Unraveling the Corporate "Black Box": How Do CEOs Create Value for Their Firms?

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Abstract

A much debated issue in corporate finance is how idiosyncratic managerial attributes affect firm value. Using CEO turnover as an identification mechanism, we empirically identify the effect of CEO human capital on firm value and show that this effect can be partially explained by the reduction in bankruptcy costs and also by various firm-policy changes related to CEO human-capital. In particular, we show that when a CEO with transferable (general) human capital is matched with a firm relying more on general skills, the firm reduces leverage, invests less in intangibles and increases the operational efficiency, relative to firms relying more on CEOs with firm-specific skills. Changes in firm policies lower business risk and reduce the costs associated with financial distress. These findings are economically significant and are not driven by endogeneity, sample selection, and reverse causality. Our results suggest that CEO human capital affects firm value, and illustrate possible channels through which managerial human capital creates firm value for corporate stakeholders.

JEL Classification: G30, J40
Key Words: CEO Turnover, CEO Human Capital, Firm Policy, Firm Performance

1. Introduction

A much debated issue in corporate finance is how idiosyncratic managerial attributes affect firm value. Moreover, with the recent spectacular debacles of firms such as Bear Stearns, Lehman Brothers, AIG and GM, there is a renewed interest in the orle of management in formulating firm policies and in the impact of these policies on firm value. When different managers are perfect substitutes for one another, managers are interchangeable inputs into the production process. In such a world, firms sharing similar technologies, and factor and product market conditions will make similar choices independent of their management team. In reality, however, managers tend to differ in their preferences, risk-aversion, skill levels, and opinions so that corporate policies may well depend on who is in control of the management team.

Indeed, Bertrand and Shoar (2003) show that the heterogeneity of investment and of financial and organizational practices of firms can be explained by the presence of manager fixed-effects. They identify specific patterns in managerial decision making that indicate differences in style across managers. Differences in managerial style may, in turn, have different efficiency implications not identifiable using the managerial fixed-effect approach. Furthermore, managerial fixed-effects are, by construction, fixed for a particular manager, and hence cannot capture the human capital of managers.[1] Instead of managerial fixed-effect, Aivazian, Lai, and Rahaman (2009) use a market-based explanation for the trend in executive compensation and show that CEO human capital has a bearing on firm performance with better performance also explaining the excess in CEO compensation relative to the typical firm in the industry. They do not, however, explore the channels through which CEO human capital translates into firm value.

In this paper, we focus on possible channels involving firm policies, through which CEO human capital can affect firm value. We first identify the effect of CEO human capital on firm policies and then relate the effect on firm value via those policies. The first empirical challenge is to identify circumstances when managerial attributes affect firm policies and value. A firm may choose managers because of specific managerial attributes that fit its optimal strategies; the firm's optimal strategies may be invariant over time so that an incoming manager's attributes do not affect its policies because the new manager simply continues the policies of prior managers. Quite often, however, CEO turnover results because of poor firm performance under the incumbent manager, and the board expects the incoming manager to follow a different strategy. In that case, managerial turnover affects corporate practices because of changes in firms' optimal strategies.

[1] Bertrand and Shoar (2003) introduce a novel way to study the effects of managerial attributes on various corporate outcomes. It is, however, difficult to interpret what exactly the managerial fixed-effect mean for managerial human capital. For example, what does it mean for managerial human capital if the fixed-effect is negative as opposed to a positive managerial fixed-effect?

We use the incidence of CEO turnover at the firm-level to investigate how heterogeneity in newly appointed CEO human capital explains differences in firm performance via the channel of firm policy changes following a CEO turnover.[2]

Another empirical challenge is to measure the human capital of a particular CEO. Although CEO skills are difficult to observe, we can, as in Murphy and Zábojník (2007), decompose the skill matrix into firm-specific skills (CEO human capital specific to the firm) and general skills (CEO human capital transferable across firms and industries). Following Aivazian et al. (2009), we interact the CEO type (incumbent, internal, and external) with an industry-level measure of general purpose technology (as a proxy for the importance of general skills) to measure managerial human capital. We argue that firms that rely more on general skills hire CEOs with more general skills. The interaction between the external CEO dummy variable and the industry-level general purpose technology captures the degree to which firm-level general skills requirements are matched with CEO human capital (transferable versus non-transferable skills).

We study three different firm policies, namely, financial policy, investment policy, and operating policy, to develop empirically testable hypotheses relating CEO human capital to firm policy and performance. In our empirical specification, we recognize that firm polices are interdependent, and that unobservables affecting one policy may be correlated with unobservables affecting another policy. To address these issues, we jointly estimate three policy equations by using Three-Stage Least Squares (*3SLS*). We find that a CEO with transferable (general) human capital reduces leverage (*Long-Term Debts/Net Fixed Assets*), invests less in intangibles (*R&D and Advertising Expense/Net Fixed Assets*), and increases the sensitivity of cash flow to sales (*% Change in Operating Income/% Change in Net Sales*) compared to a CEO with more firm-specific skills. The policy changes under a new CEO lower the underlying business risk of the firm. Using a standard bankruptcy prediction model, we find that CEO general skills reduce the bankruptcy risk of the firm as compared to firm-specific skills, thus also reducing the direct and indirect costs associated with potential financial distress.

Lower underlying business risk implies less volatile firm-returns. We find that abnormal returns relative to that of the industry median firm become lower with reduced leverage and lower intangibles, but higher with increased operational efficiency under a new CEO with more general human capital. As in Aivazian et al. (2009), we find that when a firm relying more on general skills is matched with a CEO with

[2]CEO turnover may not be the only instances where one can study the effect of managerial attributes on firm policies. For example, when the firm has a weak corporate governance structure, a manager can impose his idiosyncratic attributes on firm policies. We control for corporate governance structure of the firm to attenuate this issue, and focus instead on CEO turnover to identify the effect of managerial human capital on firm policies, and on firm value.

more general skills, more shareholder value is created as compared to a firm relying more on general skills but employing a CEO with more firm-specific skills. Our new insight is, not only that CEOs with more general skills create more shareholder value when matched with firms relying more on such skills, but also that these incremental values are attained with lower risk. We also find that the effect of CEO human capital on firm excess returns via alteration in firm policies is robust and economically significant.

The previous literature has studied the relationship of firms and stakeholders, and how this relationship influences such corporate strategies as capital structure choice (Titman and Wessels, 1988; Kale and Shahrur, 2007; Banerjee, Dasgupta, and Kim, 2008), design of CEO compensation (Arora and Alam, 2005), information disclosure (Almazan, Suarez, and Titman, 2006), and earnings management (Raman and Shahrur, 2008). More recently, there has been increased interest in the role of the firm's workforce in financing and strategic decisions. This is not surprising since the value of employee human capital tends to account for a significant portion of firm value (Blair, 1999; Berk, Stanton, and Zechner, 2008). Our contribution is two-fold: first, to the best of our knowledge our paper is the first to address the relationship between CEO human capital and corporate investment and financing; second, by linking CEO skills to firm performance, we gain a better understanding of the efficiency implications of the impact of managerial attributes on corporate policies.

In Section 2, we discuss the related literature and develop empirically testable hypotheses. Section 3 describes the data and variables used in our empirical estimation. Section 4 discusses various empirical strategies that are employed for our empirical analysis and presents the results. Section 5 concludes the paper.

2. Related Literature and Empirical Hypotheses

A major empirical challenge in a study of the relationship between CEO skills and corporate outcomes such as firm performance, CEO hiring decisions, and CEO compensation, is to have an accurate measure of CEO skills. Simple measures such as CEO age, tenure in the firm, and educational background are commonly used as proxies for CEO skills in a univariate analysis. For example, Murphy and Zábojník (2007) argue that the decline in the CEO tenure in the firm (as a proxy for the CEO's firm-specific skills) and the increase in the proportion of CEOs with MBA degrees (as a proxy for the CEO's general managerial abilities) in recent years are evidence of their conjecture that CEO general skills have become relatively more important than firm-specific skills. Aivazian et al. (2009) argue that understanding the effect of managerial human capital on corporate outcomes requires an understanding of the process of technological evolution in the

firm's industry. Following Aivazian et al. (2009), we adopt an identification strategy that isolates the effect of managerial general human capital on corporate outcomes by interacting newly hired CEO type with the evolution of general purpose technology in the firm's industry. We use industry-level computerization and information technology intensity as proxies for general purpose technologies, and interact these with CEO type (external versus internal) in order to identify the type of CEO human capital suited to the firm. We then develop empirical hypotheses linking CEO human capital with firm policies and firm value.

2.1. Managerial Human Capital and Financing Policy

Ever since Modigliani and Miller (1958) first showed that financing policy is irrelevant for firm value in a frictionless economy, financial economists have puzzled over the nature of frictions that make financing policy important in reality. A consensus has emerged that transaction costs, taxes, agency problems, costs of financial distress, and asymmetric information are important in understanding the relevance of financing policy. The effect of managerial human capital on firm policy can be better understood via a framework with such frictions.

For example, Butt-Jaggia and Thakor (1994) argue that a firms financial structure depends on its human asset specificity. Since firm's employees are concerned about the specificity of their human capital, they may choose to invest less in firm-specific human capital when the firm has a higher probability of bankruptcy. Thus, Butt-Jaggia and Thakor's model (1994) suggests that firms with greater human asset specificity should maintain lower leverage ratios. Complementary to this work, Berk, Stanton, and Zechner (2009), building on Harris and Holmström (1982), show that when employees are averse to bearing their own human capital risk firms with more leverage should pay higher wages. Although these studies enhance our understanding of how employee human capital can affect corporate financial structure decisions, they address such interaction only from the perspective of employees in general and pay little attention to the firm's relationship with its top executives who control firm policies, including financial structure decisions. In particular, we know little about the role of CEO human capital in a firms financing and other strategic decisions.

We believe that frictions related to "agency problems" are a basis for understanding the effect of managerial human capital on firm financial structure. Jensen (1976) argues that financial structure of a firm could be used as a disciplinary mechanism to curb managerial opportunism and hence reduce the agency problem between managers and other stakeholders of the firm. Hirshleifer and Thakor (1992), on the other hand, show that when managers are concerned about their reputational capital, they may be conservative

in their investment behaviors and ex ante may allow shareholders to issue more debt. However, issuing debt is costly at least for two reasons: (i) increased leverage also increases the direct and indirect bankruptcy costs, and (ii) more debt reduces managerial flexibility in exploiting growth opportunities for reasons such as debt overhang (Myers, 1977) and debt covenants. Thus, in using financial structure as a disciplinary tool for curbing managerial opportunism, shareholders face a trade-off between the agency benefit of debt and the bankruptcy as well as reduced flexibility costs of debt.[3] Managerial reputation concern can potentially alter the balance between the agency benefit of debt and the bankruptcy as well as reduced flexibility costs of debt.

A manager with firm-specific human capital has less reputational concern since his skills are less valuable outside the current firm. Lack of outside options for such a manager also means that he has no reputational capital to protect. Absence of reputational capital outside the firm may lead to managerial opportunism, excessive risk-taking, and short-term return chasing by the manager. Following the logic of Jensen (1986), the firm can use the financial structure (increase debt) to curb opportunism for a manager with more firm-specific human capital. By contrast, a manager with general human capital has reputational capital to protect. Reputational concern by such a manager may lead to conservative investment behavior (Hirshleifer and Thakor, 1992), and thus no opportunistic activity by the manager. Following the logic of Jensen (1986), shareholders of the firm can use financial structure as less of a disciplinary tool relative to a firm with firm-specific managerial human capital. We can summarize the foregoing discussion in the following hypothesis:

Hypothesis 1 *Firms with general managerial human capital rely less on leverage as a disciplinary mechanism than firms with firm-specific managerial human capital.*

2.2. Managerial Human Capital and Investment Policy

Applying the logic of Jensen and Meckling (1976) and Treynor and Black (1976), Amihud and Lev (1981) argue that a risk averse manager whose behavior is unobservable may diversify his firm to increase the certainty equivalent value of his human capital. They show that the greater the degree to which any firm is manager-controlled, the more likely a firm will engage in conglomerate merger activity. Rose (1992) proposes a model in which firm diversification acts as an efficient form of nonpecuniary compensation for the manager. In the model diversification rewards the manager by reducing the likelihood of bankruptcy which in turn increases the expected value of his firm-specific human capital. These models focus on diversification

[3]This particular tarde-off is similar to the traditional trade-off theory of capital structure where the firm faces the trade-off between the corporate income taxes benefit of debt and the potential bankruptcy costs.

in general without addressing the specific type of assets in which managers with different types of human capital are going to invest in.

