV	-0.021 (-0.51)	0.026 (0.43)	0.081 (1.61)	0.001 (0.01)	-0.093** (-2.34)	0.101 (1.13)	*YEAR*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
SLACK	0.190 (1.47)	0.689*** (3.85)	0.275 (1.80)	0.384 (1.56)	-0.013 (-0.11)	0.778*** (3.20)	*F-statistic (p-value)*	19.81 (p<0.01)	20.66 (p<0.01)	17.45 (p<0.01)	12.68 (p<0.01)	6.68 (p<0.01)	10.42 (p<0.01)
INDE%	-0.615*** (-7.93)	-1.167*** (-10.74)	-0.712*** (-8.01)	-1.334*** (-9.36)	-0.067 (-0.84)	-0.961*** (-6.06)	*Adjusted R2*	4.47%	4.69%	4.91%	5.13%	7.37%	5.34%
CEO_COMP	-0.054*** (-3.77)	-0.099*** (-5.03)	-0.060*** (-2.70)	-0.093*** (-3.67)	-0.022 (-1.49)	-0.098*** (-3.32)	*N*	2,970	2,970	2,374	1,670	596	1,300
TMT_COMP	0.012 (0.71)	0.017 (0.73)	0.001 (0.06)	0.016 (0.60)	-0.001 (-0.07)	0.020 (0.51)							
DIRECTOR_ COMP	-0.002 (-0.37)	0.001 (0.03)	-0.003 (-0.44)	-0.001 (-0.13)	0.002 (0.35)	0.002 (0.20)							
LAG_RDIE	0.946*** (2.91)	-0.673 (-1.00)	1.133*** (3.07)	1.651** (2.14)	0.022 (0.06)	-1.362*** (-2.87)							
INDUSTRY	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*							
YEAR	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*							
F-statistic	27.24	32.82	30.17	20.95	8.12	16.63							
(p-value)	(p<0.01)	(p<0.01)	(p<0.01)	(p<0.01)	(p<0.01)	(p<0.01)							
Adjusted R^2	12.15%	14.38%	15.56%	15.14%	15.22%	15.28%							
N	2,970	2,970	2,374	1,670	596	1,300							

Note: Definitions of other variables appear in Table II. *** and ** represent significance at the 1% and 5% levels using the two-tailed test, respectively.

Table V CEO tenure, managerial myopia and R&D inefficiency by fixed effect regression