Hirshleifer and Thakor (1992) argue that incentive to build reputational capital by the manager distorts the firm's investment policy to relatively safe projects, thereby aligning managerial interests with those of the debtholders even though managers are hired or fired by the shareholders. We argued earlier that managers with general human capital have incentives to build and protect their reputational capital compared to managers with firm-specific human capital. Moreover, relatively safe investment projects are those with less uncertainty associated with their valuations, in other words, investments in tangible assets. We can summarize the foregoing discussion on the relationship between managerial human capital and firm investment policy in the following hypothesis:

Hypothesis 2 *Managers with general human capital invest less in intangibles than managers with firm-specific human capital.*

2.3. Managerial Human Capital and Operating Policy

From a matching perspective, it is optimal for a firm to hire a manager who possesses the skills and knowledge that is mostly required by the firm, or equivalently, for a manager to join a firm that can best utilize her skills and knowledge. Either way, the firm-manager match will create the highest value. From the "skill-biased technological change" literature in labor economics, we know that a firm would demand for more skilled workers when it uses more advanced technology, and more general skills from the workers are required when the firm is more computerized (see, for example, Bresnahan, 1999; Autor, Katz and Krueger, 1998; and Bresnahan, Brynjolfsson and Hitt, 2002). On the other hand, within a firm, the employees would decide what kind of human capital they want to invest in. In fact, an employee's investment in firm-specific human capital can be risky because of the potential "hold-up" problem (see Williamson, 1975; Grout, 1984) since it is impossible to stipulate all the ex post outcome contingencies in an ex ante contract that guarantees that the employee will receive the expected stream of benefits from his investment in firm-specific human capital (see also Butt-Jaggia and Thakor, 1994). In the worst case, the employee may be expropriated by the firm after they have made firm-specific investments (Shleifer and Summers, 1988), or even lose the stream of benefits in its entirety if they are fired by the firm or the firm is liquidated (Berk, Stanton, and Zechner, 2009). Given a firm's technology level and the incentive compatibility of the compensation contracts, some employees may choose to invest more in firm-specific skills while others may choose to invest more in skills transferable across firms and industries.

In relation to CEO human capital, the foregoing discussion suggests that some firms require more general skills from the CEOs while others may rely more on firm-specific skills. On the other hand, some CEOs in the managerial labor market should possess more general human capital and other have more firm-specific human capital. Back to the matching story, we should expect that a firm can get the best out of its newly appointed CEO when the skill requirement of the firm is perfectly matched with the skills and knowledge of the CEO applicable only to that particular firm. In short, we can summarize the foregoing discussion in the following hypothesis:

Hypothesis 3 *Managers with general human capital increase the operational efficiency of the firm when matched with firms relying more on general skills.*

2.4. Managerial Human Capital and Firm Value

Hypotheses 1 to 3 imply that managers with general human capital would take less leverage, invest less in intangibles, and would improve the operational efficiency of a firm when the firm also relies more on general skills. The joint effect of all these policy changes would naturally lead to lower underlying business risk of the firm, and hence, lower costs associated with financial distress. These policy changes should also reflect in firm value. Indeed, Aivazian et al. (2009) show that CEO human capital has a bearing on firm value, but the authors do not explore the possible channels through which CEO human capital can translate into firm value. In this paper, we identify one possible channel, firm policy changes, through which CEO human capital can affect firm value. The following hypothesis summarizes this point:

Hypothesis 4 *Managers with general human capital pursue policies that lower business risk when matched with firms relying more on general skills. Such policies translate into higher firm value.*

3. Data and Variable Construction

3.1. Sample Construction

We begin with the set of firms that have been listed in the S&P 500 Index for at least one year between 1992 and 2006 which form the "Whole Sample." These firms are identified from the S&P 500 Index Constituents database in COMPUSTAT.[4] We focus on the S&P 500 constituents for three reasons. First, S&P 500 firms are broadly representative of the US industrial and service sectors. Thus, empirical regularities identified in this sample could be generalized to some extent to other firms as well. Second, to

[4]We include the firm in the Whole Sample if it is listed in the S&P 500 Index in December of each year between 1992 and 2006.

be included in the S&P 500, a firm has to perform above a certain threshold that in turn makes the sample firms homogeneous along certain quality (performance) dimensions. Focusing on this quasi-homogeneous (in terms of firm quality) sample of firms lessens the possibility of endogeneity driven by unobserved firm characteristics that may confound the identification of the regression coefficients, as discussed in the previous section. Finally, some of the CEO characteristics are hand-collected, and it is practical to focus on a manageable sample, and we focus on the S&P 500 constituents.

For each observation in the Whole Sample, we identify the CEO of each firm from the "CEOANN" variable in the COMPUSTAT ExecuComp database. We select the newly appointed CEOs from the Whole Sample to form the "Turnover Sample." A newly appointed CEO is identified if the CEO in year t is different from the CEO in year $t-1$ for a firm in the S&P 500 constituency. We also differentiate among a newly appointed internal CEO, an external CEO, and an incumbent CEO.[5] Therefore, a CEO in the Turnover Sample is either an internal hire or an external hire. The rest of the CEOs in the Whole Sample who are not in the Turnover Sample are considered as incumbent CEOs. For example, a newly appointed external CEO in year t is included in both the Turnover Sample and the Whole Sample. However, if she stays in the same CEO position in year $t+1$, she is treated as an incumbent CEO in the Whole Sample but does not appear in the Turnover Sample.

In the empirical specification, we are interested to see how the CEO identified in year t affects firm performance in year $t+1$ and $t+2$. Hence, we require that the CEO of a firm in year t to be in the same position throughout years $t+1$ and $t+2$, and that the CEOs in years $t-1$ and $t-2$ are the same person. This excludes interim CEO cases, and ensures that the CEO in year t is solely responsible for the firm performances in years $t+1$ and $t+2$.

3.2. Variable Construction

3.2.1. Firm Policy Variables

Financial Policy: We use three different financial policy measures: *Total Liabilities/Net Fixed Assets*, *Long-term Debt/Net Fixed Assets*, and *Net Debt/Net Fixed Assets*. Net Debt is defined as: *(Total Liabilities - Cash and Marketable Securities)*.

Investment Policy: We use three different investment policy measures: *Investment in Fixed Assets/Net Fixed Assets*, *Investment in Intangibles/Net Fixed Assets*, and *Acquisition Expenditure/Net Fixed Assets*. We defined intangibles as: R&D and advertising expenditures while ignoring goodwill which is hard to measure.

[5]The definition of an external CEO hire will be explained below.

Operating Policy: We use three different operating policy variables: $Log(|EBITDA_t - EBITDA_{t-1}|)$, $Sigma$, and firm-level operating leverage. We calculate $Sigma$ as the idiosyncratic volatility of firm's stock return. We regress firm-level weekly stock return on the NYSE/NASDAQ/AMEX value-weighted index and use standard-deviation of the error-term from the regression as our measure of $Sigma$. Operating leverage of the firm is defined as: $\%\, Change\, in\, Operating\, Income / \%\, Change\, in\, Sales$.

3.2.2. Firm Performance Measure

The primary outcome variable of our analysis is firm performance during the first two years following the CEO turnover. We use the industry-adjusted cumulative return ($IACR$) from two subsequent years following CEO turnover as measures of firm performance attributed to the turnover. We use a 2-year window to calculate cumulative return for two reasons. First, enlarging the event window by more than two years to calculate the cumulative abnormal returns would make it difficult to rationalize that the abnormal return is due to CEO turnover because over a longer horizon many other factors can affect a firm's abnormal performance other than the CEO turnover. Second, when the new external CEO has been in the position for a longer period, she will also acquire firm-specific knowledge so that the firm performance reflects the contributions from both her general and firm-specific skills. Thus, when a new CEO stays with the current firm for more than two years we no longer treat the CEO as a new hire. In other words, all CEOs with more than two years of tenure with the current firm are treated as incumbents for the purpose of our analysis.

To calculate the industry-adjusted cumulative return, we first define the 2-year cumulative return of firm i in industry j and in year t as

$$CR2_{ijt} = \prod_{\tau=t+1}^{t+2} \Big(1 + R_{ij\tau}\Big) - 1.$$

Then the industry-adjusted cumulative return $IACR2_{ijt}$ is defined as:

$$IACR2_{ijt} = CR2_{ijt} - \widetilde{CR2}_{jt} \tag{1}$$

where $\widetilde{CR2}_{jt}$ is the median of the 2-year cumulative return for all firms in industry j.

3.2.3. Importance of General Skills

The primary explanatory variable in our analysis is the importance general skills. We use industry-level measures of general purpose technology to proxy for the firm-level importance of general skills. More

specifically, we use a narrow measure of computerization and a broad measure of information technology intensity within the industry to capture the prevalence of general purpose technology in the industry, which in turn proxy for the importance of general skills for firms in the industry. From an econometric perspective, we need a measure of the importance of general skills that is exogenous to the firm but that cannot be excluded from being a determinant of the firm's post-CEO turnover performance. This is necessary to avoid simultaneity and endogeneity problems in estimating the firm's post-CEO turnover performance. We argue that industry-level computerization and information technology intensity reflect the level of general purpose technology within the industry; they are important in understanding a firm's performance while at the same time, since these measures are at the industry level, simultaneity and endogeniety problems in estimating the firm's post-CEO turnover performance are avoided.

We use data on private assets from the National Income and Product Accounts (NIPA) tables of the Bureau of Economic Analysis (BEA), and on the total number of workers in different industries from the Current Employment Statistics (CES) published by the Bureau of Labor Statistics (BLS), to construct our proxies for computerization and information technology intensity as measures of the importance of general skills. We construct the following measures:

$$Computer\ Endowments_{jt} = log\Big(\frac{Stock\ of\ Computer\ Equipment\ \&\ Software_{jt}}{Total\ Number\ of\ Workers_{jt}}\Big)$$
$$Speed\ of\ Computerization_{jt} = log\Big(\frac{Investment\ in\ Computer\ Equipment\ \&\ Software_{jt}}{Total\ Number\ of\ Workers_{jt}}\Big)$$
$$IT\ Endowments_{jt} = log\Big(\frac{Stock\ of\ Computer\ \&\ Communication\ Equipment\ \&\ Software_{jt}}{Total\ Number\ of\ Workers_{jt}}\Big)$$
$$Speed\ of\ IT\ Adoption_{jt} = log\Big(\frac{Investment\ in\ Computer\ \&\ Communication\ Equipments\ \&\ Software_{jt}}{Total\ Number\ of\ Workers_{jt}}\Big)$$

where IT denotes $Information\ Technology$, j refers to industry, and t refers to year. The stock and investment measures of computer and information technology assets are in constant 2000 dollars.[6] Figure 2 shows that computerization increases for all industries over the sample periods, but there remains a considerable amount of variation across industries within a particular year. We utilize the between-industry variations in computerization to identify the CEO general skills effects on firm performance.

In terms of industry classifications, the firms in COMPUSTAT are classified either under the Standard Industry Classification (SIC) system or the North America Industry Classification System (NAICS) industry

[6]See US Department of Commerce (2003) for more details about the construction of a quality-adjusted price index for computer and other equipment. To correct for potential measurement error problems in the computerization measures, we use a 3-year centered average for each measure, i.e., the measure in year t is the average of that measure in years $t-1$, t and $t+1$.

definitions. On the other hand, BEA uses its own industry classification system for their data. We make use of the NAICS-SIC definition conversion tables published by the Census Bureau and our own conversion table to convert the variables into consistent 2-digit BEA industry classifications, so that our measures are comparable across various industry classifications.[7]

3.2.4. Other Control Variables

Industry-Adjusted Sales: We define the industry-adjusted sales (in log) as the log of sales minus the industry median log of sales. This variable is used to control for firm size.

Industry-Adjusted Returns on Assets: We use industry-adjusted returns on a firm's assets to control for the past performance of the firm. For any given year t we calculate the return on a firm's assets as : $Net\ Income/Total\ Assets$ for years $t-1$ and $t-2$ and cumulate the net assets returns to control for the firm's performance before the turnover in year t.

Corporate Governance Index: To control for firm-level corporate governance, we use Gompers, Ishii, and Metrick (2003) corporate governance score, generally known as the G index.[8]

Age of the CEO: The age of the CEO is obtained from ExecuComp. However, ExecuComp does not contain complete CEO information for all the firm-year observations. Whenever there is missing CEO information but the name of the particular CEO is known, we search for the missing information from other sources, including the Marquis Who's Who Directory, Forbes' People Tracker, Factiva database, and proxy statements of the firms.

MBA Dummy: We check whether the CEO holds a Master of Business Administration degree or equivalent. The information is hand-collected from the Who's Who Directory and the CEO's biography on the firm's internet site.

Policy-Specific Control Variables: In order to identify a specific policy equation in the 3SLS regression specification, we also include some policy specific control variables. For the financing policy equation, we follow Rajan and Zingales (1995) and include following control variables: firm size (*Log (Total Assets)*), asset

[7]The 2-digit BEA industries (industry codes in parentheses) are: Mining (21); Utilities (22); Construction (23); Manufacturing (31); Wholesale trade (42); Retail trade (44); Transportation and warehousing (48); Information (51); Finance and insurance (52); Real estate and rental and leasing (53); Professional, scientific, and technical services (54); Management of companies and enterprises (55); Administrative and waste management services (56); Education services (61); Health care and social assistance (62); Arts, entertainment and recreation (71); Accommodation and food service (72); Other services, except government (81).

[8]The G index is derived from the incidence of 24 unique governance rules that proxy for the level of shareholder rights in a firm. Gompers, Ishii, and Metrick (2003) show that an investment strategy of buying firms in the lowest decile of the index (strongest rights) and selling firms in the highest decile of the index (weakest rights) would have earned abnormal returns of 8.5% per year during their sample period. They also find that firms with lower G index values (stronger shareholder rights) had higher firm values, higher profits, higher sales growth, lower capital expenditures, and made fewer corporate acquisitions.

tangibility (*Net Fixed Asset/Total Assets*), Tobin's Q (*Market Value of Assets/ Book Values of Assets*), and profitability (*Net Income/Sales*). For investment policy equation, we follow Kaplan and Zingales (1997) and Aivazian, Ge and Qiu (2005) and include the following control variables: cash holdings (*Cash and Marketable Securities/Net Fixed Assets*), and Sales-to-Fixed Assets (*Sales/Net Fixed Assets*). For the operating policy equation, we follow Jensen and Meckling (1976) and include the following control variables: managerial shareholdings (*% of shares owned by top 5 managers from the ExcutiveComp*), and managerial risk-taking incentives (*% of compensation as Employee Stock Option*).

3.3. Descriptive Statistics

Table 1 shows the summary statistics for the changes in the firm policy variables defined in the previous section. For each policy variable of firm i in year t, $\left(y_{it}\right)$, the change in policy is defined as the difference between the variables in year $t+2$ and year t: $y_{it+2} - y_{it}$. We then compare the changes in these policy variables in two samples: the Turnover Sample (which includes all the newly appointed CEOs) and the Non-Turnover Sample (which includes observations in the Whole Sample but not in the Turnover Sample, i.e., the incumbent CEOs). Based on our sample selection scheme and excluding the outliers and missing values in the policy variables, we have 431 observations in the Turnover Sample (including 104 new external CEOs and 327 new internal CEOs) and 2758 observations in the Non-Turnover Sample.

Panel A reports the summary statistics for the Turnover sample and panel B reports the summary statistics for the Non-Turnover sample. By comparing the summary statistics in panels A and B, we note that, on average, CEO turnover is associated with an increase in leverage, an increase in firm investment, and a decrease in operating cash-flow volatility, irrespective of empirical proxies, compared to the sample of firms with no turnover.[9] Although these are unconditional statistics, they illustrate the point that firm policies are, on average, systematically different under the incumbent and the newly appointed CEOs. In the subsequent sections of the paper, we further explore the reasons for such systematic difference in firm policies, and also the value implication of these policy changes for the shareholders under the newly appointed CEOs as opposed to the incumbent CEOs.

[Table 1 is about here]

Table 2 reports the summary statistics for the control variables used in the regression analysis. It shows that various control variables are systematically different across the Turnover and the Non-Turnover

[9]It turns out that the differences in the means of *Debts-to-Equity* ratios between the Turnover and Non-Turnover Sample are not statistically significant, while the other policy variables are statistically different.

samples.[10] This raises the concern that the Turnover Sample may not be a random sample of the population. We address this concern while estimating the effects of managerial human capital on firm value. Table 3 reports the summary statistics for the control variables for the external and the internal CEO firms within the Turnover sample. We also observe some noticeable differences in some control variables for firms that hire external CEOs and those that hire internal CEOs.[11] This raises the concern that the endogenous hiring decision may confound the empirical results. We address this concern using the *Control Function Approach* while estimating the effect of CEO human capital on firm policies.

[Tables 2 and 3 are about here]

4. Empirical Strategy and Results

4.1. Univariate Analysis

We present two types of univariate analysis here. First, we graphically show in Figure 1 that industry-level computerization and information technology intensity are positively correlated with average CEO compensation, external CEO hiring, and firm value. The correlation coefficients are all statistically significant at 1% level. Although the Figure 1 shows the series in levels, we also apply Hodrick-Prescott (H-P) filter to decompose these series into trend and irregular components, and find that these series are also positively correlated and statistically significant at the trend level.[12] Although the correlation does not imply causality, the analysis here illustrates that firm value, CEO hiring, and CEO compensation are all related to the technological evolution within a firm's industry. Thus, the firm needs to hire a CEO whose human capital best matches the technological constraint of the firm, and when it is the case, CEO human capital can become a complementary force in creating sharehlders' value. But how CEO human capital (when best match the technological constraint of the firm) can translate into firm value remains an open question in the extant

[10] For example, the differences between the averages for *Net Sales*, *Past 2-Year Cumulative Return on Assets*, *Total Assets*, *Market-to-Book Ratio*, *Managerial Shareholding*, and *Executive Stock-option* are statistically significant.

[11] The means for the *Past 2-Year cumulative Return on Assets*, *Assets Tangibility*, *Cash Holding*, and *Executive Stock-option* for the external CEO sub-sample are statistically different from those for the internal CEO sub-sample.

[12] The H-P filter calculates the trend component by minimizing the following loss function:

$$\sum_{t=1}^{T}\left(X_t-\widetilde{X}_t\right)^2+\lambda\sum_{t=3}^{T}\left\{\left(X_t-\widetilde{X}_{t-1}\right)-\left(X_{t-1}-\widetilde{X}_{t-2}\right)\right\}^2$$

where X_t is the actual series and $\widetilde{X}_t$ is the trend component of the series. The first term punishes the (squared) deviations of the actual series from the trend; the second term punishes the (squared) acceleration (change of change) of the trend level. The method thus involves a trade-off between tracking the original series and the smoothness of the trend level: $\lambda = \infty$ generates a linear trend, while $\lambda = 0$ generates a trend that matches the original series. Ravn and Uhlig (2002) have shown that the smoothing parameter should vary by the fourth power of the frequency observation ratios, so that for annual data a smoothing parameter of 6.25 and for monthly data a smoothing parameter of 129,600 is recommended, while for quarterly data a smoothing parameter 1,600 is commonly used.

literature.

[Figure 1 is about here]

We argue that one possible channel through which the human capital of the new CEO can affect firm value is by deviating from strategies of the prior CEO in ways that reflect positively on firm performance. Hence, in the second univariate analysus we analyze the changes in the policy variables before and after the CEO turnover. Given a CEO turnover in year t, we compare the pre- and post-turnover averages of various policy variables. In particular, we calculate the pre- and post-turnover means of a policy variable y as:

$$\bar{y}_{it}^{Pre-turnover} = \frac{y_{it-2} + y_{it-1}}{2}$$

$$\bar{y}_{it}^{Post-turnover} = \frac{y_{it+1} + y_{it+2}}{2}$$

We then consider the difference $\left(\bar{y}_{it}^{Post-turnover} - \bar{y}_{it}^{Pre-turnover}\right)$ for each policy variable. Essentially, the pre- and post-turnover averages reveal how different the newly appointed CEOs are from their predecessors in terms of implementing firm polices. Table 4 reports the summary statistics of the differences in pre- and post-turnover means of various policy variables. Panel A shows the statistics for all the newly appointed CEOs in the Turnover Sample, and panels B and C, respectively, show the statistics for the newly hired external and internal CEOs.[13]

We note from Panel A that the *Long-Term Debts/Net Fixed-Assets* ratio and *Fixed-Capital Expenditure/Net Fixed-Assets* ratio have significantly different post-turnover means. In other words, the newly hired CEOs tend to increase leverage while reducing fixed capital investment than their predecessors. When we look at Panel B, we observe that the new external CEOs significantly raise the *Long-term Debts/Net Fixed-Assets* ratio and also have higher operating leverage relative to the new internal CEOs.[14] The unconditional summary statistics presented here highlight two points: (i) significant policy changes are associated with CEO turnover; (ii) and external CEOs are more aggressive in increasing leverage (*Long-Term Debts/Total Assets*), decreasing fixed investments (*Fixed-Capital Expenditure/Net Fixed-Assets, Acquisition Expenditure/Net Fixed-Assets*), increasing intangibles (*R&D and Advertising Expenditure/Net Fixed-Assets*), and reducing the cash-flow volatility (*Idiosyncratic Stock-Return Volatility*) compared to internal CEOs. Next, we turn to regression analysis to investigate how these changes in firm policies differ when we condition the

[13]The number of observations shown in this table is 402, which is different from that in the Turnover Sample in Table 1 because the pre-turnover means of some policy variables are unavailable.

[14]For the operating leverage variable, we compare the median of the internal CEOs with that of the external CEOs.

CEO hiring decision of the firm on the firm's reliance on specific types of managerial human capital, i.e., the technological constraint of the firm.

[Table 4 is about here]

4.2. The Effect of CEO Human Capital on Firm Policies

4.2.1. Empirical Strategy

Our primary dependent variables are changes in the measures of a firm's financial policy (FIN), investment policy (INV), and operating policy (OPE). Our primary explanatory variables are CEO type and the industry level general purpose technology. Central to our empirical identification is the relationship between CEO human capital (interaction between CEO type and industry-level general purpose technology) and firm policies. In our empirical specification, we recognize that firm policies are interrelated, and thus naturally we specify the following simultaneous equations system.

$$\begin{aligned}
\Delta FIN_{ijt} &= \alpha_1 + \beta_{11}.GPT_{jt} + \beta_{12}.EXT_{ijt} + \beta_{13}.\Big(GPT_{jt} \times EXT_{ijt}\Big) \\
&\quad + \gamma_{12}.\Delta INV_{ijt} + \gamma_{13}.\Delta OPE_{ijt} + X'_{ijt}.\delta_{11} + Z'_{1ijt}\delta_{12} + \varepsilon_{ijt} \\
\Delta INV_{ijt} &= \alpha_2 + \beta_{21}.GPT_{jt} + \beta_{22}.EXT_{ijt} + \beta_{23}.\Big(GPT_{jt} \times EXT_{ijt}\Big) \\
&\quad + \gamma_{21}.\Delta FIN_{ijt} + \gamma_{23}.\Delta OPE_{ijt} + X'_{ijt}.\delta_{21} + Z'_{2ijt}\delta_{22} + \varepsilon_{ijt} \qquad (2) \\
\Delta OPE_{ijt} &= \alpha_3 + \beta_{31}.GPT_{jt} + \beta_{32}.EXT_{ijt} + \beta_{33}.\Big(GPT_{jt} \times EXT_{ijt}\Big) \\
&\quad + \gamma_{31}.\Delta FIN_{ijt} + \gamma_{33}.\Delta INV_{ijt} + X'_{ijt}.\delta_{31} + Z'_{3ijt}\delta_{32} + \varepsilon_{ijt}
\end{aligned}$$

where i indexes a firm-CEO pair, j indexes industry and t indexes time. For each firm policy variable $y \in \{FIN, INV, OPE\}$, its change is defined as $\Delta y_{ijt} = y_{ijt+2} - y_{ijt}$. GPT_{ijt} is a measure of general purpose technology at the industry level (which is a proxy for the importance of general skills as we argue), EXT_{ijt} is the external CEO hire dummy, X_{ijt} consists of control variables common to the three policy equations. Z_{1ijt}, Z_{2ijt} and Z_{3ijt} are other control variables that are specific to the financial policy equation, investment policy equation and operating policy equation, respectively.[15]

We estimate the above system by Three-Stage Least Squares (*3SLS*) because one may argue that even after correcting for simultaneity among various firm policies, the unobservables (errors in the simultaneous

[15] All the control variables are described in Section 3 of the paper.

regression specification) may still be correlated across different policy spaces. The idea of using 3SLS is that after estimating the individual policy equations by the traditional Two-Stage Least Squares approach, we also correct for the correlation among the unobservables across different firm policy spaces in the final stage. The inclusion of Z_{1ijt}, Z_{2ijt} and Z_{3ijt} is to ensure that the relevant conditions for the identification of the system are satisfied when we estimate the system.[16]

Our main coefficient of interest is the interaction effect of importance of general skills and external CEO status on firm policy changes, and such effects are captured by the coefficients β_{13}, β_{23} and β_{33}. Given our empirical hypotheses, we expect $\beta_{13} < 0$, $\beta_{23} < 0$ and $\beta_{33} > 0$.

4.2.2. Regression Results

We have three empirical proxies for each type of firm policy. Using these proxies we estimate the above 3SLS specification for a linear combination of different empirical proxies for the policy spaces. In total, we estimate 27 different systems of firm policy equation using the 3SLS specification. In Table 5 we report the estimates from one of the system of equation. We do not report all 27 systems of equation here for space limitation, but they are available for interested readers upon request. In Table 5, our empirical proxies for firm financial, investment and operating policies are, respectively, change in leverage (*Long-term Debts/Total Assets*), change in investment in intangibles (*R&D and Advertising Expense/Net Fixed Assets*), and change in the degree of operating leverage (*% Change in Net Income/% Change Net Sales*). Our main coefficients of interest in the table are the interaction terms or the β_{13}, β_{23} and β_{33} coefficients in the regression specification above.

Table 5 shows that the interaction terms are statistically significant and also give us consistent signs of the estimate as we hypothesized in Section 2. For the financing and investment policy variables the effects of the interaction terms are negative whereas for the operating policy variable the effect is positive. These results indicate that firms relying more on general purpose technologies (high stock of computer capital, and greater speed of computerization) will reduce financial leverage, invest less in tangible assets, and increase the operating leverage when the newly appointed CEO is an external hire as opposed to when an internal candidate is promoted to the CEO level.

[Table 5 is about here]

The results in Table 5 are also economically significant. When all other explanatory variables are

[16]For details about the estimation method of a simultaneous equation system, see, for example, Wooldridge (2002). Also, note that we utilize the incidences of CEO turnovers and interact the events of turnover with the industry-level general purpose technology to identify the effect of transferable (general) CEO human capital on firm policies. The natural benchmark, relative to which we identify the effect on policy changes compared to the outgoing CEO, is the firm-specific CEO human capital.

evaluated at their mean, but the importance of general skills (as proxied by the two computerization measures) changes from the 25th percentile to the 75th percentile of the distribution, we find that, a newly hired external CEO (relative to a newly hired internal CEO) decreases financial leverage by about 5.4% to 8.4%, decreases investment in intangibles by about 2.4% to 3.3%, increases the degree of operating leverage by about 163% to 261%.[17]

In Table 6 we report the estimates from the system of firm policy equation with a different measure of general purpose technology. All dependents and explanatory variables are the same as they are in table 5. Once again the interaction term coefficients are all statistically as well as economically significant.[18] The coefficients of interest also give consistent signs as we have hypothesized in section 2. It illustrates that the effect of CEO human capital on firm policies are robust to alternative ways of measuring industry-level general purpose technology.