	JUST MEET EARNINGS THRESHOLD						JUST MISSING EARNINGS THRESHOLD					
Samples	Full Sample		Under-investment		Over-investment		Samples	Full Sample		Under-investment		Over-investment	
Measures	*RDIE_01*	*RDIE_02*	*RDIE_01*	*RDIE_02*	*RDIE_01*	*RDIE_02*	*Measures*	*SUSPECT*	*SUSPECT*	*SUSPECT*	*SUSPECT*	*SUSPECT*	*SUSPECT*
Independent Variables	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Independent Variables*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*	*Coef. (t-value)*
TENURE	0.046*** (3.92)	0.102*** (6.13)	0.046*** (3.33)	0.116*** (3.49)	0.026 (1.91)	0.086 (1.27)	*TENURE*	0.049*** (4.25)	0.083** (4.09)	0.047** (3.52)	0.083** (2.30)	0.027 (1.79)	0.084 (1.43)
SUSPECT	-0.029 (-0.41)	0.284*** (4.38)	0.020 (0.24)	0.533*** (6.61)	0.008 (0.36)	0.082 (0.77)	*SUSPECT*	0.222 (1.17)	-0.303 (-0.71)	0.541 (1.17)	-0.303 (-0.71)	0.114 (0.84)	0.199 (0.74)
TENURE × SUSPECT	-0.069** (-2.09)	-0.183*** (-5.86)	-0.106*** (-2.70)	-0.365*** (-9.12)	-0.063 (-1.39)	-0.019 (-0.41)	*TENURE × JUST_MISS*	-0.253 (-1.54)	-0.079 (-0.36)	-0.393 (-1.59)	-0.079 (-0.36)	-0.121 (-1.59)	0.221 (1.39)
AGE	0.089 (1.28)	0.150 (1.60)	0.059 (0.73)	0.031 (0.27)	0.101 (1.51)	0.312** (2.06)	*AGE*	0.138** (1.98)	0.246** (2.03)	0.121 (1.50)	0.246** (2.03)	0.104 (1.57)	0.318** (2.11)
SIZE	0.014 (1.82)	0.032*** (3.15)	0.010 (1.19)	0.037*** (2.93)	0.012 (1.40)	0.016 (1.00)	*SIZE*	0.013 (1.67)	0.034*** (2.58)	0.009 (1.00)	0.034*** (2.58)	0.012 (1.45)	0.016 (1.01)
FIX	0.524*** (7.88)	0.637*** (8.38)	0.560*** (7.67)	0.253** (2.32)	-0.165 (-1.83)	0.925*** (7.63)	*FIX*	0.607*** (9.32)	0.553*** (5.11)	0.647*** (9.13)	0.553*** (5.11)	-0.174 (-1.92)	0.897*** (7.46)
LEV	-0.026 (-0.63)	0.031 (0.56)	0.079 (1.62)	-0.032 (-0.47)	-0.084** (-2.15)	0.132 (1.53)	*LEV*	-0.001 (-0.02)	0.037 (0.50)	0.113** (2.28)	0.037 (0.50)	-0.082 (-0.84)	0.134 (1.57)
SLACK	0.159 (1.47)	0.513*** (3.57)	0.250 (1.94)	0.169 (0.89)	-0.073 (-0.74)	0.798*** (3.69)	*SLACK*	0.189 (1.73)	0.256 (1.30)	0.291** (2.25)	0.256 (1.30)	-0.082 (-0.84)	0.811*** (3.85)
INDE%	-0.670*** (-8.96)	-1.130*** (-11.22)	-0.778*** (-9.14)	-1.265*** (-9.83)	-0.046 (-0.59)	-0.937*** (-5.96)	*INDE%*	-0.744*** (-9.84)	-1.475*** (-10.96)	-0.864*** (-10.09)	-1.475*** (-10.96)	-0.044 (-0.55)	-0.938*** (-5.98)
CEO_COMP	-0.057*** (-4.26)	-0.110*** (-6.20)	-0.062*** (-4.05)	-0.101*** (-4.56)	-0.197 (-1.33)	-0.106*** (-3.72)	*CEO_COMP*	-0.066*** (-4.81)	-0.116*** (4.92)	-0.072*** (-4.68)	-0.116** (-4.92)	-0.021 (-1.39)	-0.109*** (-3.83)
TMT_COMP	0.017 (1.04)	0.020 (0.94)	0.004 (0.18)	0.027 (1.10)	0.005 (0.38)	0.015 (0.37)	*TMT_COMP*	0.022 (1.29)	0.014 (0.54)	0.009 (0.49)	0.014 (0.54)	0.007 (0.45)	0.016 (0.42)
DIRECTOR_ COMP	-0.002 (-0.31)	0.001 (0.12)	-0.003 (-0.45)	-0.001 (-0.15)	0.002 (0.40)	0.004 (0.33)	*DIRECTOR_ COMP*	-0.001 (-0.08)	-0.001 (-0.06)	-0.002 (-0.25)	-0.001 (-0.06)	0.002 (0.40)	0.005 (0.39)
LAG_RDIE	1.055*** (3.40)	-0.696 (-1.11)	1.237*** (3.53)	1.750** (2.44)	-0.034 (-0.10)	-1.129 (-1.83)	*LAG_RDIE*	1.379*** (4.41)	1.202 (2.71)	1.599*** (4.55)	-1.202*** (-2.71)	-0.058 (-0.16)	1.356*** (2.92)
INDUSTRY	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*INDUSTRY*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
F-statistic (p-value)	35.19 (p<0.01)	45.00 (p<0.01)	38.05 (p<0.01)	31.51 (p<0.01)	7.74 (p<0.01)	20.21 (p<0.01)	*F-statistic (p-value)*	37.96 (p<0.01)	31.09 (p<0.01)	40.00 (p<0.01)	31.09 (p<0.01)	7.52 (p<0.01)	21.35 (p<0.01)
Adjusted R^2	13.71%	17.35%	17.61%	20.87%	14.96%	17.58%	*Adjusted R^2*	14.33%	19.90%	17.92%	19.90%	15.04%	18.55%
N	2,970	2,970	2,374	1,670	596	1,300	*N*	2,970	2,970	2,374	1,670	596	1,300

Note: Definitions of other variables appear in Table II. The chi-square in Hausman test is between 136.91 and 349.13 and all p-value is less than 0.01. *** and ** represent significance at the 1% and 5% levels using the two-tailed test, respectively.