[Table 6 is about here]

4.2.3. Robustness Checks: Endogeneity of the Hiring Decision

A potential problem with our regression result presented above is the selection bias in the firm's hiring decisions. That is, the decision by a firm to hire an external CEO as opposed to an internal CEO may not be random. In other words, there may be some unobservables in the disturbance terms in 2 that are correlated with a firm's decision to hire an external CEO as opposed to promoting an internal employee to the CEO level. However, if the unobservables are also correlated with the outcome variable, we in fact have an endogeneity problem that requires instrumental variable estimation to correctly estimate our regression model. We assume that unobservables are correlated with the hiring decision $\left(EXT_{ijt}\right)$ but not with the outcome variables ΔFIN_{ijt}, ΔINV_{ijt}, and ΔOPE_{ijt}. To this end, we use the control function approach (Heckman and Robb, 1985) to correct for any potential endogeneity on firms' CEO hiring decisions.

The essence of the control function approach is to proxy (or control for) the portion of the disturbance term that is correlated with the hiring decision of the firm, i.e., EXT_{ijt}. Once the portion of the disturbance term that is responsible for the correlation is expunged, the new error term is uncorrelated with EXT_{ijt}, and the regression yields unbiased estimates of the impact of EXT_{ijt} and $\left(GPT_{jt} \times EXT_{ijt}\right)$ on firm policies.

[17] There are some influential observations in the degree of operating leverage variable. Even after removing these observations, we still see that the effect of the interaction term on firm operating is economically significant, although lower in magnitude as we report here.

[18] We do not report the economic significance for this table here due to space limitation, but they are available upon request for interested readers.

With the control function approach the data generating process is given by:

$$\Delta FIRMPOLICY_{ijt} = \alpha + \beta.\Big(GPT_{jt} \times EXT_{ijt}\Big) + \gamma.EXT_{ijt} + X'.\delta + f\Big(Z\Big) + \mu_j + \nu_t + \varepsilon_{ijt} \qquad (3)$$

where $FIRMPOLICY_{ijt} \in \{FIN_{ijt}, \Delta INV_{ijt}, \Delta OPE_{ijt}\}$ is the firm policy variable, $f\Big(Z\Big)$ is a function of observables Z, the set of characteristics that affect the hiring decisions of firms. Under the assumption of selection on observables, conditioning on $f\Big(Z\Big)$ results in a disturbance term, ε_{ijt}, that is independent of EXT_{ijt} and hence, the estimates of the parameters of interest β and γ are unbiased.

We construct the control function as follows. We first estimate the propensity score of the firm hiring an external CEO. In particular, the propensity score is the predicted probability from the Probit regression with EXT_{ijt} as the dependent variable on Z which includes the measures of general purpose technologies, characteristics of the newly appointed CEO (age and whether the CEO has an MBA degree), and other control variables (sales, firm performance, age of the departing CEO). Then we use a polynomial in the estimated propensity score to flexibly model $f\Big(Z\Big)$:

$$\Delta FIRMPOLICY_{ijt} = \alpha + \beta.\Big(GPT_{jt} \times EXT_{ijt}\Big) + \gamma.EXT_{ijt} + X'.\delta + \sum_{k=1}^{n} \phi_k.\hat{p}\Big(Z\Big)^k + \mu_j + \nu_t + \varepsilon_{ijt} \quad (4)$$

In the actual regressions, we use a fifth degree polynomial of the propensity score as the control function. Table 7 reports the estimates from the control function estimation of our system of firm policy equation. It shows that correcting for the potential endogeneity problem in CEO hiring the interaction term coefficients are statistically significant and give us the consistent signs as we have hypothesized in Section **??**. In short, the empirical analysis in this section highlight that different types of CEO human capital are going to have different impact on firm polices. To understand whether the change in firm policies in a certain way is value enhancing, we analyze the effect of these policy changes on the costs of a firm's financial distress in the next section.

[Table 7 is about here]

4.3. CEO Human Capital and the Costs of Financial Distress

A firm with lower financial leverage, less intangible assets, and better operational efficiency should have lower probability of financial distress. It is well documented in the finance literature that the costs of

financial distress are quantitatively important.[19] Firms with lower cost of financial distress are also valued higher by the financial market. However, the extant literature has predominantly explored the accounting and financial characteristics of the firm instead of the employee human capital aspect of the firm to investigate and to estimate the costs of financial distress. The novelty of our contribution in this section is introducing managerial human capital dimension into the analysis of costs associated with financial distress. We argue that certain type of managerial human can lower the costs associated with financial distress, which, in turn, can enhance firm value.[20]

4.3.1. Univariate Analysis

We focus on three of the most widely used bankruptcy prediction models in the extant literature, namely, Altman's (1968, 2000) models, Zmijewski's (1984) model, and Shumway's (2001) model. Altman's variables are described extensively in Altman (1968, 2000) and Mackie-Mason (1990). Zmijewski's variables include the ratio of net income to total assets, the ratio of total liabilities to total assets, and the ratio of current assets to current liabilities. Shumway (2001) criticizes Altman (1968) and Zmijewski (1984) and offers market-driven predictors of bankruptcy. Shumway's variables include a logarithm of market value, firm's past excess returns, and the idiosyncratic standard deviation of each firm's stock returns. To measure a firms' past excess return, we take the value-weighted CRSP NYSE/AMEX index return as a benchmark and subtract the index return from the monthly stock return to calculate the firm's excess return. The final, perhaps the most important, market-driven variable Shumway (2001) uses is the idiosyncratic standard deviation of a firm's stock returns, denoted as *Sigma* (σ) in this paper. Sumway (2001) argues that *Sigma* is strongly related to bankruptcy, both statistically and logically. If a firm has more variable cash flows (and hence more variable stock returns), then the firm ought to have a higher probability of bankruptcy. *Sigma* may also measure something like operating leverage. To calculate *Sigma* for each firm i in quarter t, we regress each stock's daily returns on the value-weighted NYSE/AMEX index returns for the same quarter. We then calculate *Sigma* as the standard deviation of the residuals of this regression. To avoid outliers, all independent variables are truncated at the 99th and 1st percentile values in the same manner as all other independent variables.

[19] The existing estimates of the direct bankruptcy costs are typically in the 1.4% to 7.5% range (Warner, 1977; Altman, 1984; Ang, Chua, and McConnell, 1982; Lubben, 2000; and LoPucki and Doherty, 2004). While estimates by Bris, Welch and Zhu (2005) range from zero to a daunting 20% of assets, their firms are much smaller than those in our sample, and therefore their estimates of bankruptcy costs should be expected to be higher. The indirect costs of financial distress, documented by Andrade and Kaplan (1998) for 31 highly leveraged transactions (HLTs) that subsequently became financially distressed, are likely to be between 10% and 20% of firm value.

[20] Furthermore, we have already shown in the previous section that managerial human capital is also related to changes in firm financial, investment, and operating policies. And these policy changes (lower financial leverage, lower of intangible assets, and higher operational efficiency) inevitably lead to lower probability of financial distress for a firm.

For each bankruptcy risk variable y, we calculate the change as $\Delta y_{it} = y_{it+2} - y_{it}$ when the firm hires a new CEO in year t. Table 8 reports the summary statistics for the external CEO subsample (in Panel A) and the internal CEO subsample (in Panel B). We test the statistical significance between the means of the various bankruptcy risk variables for the external and internal CEO subsamples. The results are reported in Panel C of table 8. We find that the firms with external CEOs have higher $ZSCORE$ (based on the Altman (2000) definition) and larger values for previous year excess return from the Sumway (2001) model. These results indicate that newly appointed external CEO improves on some of the standard bankruptcy risk predictor as opposed to a newly appointed internal CEO. Next, we condition the CEO type (internal versus external) on the industry-level prevalence general purpose technology to identify the effect of CEO human capital (general versus firm-specific) on the bankruptcy risk of the firm.

[Table 8 is about here]

4.3.2. Regression Analysis

We estimate a set of ordinary least square (OLS) regressions to see how the bankruptcy risk, as measured by Altman (2000) $ZSCORE$ is affected by the human capital of the new CEO:

$$\Delta ZSCORE_{ijt} = \alpha + \beta_1 GPT_{jt} + \beta_2 EXT_{ijt} + \beta_3 \left(GPT_{jt} \times EXT_{ijt}\right) + X'_{ijt}\delta + \varepsilon_{ijt}. \tag{5}$$

where $\Delta ZSCORE_{ijt}$ is defined as $ZSCORE_{ijt+2} - ZSCORE_{ijt}$. Table 9 reports the estimates from the OLS regressions. Once again our main parameters of interest are the interaction term coefficients. Results in the table show that all interaction coefficients are statistically significant and have positive effect on the outcome variable. That is, CEO general human capital can significantly improve a firm's financial health (higher $ZSCORE$) and thus can reduce the costs associated with potential financial distress.

[Table 9 is about here]

The results in Table 9 are also economically significant. When all other explanatory variables are evaluated at their mean, but the importance of general skills (as proxied by the computerization and information technology measures) changes from the 25th percentile to the 75th percentile of the distribution, we find that, relative to a newly hired internal CEO, a newly hired external CEO increases the $ZSCORE$ by about 4.8% to 6.5%. By all accounts, an increase in the $ZSCORE$ invariably leads to a decrease in the costs a firm may face related to potential financial distress.

4.4. The Effect of CEO Human Capital on Firm Value

4.4.1. Empirical Strategy

To identify the effect of CEO human capital on firm value, we implement a mediating instrument methodology as follows:[21]

$$\begin{aligned} FIRMPER_{ijt+2} &= \alpha + \beta_1.GPT_{jt} + \beta_2.EXT_{ijt} + \beta_3.\Big(GPT_{jt} \times EXT_{ijt}\Big) \\ &\quad + X'_{ijt}.\delta + \mu_i + \nu_t + \varepsilon_{ijt} \qquad (6) \\ FIRMPER_{ijt+2} &= \alpha' + \beta'_1.GPT_{jt} + \beta'_2.EXT_{ijt} + \beta'_3.\Big(GPT_{jt} \times EXT_{ijt}\Big) \\ &\quad + \sum_{k=0}^{2} \phi'_k.ZSCORE_{ijt+k} + X'_{ijt}.\delta' + \mu_i + \nu_t + \varepsilon_{ijt} \qquad (7) \\ FIRMPER_{ijt+2} &= \alpha'' + \beta''_1.GPT_{jt} + \beta''_2.EXT_{ijt} + \beta''_3.\Big(GPT_{jt} \times EXT_{ijt}\Big) \\ &\quad + \sum_{k=0}^{2} \gamma''_k.FIN_{ijt+k} \\ &\quad + \sum_{k=0}^{2} \delta''_k.INV_{ijt+k} \\ &\quad + \sum_{k=0}^{2} \theta''_k.OPE_{ijt+k} \\ &\quad + X'_{ijt}.\delta'' + \mu_i + \nu_t + \varepsilon_{ijt} \qquad (8) \end{aligned}$$

where $FIRMPER_{ijt+2}$ is two year cumulative abnormal return relative to the industry median following the CEO turnover; μ_i is the firm fixed-effect; ν_t is year fixed-effect. In regression model (7) we use Altman's (2000) $ZSCORE$ as the mediating instrument, and in model (8) we use the firm policy variables in their levels as mediating instruments. We use the policy variables in their levels because we are using the universe of S&P 500 constituent not just the turnover sample. We use the whole sample in estimating the empirical model because isolating the effect of CEO human capital on firm value may be confounded with sample selection problem if we just focus on the turnover sample.

In these models, β_3 estimates the "total effect" of CEO general human capital on $FIRMPER_{ijt+2}$ and β'_3 estimates the "indirect effect" of CEO general human capital on $FIRMPER_{ijt+2}$ after $ZSCORE_{it}$, $ZSCORE_{it+1}$, and $ZSCORE_{it+2}$ have been controlled for in regression model (7), and also after FIN_{ijt+k}, INV_{ijt+k}, and OPE_{ijt+k} $\Big(k = 0, 1, 2\Big)$, have been controlled for in regression model (8). From these

[21] See the appendix for a brief description on the mediating instrument methodology.

regression models, we calculate the reduction in the "total effect" as a result of mediation using $\left(\beta_3 - \beta_3'\right)$ and bootstrap the reduction parameter to come up with confidence intervals. The design considerations of our mediating instrument methodology weaken the plausibility of reverse mediation. That is, mediation from the outcome variable to any of the explanatory variables does not make sense since in all regressions the explanatory variables are measured temporally before the outcome variable.

Table 10 reports the results using Altman (2000) $ZSCORE$ as a mediating instrument. It shows that the indirect effect of CEO general human capital, captured by the coefficient β_3', on a firm's abnormal performance is positive and statistically significant. The immediate level of the mediating instrument, $ZSCORE_{t+2}$, has a positive effect on a firm's abnormal performance, but the distance level of the $ZSCORE_t$ has a negative effect. However, the combine effect of the mediating instrument is positive $\left(\sum_{k=0}^{2} \phi_k' > 0\right)$ and statistically different from 0. Furthermore, the effect of the interaction term declines when the $ZSCORE$ is controlled for in the regression model which indicate that part of the effect of the interaction term is being mediated away via the $ZSCORE$ channel. To investigate whether the decline in the effect of the interaction term is statistically significant, we bootstrap the reduction parameters $\left(\beta_3 - \beta_3'\right)$ 1000 times. Figure 3 shows the bootstrap distribution of the reduction parameter. Regardless of the proxy measure used for industry-level general purpose technology, the "total effect" of CEO general skills (interaction term) on abnormal firm performance reduces 90% of the time in 1000 bootstrap replications. These results indicate that CEO general human capital can reduce the costs associated with potential financial distress, which in turn, can increase the value of the firm.

[Table 10 is about here]

Tables 11 to 14 report the results when we use various firm policies in their levels as mediating instruments. Similar to the results reported in Table 10, these tables also show that the indirect effect of CEO general human capital, captured by the coefficient β_3'', on a firm's abnormal performance is positive and statistically significant. Furthermore, the effect of the interaction term declines when the firm policy variables are controlled for in the regression models which indicate that part of the effect of the interaction term is being mediated away via the firm policy channel. However, the reduction parameters $\left(\beta_3 - \beta_3''\right)$ are significant only 75% to 85% of the time in 1000 bootstrap replications. These results indicate that CEO general human capital can translate into firm value via the channel of firm policy changes, but reduction in the costs of potential financial distress seems to be a stronger channel than the firm policies to mediate the effect from CEO human capital to firm value.

[Tables 11 to 14 are about here]

5. Conclusion

Managerial attributes and executive labor market dynamics have recently been introduced into the literature to better understand how management may affect firm investment, compensation, and bankruptcy risks (see, for example, Bertrand and Shoar, 2003; Murphy and Zábojník, 2007; Aivazian, Lai, and Rahaman, 2009; Berk, Stanton, and Zechner, 2009). Our paper extends the literature in three important ways. First, we show that managerial human capital affects firm value. Second, that general (transferable) managerial skills create disproportionately more firm value than firm-specific skills for firms more reliant on general purpose technologies. Third, the enhanced value engendered by general managerial skills is due to firm policy changes that reduce expected financial distress cost.

A related research question to that of the current paper is, when is managerial human capital detrimental to firm value, and what is the relationship between managerial human capital and corporate bankruptcy?

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Appendices

A. Mediating Instrument Methodology

In an effort to avert confounding in observational studies, economists and social scientists have devised "Instrumental Variable (IV)" method which is based on a basic principle that the instrument must be correlated with the explanatory variable while being uncorrelated with the outcome variable (dependent variable). A mediating instrumental variable, on the contrary, is an auxiliary variable that fulfills radically different conditions from those demanded by the traditional instrumental variable. A mediating instrument must be correlated with both the explanatory variable and the outcome variable so that it can mediate the causation from the explanatory to the outcome variable.

To explain the mediating instrument methodology, consider a variable X that is assumed to affect another variable Y. The variable X is called the initial variable, and the variable that it causes, or Y, is called the outcome variable. The effect of X on Y may be mediated by a process or mediating variable M, and the variable X may still affect Y. Complete mediation is the case in which variable X no longer affects Y after M has been controlled for, whereas partial mediation is the case in which the path from X to Y is reduced in absolute size but is still different from zero when the mediator is controlled for. Note that a mediational model is a causal model meaning that the mediator is presumed to cause the outcome and not vice versa. If the presumed model is not correct, the results from the mediational analysis are of little value.

When the mediational model is correctly specified, Baron and Kenny (1986) and Judd and Kenny (1981) outline four steps in establishing mediation: (i) the initial variable must be correlated with the outcome in a regression model where Y is the criterion variable and X is a predictor establishing the fact that there is an effect that may be mediated; (ii) the initial variable X must be correlated with the mediator M in a regression model where M is the criterion variable and X is a predictor; (iii) the mediator M must affect the outcome variable Y in a regression model where Y is the criterion variable and X and M are predictors; (iv) to establish that M completely mediates the $X \rightarrow Y$ relationship, the effect of X on Y controlling for M should be zero. The effects in both (iii) and (iv) are estimated in the same equation. It is not sufficient just to correlate the mediator M with the outcome Y; the mediator and the outcome may be correlated because they are both caused by the initial variable X. Thus, the initial variable X must be controlled in establishing the effect of the mediator M on the outcome variable Y.

Figure 1: **Computerization, CEO Wage, External Hiring, and Firm Value**

This figure shows the time-series paths of average industry-level computerization, average CEO wage, average fraction of external CEO over the newly appointed CEOs, and average firm value. Firm value is defined as the sum of the market value of equity and the book value of debts. The figure illustrates that, on average, firm value is positively correlated with industry-level computerization, CEO wage, and external CEO hiring during the sample years (1992-2006) and they are all rising. The correlation coefficients of average industry-level computerization, average CEO wage, average fraction of external CEOs with average firm value are positive and statistically different from 0 at the 1% level of significance.

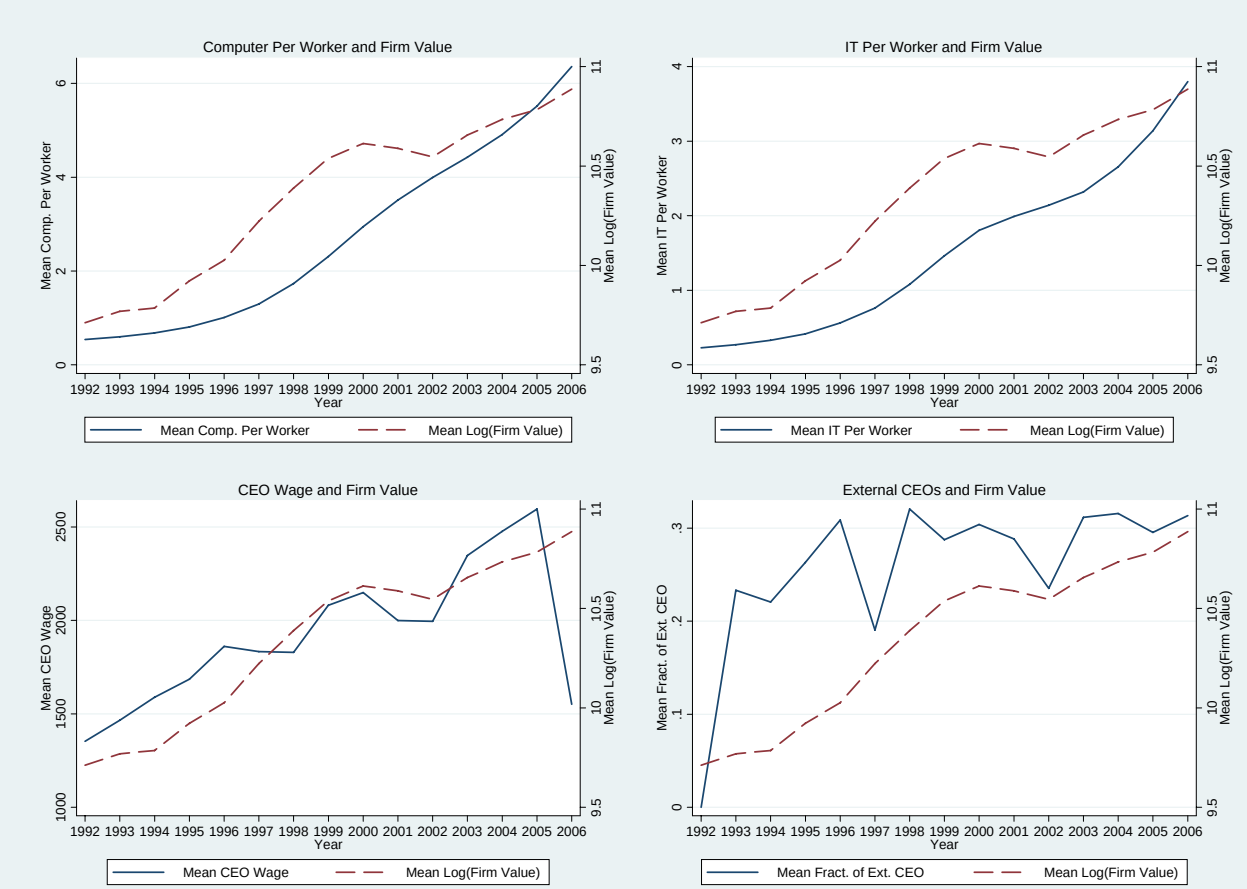

Figure 2: **Heterogeneity in Computerization Across Industries Over Various Sample Periods**

This figure shows the level of computerization across various industries over four different sample years. In the figure, the y-axis depicts the log of computer capital per worker (in constant 2000 dollars) in a given industry and the x-axis represents the 2-digit Bureau of Economics Analysis (BEA) industry classifications. The 2-digit BEA industries (industry codes in parentheses) are: Mining (21); Utilities (22); Construction (23); Manufacturing (31); Wholesale trade (42); Retail trade (44); Transportation and warehousing (48); Information (51); Finance and insurance (52); Real estate and rental and leasing (53); Professional, scientific, and technical services (54); Management of companies and enterprises (55); Administrative and waste management services (56); Education services (61); Health care and social assistance (62); Arts, entertainment and recreation (71); Accommodation and food service (72); Other services, except government (81). The figure shows that computerization increases for all industries over the sample periods (dots lie higher on the y-axis over the years). For example, in 1992 there are 4 industries with log (computer capital per worker) above the dotted '0' line whereas in 1997 there are 7 industries above the '0' line threshold. The figure also highlights that a considerable amount of heterogeneity remains across industries within a particular year; that is, the dots do not lie on a horizontal line.

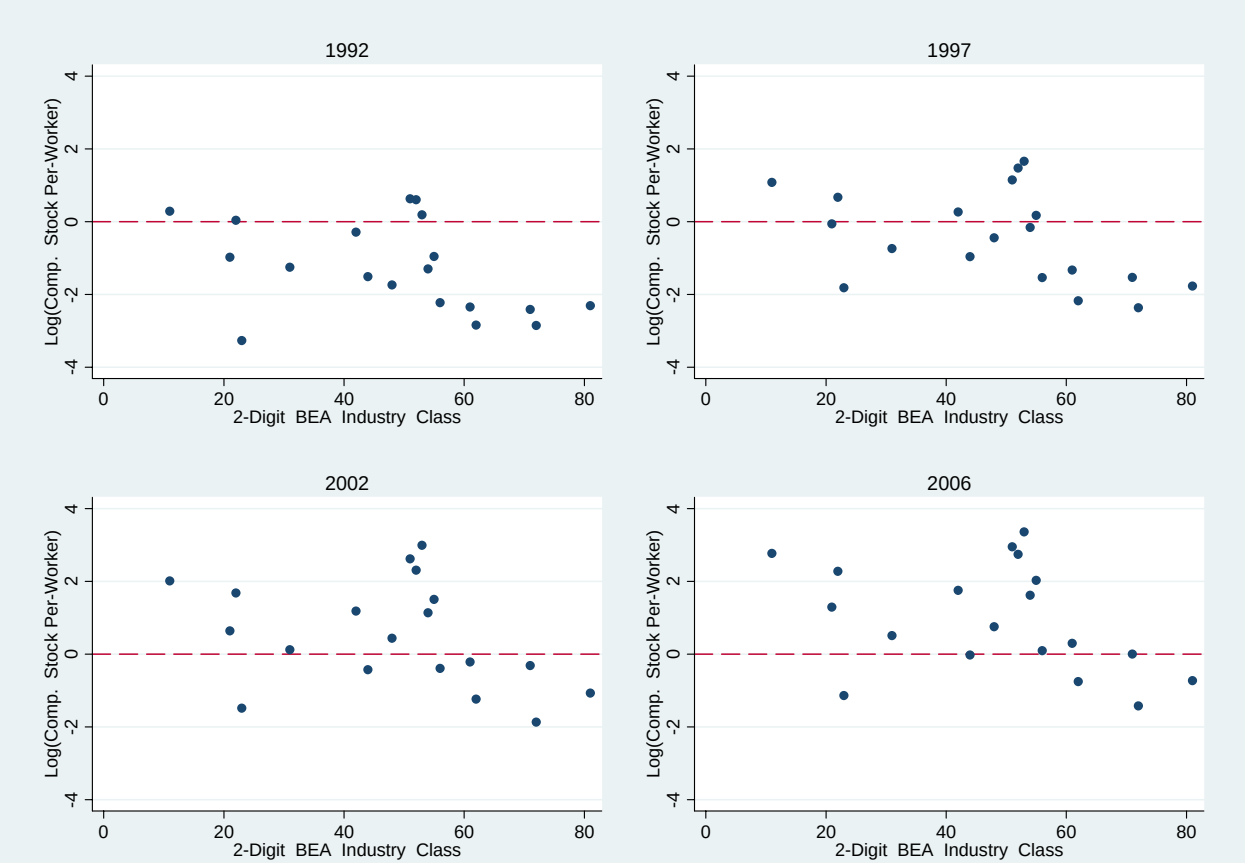

Figure 3: **CEO Human Capital, Costs of Financial Distress, and Firm Value**

This graph shows the bootstrap distribution of difference $(\beta - \beta')$ in the "Total Effect" of CEO human capital on firm performance as a result of mediation through the reduction in costs associated with financial distress. The reduction parameter $(\beta - \beta')$ is calculated from the following two regression models: $FIRMPER_{ijt+2} = \alpha + \beta.(GPT_{jt} \times EXT_{ijt}) + X'_{ijt}.\delta + \mu_i + \nu_t + \varepsilon_{ijt}$ and $FIRMPER_{ijt+2} = \alpha + \beta'.(GPT_{jt} \times EXT_{ijt}) + \phi'_1.ZSCORE_{ijt} + \phi'_2.ZSCORE_{ijt+1} + \phi'_3.ZSCORE_{ijt+2} + X'_{ijt}.\delta + \mu_i + \nu_t + \varepsilon_{ijt}$. The vertical axis denotes the probability with which mediation takes place, that is $(\beta - \beta') < 0$, and the horizontal axis shows the change in the "Total Effect" of the interaction term (CEO human capital proxy). In the figure, (a) corresponds to Column 2 of Table 10, (b) corresponds to Column 4 of Table 10, (c) corresponds to Column 6 of Table 10, and (d) corresponds to Column 8 of Table 10. It clearly shows that the "Total Effect" decreases (difference is negative) with 90% of the times in our 1000 bootstrap replications. In other words, CEO human capital translate into lower costs associated with financial distress and lower costs of distress in turn translates into higher firm value.

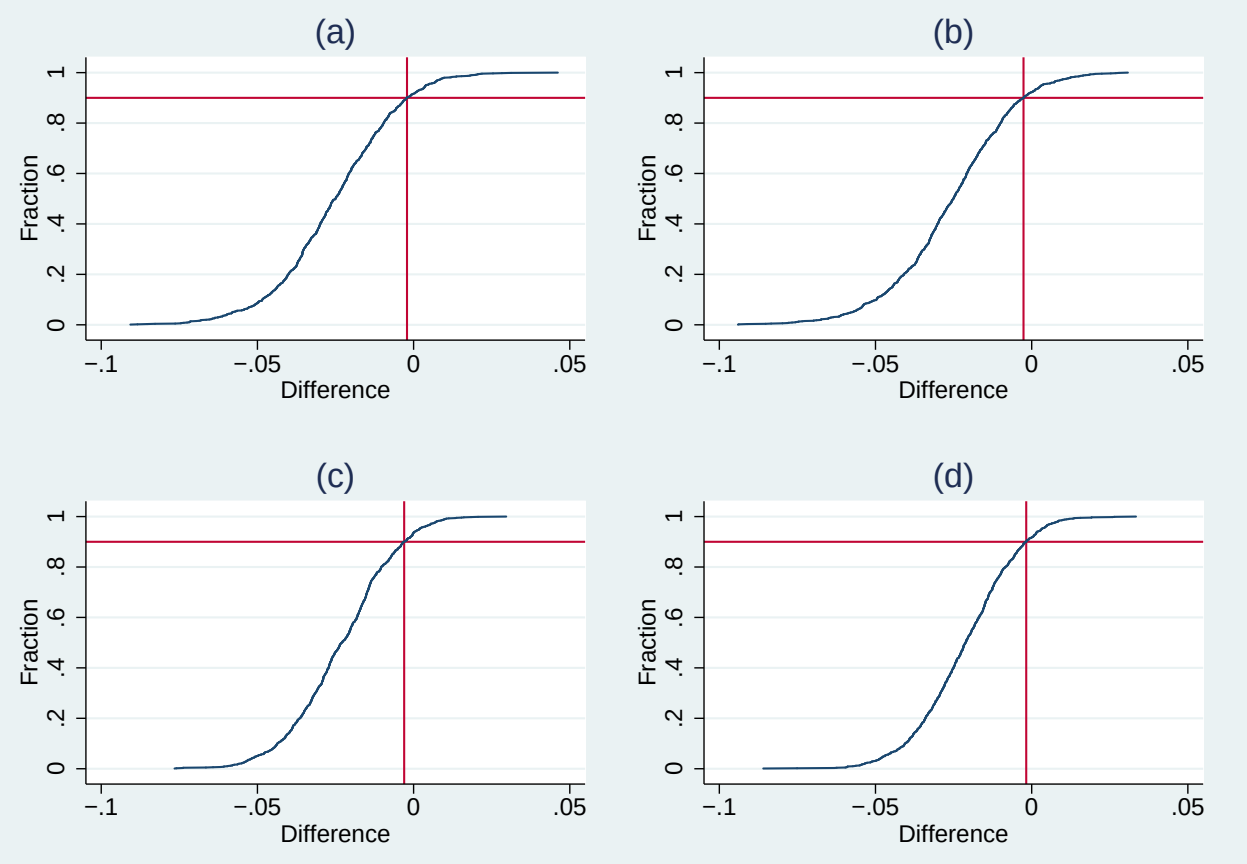

Table 1: **Summary Statistics for the Policy Variables: Turnover and Non-turnover Samples**

This table reports the summary statistics for the changes in financial, investment, and operating policy variables. Panel A reports the summary statistics for the turnover sample and Panel B reports the summary statistics for the non-turnover sample. For the Turnover Sample, we calculate the changes in the policy variables from year t to year $t+2$, where year t is the year when the CEO turnover takes place. For the Non-turnover Sample, we fix any year t and calculate the changes in the policy variables from year t to year $t+2$.

	N	Mean	Median	Min	Max	S.D.
			Panel A: Turnover Sample			
Financial Policy Variables:						
Δ *Long-Term Debts/Net Fixed-Assets*	431	0.0449	0.0000	−2.9453	3.1140	0.5832
Δ *Debts-to-Equity Ratio*	431	0.1359	0.0024	−25.6839	21.9363	3.0611
Δ *Net Debts/Net Fixed-Assets*	431	−0.0835	0.0000	−13.4379	7.8157	1.2596
Investment Policy Variables:						
Δ *Fixed-Capital Expenditure/Net Fixed-Assets*	431	0.0046	0.0035	−0.3465	0.3203	0.0789
Δ *R&D and Advertising Expenditure/Net Fixed-Assets*	431	0.0152	0.0000	−0.6776	0.9866	0.1333
Δ *Acquisition Expenditure / Net Fixed-Assets*	431	0.0226	0.0000	−1.7185	2.1204	0.3342
Operating Policy Variables:						
Δ *Log* $\lvert EBITDA - EBITDA_{-1} \rvert$	431	−0.2717	−0.2074	−4.2748	4.1261	1.4823
Δ *% Change in Net-Income/% Change in Sales*	431	0.1594	0.0000	−533.9188	756.3330	93.8325
Δ *Idiosyncratic Stock-Return Volatility*	431	−0.0036	−0.0010	−0.1072	0.1238	0.0316
			Panel B: Non-Turnover Sample			
Financial Policy Variables:						
Δ *Long-Term Debts/Net Fixed-Assets*	2758	0.0396	−0.0079	−3.4437	5.6965	0.5829
Δ *Debt-to-Equity Ratio*	2758	−0.0101	−0.0059	−27.3599	23.4097	2.0723
Δ *Net Debts/Net Fixed-Assets*	2758	−0.0210	−0.0174	−12.2557	14.3351	1.1817
Investment Policy Variables:						
Δ *Fixed-Capital Expenditure/Net Fixed-Assets*	2758	−0.0059	−0.0004	−0.3824	0.3512	0.0868
Δ *R&D and Advertising Expenditure/Net Fixed-Assets*	2758	0.0077	0.0000	−0.9378	0.9847	0.1282
Δ *Acquisition Expenditure/Net Fixed-Assets*	2758	0.0205	0.0000	−1.8883	2.2814	0.3321
Operating Policy Variables:						
Δ *Log* $\lvert EBITDA - EBITDA_{-1} \rvert$	2758	0.0442	0.0365	−4.2560	4.3192	1.4026
Δ *% Change in Net-Income/% Change in Sales*	2758	0.5225	0.0000	−832.0819	880.4010	103.4204
Δ *Idiosyncratic Stock-Return Volatility*	2758	0.0001	0.0000	−0.1276	0.1265	0.0329

Table 2: **Summary Statistics of Other Control Variables: Turnover and Non-Turnover Samples**

This table reports the summary statistics of the various control variables used in our regression analysis. Panel A reports the summary statistics for the turnover sample, and Panel B reports the summary statistics for the non-turnover sample. All variables are adjusted by the industry-median from the actual series. In the table, *Asset Tangibility* is defined as *Net Fixed Assets/Total Assets*; *Market-to-Book Ratio* is defined as *Market Value of Assets/Book Value of Assets*, where the *Market Value of Assets* is calculated by adding the market value of equity with the book value of debts; *Profitability* is defined as *Net Income/Net Sales*; Cash Holding the defined as *Cash and Marketable Securities/Net Fixed Assets*; Sales-to-Fixed Assets is defined as *Net Sales/Net Fixed Assets*; *Managerial Shareholding* is defined as the % of a firm's shares owned by the top 5 executives of the company, and *Executive Stock-option* is defined as employee stock-option awarded to the top 5 executives as part of the overall compensation package.

	N	Mean	Median	Min	Max	S.D.
			Panel A: Turnover Sample			
Corporate Governance Index	431	9.8747	10.0000	3.0000	16.0000	2.5669
Net Sales	431	−0.0461	−0.0746	−3.0248	3.4329	1.0724
Past 2-Year Cumulative Return on Assets	431	0.0026	−0.0001	−0.5843	0.3754	0.1209
CEO Age	431	52.5592	53.0000	34.0000	69.0000	5.8581
CEO MBA	431	0.3852	0.0000	0.0000	1.0000	0.4872
Total Assets	431	−0.1551	−0.1973	−3.2993	3.2873	1.1350
Assets Tangibility	431	0.0316	0.0045	−0.4772	0.5941	0.1605
Market-to-Book Ratio	431	0.3861	0.0000	−1.4243	10.3890	1.2649
Profitability	431	−0.0135	0.0016	−4.6291	0.2997	0.2362
Cash Holding	431	0.3539	−0.0010	−4.3207	23.7387	1.5641
Sales-to-Fixed Assets	431	0.9988	−0.0350	−18.3880	162.8996	8.4787
Managerial Shareholding	431	0.9442	−0.0144	−1.3521	34.3188	3.6429
Executive Stock-option	431	0.0364	0.0363	−0.7031	0.6662	0.2495
			Panel B: Non-Turnover Sample			
Corporate Governance Index	2758	9.6563	10.0000	2.0000	16.0000	2.6169
Net Sales	2758	−0.1730	−0.1961	−3.3259	3.8023	1.1174
Past 2-Year Cumulative Return on Assets	2758	0.0143	0.0096	−0.6098	0.3797	0.1110
CEO Age	2758	56.3883	57.0000	29.0000	81.0000	6.3983
CEO MBA	2758	0.3408	0.0000	0.0000	1.0000	0.4741
Total Assets	2758	−0.2784	−0.2849	−4.5409	4.4819	1.1622
Assets Tangibility	2758	0.0229	0.0000	−0.6980	0.5561	0.1649
Market-to-Book Ratio	2758	0.5209	0.0668	−2.6639	17.3354	1.4649
Profitability	2758	0.0074	0.0059	−0.7258	0.4658	0.0665
Cash Holding	2758	0.5131	−0.0003	−4.9048	87.4446	2.6258
Sales-to-Fixed Assets	2758	1.4749	0.0478	−21.2857	164.9038	7.5747
Managerial Shareholding	2758	1.8270	0.1096	−5.2340	89.6528	5.2875
Executive Stock-option	2758	0.0115	0.0000	−0.8389	0.9320	0.2684

Table 3: **Summary Statistics of Other Control Variables: External- and Internal-CEO Turnover**

This table reports the summary statistics of the various control variables used in our regression analysis. Panel A reports the summary statistics for the external-CEO turnover sample, and Panel B reports the summary statistics for the internal-CEO turnover sample. All variables are adjusted by the industry-median from the actual series. In the table, *Asset Tangibility* is defined as *Net Fixed Assets/Total Assets*; *Market-to-Book Ratio* is defined as *Market Value of Assets/Book Value of Assets*, where the *Market Value of Assets* is calculated by adding the market value of equity with the book value of debts; *Profitability* is defined as *Net Income/Net Sales*; Cash Holding the defined as *Cash and Marketable Securities/Net Fixed Assets*; Sales-to-Fixed Assets is defined as *Net Sales/Net Fixed Assets*; *Managerial Shareholding* is defined as the % of a firm's shares owned by the top 5 executives of the company, and *Executive Stock-option* is defined as employee stock-option awarded to the top 5 executives as part of the overall compensation package.

	N	Mean	Median	Min	Max	S.D.
	Panel A: Turnover Sample (External CEOs only)					
Corporate Governance Index	104	9.8750	10.0000	4.0000	15.0000	2.5302
Net Sales	104	−0.1340	−0.1056	−2.5507	2.8462	1.1604
Past 2-Year Cumulative Return on Assets	104	−0.0236	−0.0131	−0.5323	0.3557	0.1378
CEO Age	104	52.1827	53.0000	38.0000	68.0000	5.3982
CEO MBA	104	0.3654	0.0000	0.0000	1.0000	0.4839
Total Assets	104	−0.1875	−0.3137	−2.2298	2.7968	1.0895
Assets Tangibility	104	−0.0052	−0.0343	−0.3345	0.5941	0.1429
Market-to-Book Ratio	104	0.2841	0.0037	−1.1582	4.4023	0.9917
Profitability	104	−0.0351	−0.0224	−0.5833	0.1646	0.0999
Cash Holding	104	0.6660	0.0953	−0.5631	7.6849	1.4341
Sales-to-Net Fixed Assets	104	1.1024	0.0619	−3.5373	13.5373	3.3302
Managerial Shareholding	104	0.6835	−0.0659	−0.5408	18.4900	2.6414
Executive Stock-option	104	0.0670	0.0914	−0.6566	0.6432	0.2840
	Panel B: Turnover Sample (Internal CEOs only)					
Corporate Governance Index	327	9.8746	10.0000	3.0000	16.0000	2.5823
Net Sales	327	−0.0181	−0.0746	−3.0248	3.4329	1.0431
Past 2-Year Cumulative Return on Assets	327	0.0109	0.0048	−0.5843	0.3754	0.1139
CEO Age	327	52.6789	53.0000	34.0000	69.0000	5.9998
CEO MBA	327	0.3914	0.0000	0.0000	1.0000	0.4888
Total Assets	327	−0.1448	−0.1547	−3.2993	3.2873	1.1505
Assets Tangibility	327	0.0433	0.0256	−0.4772	0.5376	0.1642
Market-to-Book Ratio	327	0.4185	0.0000	−1.4243	10.3890	1.3398
Profitability	327	−0.0066	0.0064	−4.6291	0.2997	0.2650
Cash Holding	327	0.2546	−0.0074	−4.3207	23.7387	1.5925
Sales-to-Net Fixed Assets	327	0.9659	−0.0771	−18.3880	162.8996	9.5558
Managerial Shareholding	327	1.0271	−0.0086	−1.3521	34.3188	3.9078
Executive Stock-option	327	0.0267	0.0208	−0.7031	0.6662	0.2372

Table 4: **Changes in Firm Policies: Pre- and Post-turnover Periods**

This table reports the summary statistics for the changes in financial, investment, and operating policy variables between the pre- and post-turnover periods. For each turnover case, we calculate the pre-turnover mean of each policy variable in $t-1$ and $t-2$; and the post-turnover mean in $t+1$ and $t+2$. We then compute the variables in this table as the difference between the pre- and post-turnover means. Panel A reports the summary statistics for the Turnover Sample; Panel B reports the summary statistics for the internal CEOs in the Turnover Sample; and Panel C reports the summary statistics for the external CEOs in the Turnover Sample.

	N	Mean	Median	Min	Max	S.D.
			Panel A: Turnover Sample			
Financial Policy Variables:						
Long-Term Debts/Net Fixed-Assets	402	0.0901	0.0409	−3.6677	2.7823	0.6064
Debt-to-Equity Ratio	402	−0.3041	0.0144	−56.2262	31.1262	4.9556
Net Debts/Net Fixed-Assets	402	−0.0418	0.0372	−17.9462	4.4380	1.3765
Investment Policy Variables:						
Fixed-Capital Expenditure/Net Fixed-Assets	402	−0.0115	−0.0051	−0.4162	0.3543	0.0897
R&D and Advertising Expenditure/Net Fixed-Assets	402	0.0182	0.0000	−0.9639	1.0468	0.1475
Acquisition Expenditure/Net Fixed-Assets	402	0.0049	0.0000	−1.8433	1.6246	0.2821
Operating Policy Variables:						
Log $(\lvert EBITDA - EBITDA_{-1}\rvert)$	402	0.1082	0.1964	−4.1245	4.9417	1.2131
% Change in Net-Income/% Change in Sales	402	73.5394	0.3217	−4484.3428	32834.7031	1666.8372
Idiosyncratic Stock-Return Volatility	402	−0.0067	−0.0058	−0.1723	0.1142	0.0405
			Panel B: Turnover Sample (External CEOs only)			
Financial Policy Variables:						
Long-Term Debts/Net Fixed-Assets	97	0.1677	0.0883	−1.9997	2.5260	0.6083
Debt-to-Equity Ratio	97	−0.2189	0.0597	−54.6341	17.6413	6.0251
Net Debts/Net Fixed-Assets	97	−0.0322	0.0153	−6.8888	2.4836	1.0449
Investment Policy Variables:						
Fixed-Capital Expenditure/Net Fixed-Assets	97	−0.0213	−0.0148	−0.3309	0.1965	0.0987
R&D and Advertising Expenditure/Net Fixed-Assets	97	0.0328	0.0000	−0.9639	1.0468	0.2132
Acquisition Expenditure/Net Fixed-Assets	97	−0.0212	0.0000	−1.8433	1.3743	0.3783
Operating Policy Variables:						
Log $(\lvert EBITDA - EBITDA_{-1}\rvert)$	97	−0.0074	−0.0890	−2.7966	2.9223	1.1959
% Change in Net-Income/% Change in Sales	97	−0.4429	4.2566	−843.9858	999.2916	203.4868
Idiosyncratic Stock-Return Volatility	97	−0.0074	−0.0090	−0.1142	0.1142	0.0474
			Panel C: Turnover Sample (Internal CEOs only)			
Financial Policy Variables:						
Long-Term Debts/Net Fixed-Assets	305	0.0655	0.0378	−3.6677	2.7823	0.6047
Debt-to-Equity Ratio	305	−0.3312	−0.0054	−56.2262	31.1262	4.5746
Net Debts/Net Fixed-Assets	305	−0.0448	0.0622	−17.9462	4.4380	1.4678
Investment Policy Variables:						
Fixed-Capital Expenditure/Net Fixed-Assets	305	−0.0084	−0.0035	−0.4162	0.3543	0.0866
R&D and Advertising Expenditure/Net Fixed-Assets	305	0.0135	0.0000	−0.6519	0.9524	0.1193
Acquisition Expenditure/Net Fixed-Assets	305	0.0133	0.0000	−1.8390	1.6246	0.2439
Operating Policy Variables:						
Log $(\lvert EBITDA - EBITDA_{-1}\rvert)$	305	0.1450	0.2236	−4.1245	4.9417	1.2181
% Change in Net-Income/% Change in Sales	305	97.0682	0.1189	−4484.3428	32834.7031	1910.3614
Idiosyncratic Stock-Return Volatility	305	−0.0065	−0.0055	−0.1723	0.0935	0.0382

Table 5:

CEO Turnover and Firm Policies: 3SLS Regression for the Industry-Level Computerization

This table reports the estimate from the 3-stage least squares regression analysis using the industry-level computerization as a measure of general purpose technology for the Turnover Sample. The three dependent variables are: (i) $\Delta LTD/TA$ (change in *Long-term Debts/Total Assets*); (ii) $\Delta RDA/NFA$ (change in *R&D and Advertising Expenditure/Net Fixed Assets*); (iii) ΔDOL (change in *Degree of Operating leverage*, which is calculated as change in *% Change in Net income/% Change in Net Sales*). All other explanatory variables are adjusted by the industry-median from the actual series, their definitions are the same as in previous tables. Standard errors are clustered at industry level; *t*-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)			(2)		
	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL
Constant	0.0843	0.0121	−49.7131	−0.3247	−0.0570	−23.1729
	(0.1063)	(0.1082)	(−0.6707)	(−0.3762)	(−0.3608)	(−0.2616)
Computer Endowments	0.6040	0.0815	−69.0987			
	(1.1676)	(1.1649)	(−1.3405)			
Computer Endowments × External Hire Dummy	−0.4338***	−0.0566***	48.0096***			
	(−2.6128)	(−2.9838)	(2.8822)			
Speed of Computerization				−0.0463	−0.0081	−10.7623
				(−0.1200)	(−0.1292)	(−0.2616)
Speed of Computerization × External Hire Dummy				−0.3601***	−0.0561***	43.9462***
				(−2.5824)	(−2.8629)	(2.9443)
External Hire Dummy	0.1083	0.0147	−3.5571	−0.1305	−0.0189	24.9578*
	(0.8163)	(0.6598)	(−0.2657)	(−0.8174)	(−0.6967)	(1.6658)
Δ *LTD/TA*		−0.1378	66.2614**		−0.1700	71.7989**
		(−1.1544)	(2.2484)		(−1.1254)	(2.4740)
Δ *RDA/NFA*	−7.7204***		800.2421***	−6.4613***		740.2800***
	(−2.9152)		(2.6729)	(−3.0692)		(2.6288)
Δ *DOL*	0.0054	0.0007		0.0049	0.0007	
	(1.2876)	(1.0868)		(1.2497)	(1.0022)	
Corporate Governance Index	0.0008	0.0002	0.4939	0.0023	0.0006	0.3550
	(0.0361)	(0.0573)	(0.2169)	(0.1103)	(0.1521)	(0.1599)
Net Sales	−0.0974	−0.0128	9.5652*	−0.0909	−0.0140	9.4385*
	(−1.3522)	(−1.5433)	(1.7489)	(−1.4669)	(−1.5086)	(1.7733)
Past 2-Year Cumulative Return on Assets	−0.2384	−0.0243	25.8603	−0.1163	−0.0097	18.0082
	(−0.3906)	(−0.2857)	(0.4505)	(−0.2191)	(−0.0981)	(0.3231)
CEO Age	0.0174*	0.0023	−1.0153	0.0154*	0.0026	−0.9237
	(1.7669)	(1.0837)	(−0.9502)	(1.7314)	(1.0383)	(−0.9012)
CEO MBA	0.2643**	0.0353*	−25.9376**	0.2400**	0.0387*	−25.4842**
	(2.0943)	(1.7353)	(−2.0195)	(2.0923)	(1.6662)	(−2.0491)
Total Assets	0.0018			0.0035		
	(0.0383)			(0.0883)		
Asset Tangibility	0.0493			0.0414		
	(0.2483)			(0.2763)		
Market-to-Book Ratio	0.0422	0.0054		0.0366	0.0063	
	(0.8151)	(0.7060)		(0.8025)	(0.7233)	
Profitability	0.0105			0.0364		
	(0.0219)			(0.0814)		
Cash Holding		−0.0011			−0.0011	
		(−0.2651)			(−0.2440)	
Sales-to-Net Fixed Assets		−0.0000			−0.0002	
		(−0.0124)			(−0.0893)	
Managerial Shareholding			−0.5771			−0.5870
			(−0.4554)			(−0.4492)
Executive Stock-option			−16.4169			−17.0850
			(−0.9633)			(−0.9937)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations		454			454	

Table 6: **CEO Turnover and Firm Policies: 3SLS Regression for the Industry-Level IT Intensity**

This table reports the estimate from the 3-stage least squares regression analysis using the industry-level information technology (IT) intensity as a measure of general purpose technology for the turnover sample. The three dependent variables are: (i) $\Delta LTD/TA$ (change in *Long-term Debts/Total Assets*); (ii) $\Delta RDA/NFA$ (change in *R&D and Advertising Expenditure/Net Fixed Assets*); (iii) ΔDOL (change in *Degree of Operating leverage*, which is calculated as change in *% Change in Net income/% Change in Net Sales*). All other explanatory variables are adjusted by the industry-median from the actual series, their definitions are the same as in previous tables. Standard errors are clustered at industry level; t-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)			(2)		
	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL
Constant	−0.3856	−0.0768	−18.2374	0.7933	0.1104	−113.4623
	(−0.2487)	(−0.2865)	(−0.1132)	(0.9058)	(0.8431)	(−1.4999)
Information Technology (IT) Endowments	0.1434	0.0290	−6.3246			
	(0.1814)	(0.2283)	(−0.0770)			
IT Endowments × External Hire Dummy	−0.2881**	−0.0440***	31.1712**			
	(−2.4716)	(−2.9551)	(2.5733)			
Speed of IT Adoption				−1.3797**	−0.2034**	138.9169**
				(−1.9976)	(−2.0031)	(2.0704)
Speed of IT Adoption × External Hire Dummy				−0.2904**	−0.0431***	29.6058**
				(−2.4075)	(−2.6237)	(2.4252)
External Hire Dummy	0.7111***	0.1104***	−67.8068**	0.4596**	0.0697**	−39.7894*
	(2.6783)	(2.6561)	(−2.2648)	(2.4850)	(2.0472)	(−1.9269)
Δ *LTD/TA*		−0.1713	62.3372**		−0.1609	69.8316**
		(−1.2813)	(2.0783)		(−1.0872)	(2.4503)
Δ *RDA/NFA*	−6.6666***		701.7384***	−6.7898***		663.1856**
	(−2.5921)		(2.6167)	(−2.8194)		(2.4723)
Δ *DOL*	0.0047	0.0007		0.0060	0.0008	
	(1.0956)	(0.9265)		(1.3751)	(1.1238)	
Corporate Governance Index	0.0025	0.0007	0.3841	0.0012	0.0004	0.3232
	(0.1203)	(0.1879)	(0.1786)	(0.0533)	(0.1028)	(0.1511)
Net Sales	−0.0972	−0.0144	9.2311*	−0.1064*	−0.0156*	10.2578**
	(−1.2654)	(−1.6373)	(1.7959)	(−1.7218)	(−1.6509)	(1.9706)
Past 2-Year Cumulative Return on Assets	−0.1432	−0.0083	15.8128	−0.0785	−0.0055	4.3617
	(−0.2430)	(−0.0886)	(0.2933)	(−0.1329)	(−0.0551)	(0.0829)
CEO Age	0.0154*	0.0026	−0.7003	0.0157	0.0025	−0.8794
	(1.7237)	(1.1046)	(−0.7018)	(1.6401)	(1.0020)	(−0.8833)
CEO MBA	0.2306**	0.0369*	−22.6076*	0.2553**	0.0388*	−24.4357**
	(2.0183)	(1.7045)	(−1.8918)	(2.0809)	(1.6622)	(−2.0290)
Total Assets	0.0067			0.0029		
	(0.1174)			(0.0931)		
Asset Tangibility	0.0740			0.0314		
	(0.3549)			(0.1773)		
Market-to Book Ratio	0.0446	0.0075		0.0385	0.0065	
	(0.8573)	(0.9115)		(0.7603)	(0.7288)	
Profitability	0.0584			0.0430		
	(0.1276)			(0.0986)		
Cash Holding		−0.0020			−0.0007	
		(−0.4532)			(−0.1842)	
Sales-to-Fixed Assets		−0.0002			−0.0002	
		(−0.1136)			(−0.1054)	
Managerial Shareholding			−0.6450			−0.4491
			(−0.5228)			(−0.3543)
Executive Stock-option			−17.1707			−16.1333
			(−1.0166)			(−0.9477)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations		454			454	

Table 7: **3SLS Robust Regression Using the Control Function Approach**

This table reports the estimate from the 3-stage least squares regression analysis, controlling for the potential endogeneity in hiring decisions using the control function approach. We first run a probit regression of the External Hire Dummy on two dummy variables: whether the departing CEO is over 60 years old, and whether the departing CEO has an MBA degree, and other control variables. We then include a 5th degree polynomial of the propensity score as extra control variables in the 3SLS regression. The three dependent variables are: (i) $\Delta LTD/TA$ (change in *Long-term Debts/Total Assets*); (ii) $\Delta RDA/NFA$ (change in *R&D and Advertising Expenditure/Net Fixed Assets*); (iii) ΔDOL (change in *Degree of Operating leverage*, which is calculated as change in *% Change in Net income/% Change in Net Sales*). All other explanatory variables are adjusted by the industry-median from the actual series, their definitions are the same as in previous tables. Only the estimates of the general purpose technology measures, the External Hire Dummy, and their interaction terms are reported. Standard errors are clustered at industry level; t-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)			(2)		
	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL
Computer Endowments	0.6304	0.0492	−52.5137			
	(0.7780)	(0.6976)	(−0.8391)			
Computer Endowments × External Hire Dummy	−0.7358***	−0.0587***	62.1532***			
	(−2.7595)	(−3.1662)	(2.7300)			
Speed of Computerization				−0.1567	−0.0142	10.6239
				(−0.2597)	(−0.2433)	(0.2061)
Speed of Computerization × External Hire Dummy				−0.6092***	−0.0574***	56.6302***
				(−2.6127)	(−3.0570)	(2.7593)
External Hire Dummy	0.0685	0.0043	−3.3389	−0.3264	−0.0315	32.9977*
	(0.3226)	(0.2174)	(−0.2047)	(−1.2903)	(−1.2709)	(1.6877)
Observations		448			448	
	(3)			(4)		
	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL	$\Delta LTD/TA$	$\Delta RDA/NFA$	ΔDOL
Information Technology (IT) Endowments	0.1893	0.0190	−17.2778			
	(0.1946)	(0.1606)	(−0.1688)			
IT Endowments × External Hire Dummy	−0.4045**	−0.0441***	44.6240***			
	(−2.1120)	(−3.1669)	(2.6936)			
Speed of IT Adoption				−2.7023*	−0.1895**	176.9592**
				(−1.9283)	(−1.9875)	(2.0450)
Speed of IT Adoption × External Hire Dummy				−0.6093**	−0.0425***	39.8382**
				(−2.2475)	(−2.7985)	(2.3378)
External Hire Dummy	0.9271**	0.0995***	−97.9601**	0.8060**	0.0557*	−51.3882*
	(2.1989)	(2.7892)	(−2.5040)	(1.9956)	(1.8959)	(−1.9201)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations		448			448	

Table 8: **CEO Turnover and Changes in Firm-Level Financial Distress Predictors**

This table reports the summary statistics of the changes in various indicators of financial distress surrounding the CEO turnover. We use alternative measures of financial distress predictors specified in Altman (1968, 2000), Zmijewski (1984), and Shumway (2001). For each of the firm-level distress predictor, we calculate the change as $Y_{t+2} - Y_t$ for a CEO turnover in period t. Panel A of the table reports the summary statistics of the difference for the external CEO turnover sample whereas Panel B reports the summary statistics for the internal CEO turnover sample. Panel C reports the difference of the change in the financial distress predictors between the external and the internal CEO turnover sample. We also report the t-statistics in Panel C where * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	N	Mean	Median	Min	Max	S.D.
			Panel A: External CEOs)			
Altman (1968, 2000):						
$\Delta ZSCORE - 1968$	102	0.2398	0.1827	−12.7098	13.9031	2.5546
$\Delta ZSCORE - 2000$	102	0.1430	0.1341	−2.2456	1.5246	0.5542
Zmijewski (1984):						
Δ *Net Income/Total Assets*	102	0.0301	0.0212	−0.4936	0.5145	0.1082
Δ *Total Liab./Total Assets*	102	−0.0047	−0.0022	−0.3177	0.3215	0.1034
Δ *Current Assets/Current Liab.*	102	0.0061	−0.0076	−8.3186	8.7057	1.3190
Shumway (2001):						
Δ *Log (Market Value)*	102	0.0297	0.0313	−0.9418	1.0004	0.3279
Δ *Past Excess Return*	102	0.2133	0.0960	−0.8196	2.0822	0.5544
Δ *Sigma*	102	−0.0021	−0.0024	−0.1063	0.1109	0.0344
			Panel B: Internal CEOs			
Altman (1968, 2000):						
$\Delta ZSCORE - 1968$	324	−0.0540	0.0101	−31.9063	11.7535	2.8729
$\Delta ZSCORE - 2000$	324	−0.0983	−0.0008	−23.0278	1.9980	1.3515
Zmijewski (1984):						
Δ *Net Income/Total Assets*	324	0.0144	0.0001	−0.3215	4.1360	0.2388
Δ *Total Liab./Total Assets*	324	0.0002	−0.0013	−0.2919	0.6794	0.0899
Δ *Current Assets/Current Liab.*	324	−0.0099	−0.0013	−1.6796	1.6742	0.4204
Shumway (2001):						
Δ *Log (Market Value)*	324	0.0512	0.0170	−1.2780	1.2591	0.3264
Δ *Past Excess Return*	324	0.0041	0.0000	−1.6694	1.5937	0.4103
Δ *Sigma*	324	−0.0042	−0.0007	−0.1072	0.1238	0.0308
	Panel C: Differences for External CEOs and Internal CEOs)					
	$\text{Mean}^{\texttt{External}}$ - $\text{Mean}^{\texttt{Internal}}$			t-statistic		
Shumway (2001):						
$\Delta ZSCORE - 1968$	0.2961			0.3499		
$\Delta ZSCORE - 2000$	0.2419			1.7717*		
Zmijewski (1984):						
Δ *Net Income/Total Assets*	0.0158			0.6586		
Δ *Total Liab./Total Assets*	−0.0032			−0.3103		
Δ *Current Assets/Current Liab.*	0.0206			0.2476		
Shumway (2001):						
Δ *Log (Market Value)*	−0.0081			−0.2151		
Δ *Past Excess Return*	0.2065			4.0817****		
Δ *Sigma*	0.0015			0.4185		

Table 9: **CEO Human Capital and the Costs of Financial Distress**

This table reports the OLS regression result relating CEO human capital to a measure of a firm's financial health, proxied by Altman's (2000) *ZSCORE*, for the Turnover Sample. The dependent variable is the *ZSCORE* which is defined as follows: $ZSCORE = \big(3.3 \times EBIT + Sales + 1.4 \times Retained\,Earning + 1.2 \times Working\,Capital\big)/Total\,Assets$. Standard errors are clustered at industry level. We report the t-statistics are in parentheses. In the table, * refers to significance at the 10% level, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)	(2)	(3)	(4)
	Dependent variable: *ZSCORE*			
Constant	0.2133	0.2627	0.4108	0.2122
	(0.7108)	(0.5955)	(0.7433)	(0.7166)
Computer Endowments	0.1897			
	(0.8871)			
Computer Endowments × External Hire Dummy	0.0979**			
	(2.4941)			
Speed of Computerization		0.1065		
		(0.4450)		
Speed of Computerization × External Hire Dummy		0.0939**		
		(2.8418)		
Information Technology (IT) Endowments			−0.1860	
			(−0.6321)	
IT Endowments × External Hire Dummy			0.0751***	
			(3.6227)	
Speed of IT Adoption				−0.2030
				(−0.7001)
Speed of IT Adoption × External Hire Dummy				0.0855***
				(3.5649)
External Hire Dummy	0.1157****	0.1719***	−0.0465	0.0169
	(4.4513)	(4.0810)	(−1.3703)	(0.7968)
Corporate Governance Index	−0.0124****	−0.0125****	−0.0128****	−0.0123****
	(−5.2105)	(−5.1093)	(−4.8028)	(−4.9193)
Sales	−0.0133*	−0.0138**	−0.0135*	−0.0142*
	(−2.0796)	(−2.1620)	(−1.7755)	(−1.9286)
Past 2-Year Cumulative Return on Assets	−0.6326****	−0.6267****	−0.6411****	−0.6333****
	(−6.1222)	(−6.0054)	(−5.8705)	(−5.5663)
CEO Age	−0.0048	−0.0050	−0.0054	−0.0051
	(−1.2713)	(−1.2759)	(−1.2788)	(−1.2241)
CEO MBA	−0.0293	−0.0300	−0.0288	−0.0280
	(−0.7364)	(−0.7558)	(−0.6826)	(−0.6780)
Year Fixed-effects	Yes	Yes	Yes	Yes
Industry Fixed-effects	Yes	Yes	Yes	Yes
Observations	450	450	450	450
R^2	0.087	0.087	0.086	0.087

Table 10: **CEO Human Capital, the Costs of Financial Distress, and Firm Value**

This table reports the OLS regression result relating CEO human capital to firm value via the channel of reduced costs of financial distress, proxied by Altman's (2000) *ZSCORE*, for the Whole Sample. The dependent variable is the *ZSCORE* which is defined as follows: $ZSCORE = \big(3.3 \times EBIT + Sales + 1.4 \times Retained\ Earning + 1.2 \times Working\ Capital\big)/Total\ Assets$. Standard errors are clustered at industry level. We report the t-statistics are in parentheses. In the table, * refers to significance at the 10% level, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Dependent variable: *ZSCORE*				
Constant	0.2139	0.4072**	0.4628**	−0.0311	−0.1010	−0.6571*	0.3269	0.0072
	(0.9054)	(2.3458)	(2.1924)	(−0.2178)	(−0.2522)	(−1.9829)	(1.1384)	(0.0426)
$ZSCORE_{t+2}$		0.3096****		0.3092****		0.3108****		0.3105****
		(8.3013)		(8.1847)		(8.3621)		(8.4365)
$ZSCORE_{t+1}$		0.0410		0.0403		0.0384		0.0376
		(0.9738)		(0.9456)		(0.9076)		(0.8733)
$ZSCORE_t$		−0.1188***		−0.1212***		−0.1188***		−0.1200***
		(−3.1491)		(−3.0895)		(−3.0444)		(−3.1644)
Computer Endowments	0.3567****	0.3696****						
	(6.3266)	(5.5873)						
Computer Endowments × External Hire Dummy	0.1033***	0.0739**						
	(3.9333)	(2.4226)						
Speed of Computerization			0.2948****	0.3009****				
			(7.1722)	(5.5576)				
Speed of Computerization × External Hire Dummy			0.0960***	0.0636**				
			(3.8859)	(2.2114)				
Information Technology (IT) Endowments					0.2040	0.2246		
					(1.6102)	(1.5710)		
IT Endowments × External Hire Dummy					0.1074****	0.0811***		
					(6.8564)	(3.4071)		
Speed of IT Adoption							0.0736	0.0514
							(0.7017)	(0.4272)
Speed of IT Adoption × External Hire Dummy							0.1127****	0.0875***
							(6.0042)	(3.3126)
External Hire Dummy	0.0044	0.0088	0.0623	0.0440	−0.2170****	−0.1591**	−0.1290***	−0.0967**
	(0.1079)	(0.3382)	(1.3959)	(1.4046)	(−5.2610)	(−2.7616)	(−3.5741)	(−2.3954)
Corporate Governance Index	−0.0075	−0.0116**	−0.0088	−0.0129**	−0.0076	−0.0108**	−0.0095	−0.0130**
	(−1.0406)	(−2.3330)	(−1.2964)	(−2.5463)	(−1.1745)	(−2.2578)	(−1.5077)	(−2.4461)
Sales	−0.3111****	−0.2731***	−0.3085***	−0.2706***	−0.3064***	−0.2684***	−0.3030***	−0.2659***
	(−4.1421)	(−3.7239)	(−4.0496)	(−3.6143)	(−3.8611)	(−3.3804)	(−3.6584)	(−3.2522)
Past 2-Year Cumulative Return on Assets	−0.5535***	−0.4911**	−0.5460***	−0.4791**	−0.5494***	−0.4825**	−0.5578***	−0.4901**
	(−3.1453)	(−2.7778)	(−3.1552)	(−2.7654)	(−3.1230)	(−2.7257)	(−3.0753)	(−2.7325)
CEO Age	−0.0070***	−0.0063*	−0.0071***	−0.0064*	−0.0059*	−0.0052	−0.0062**	−0.0054
	(−3.0175)	(−1.9115)	(−3.1873)	(−1.9846)	(−2.0252)	(−1.3288)	(−2.1971)	(−1.4017)
CEO MBA	0.0101	0.0386	0.0075	0.0366	0.0110	0.0393	0.0090	0.0374
	(0.2962)	(1.3868)	(0.2259)	(1.3117)	(0.3193)	(1.3813)	(0.2657)	(1.3216)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3330	3289	3330	3289	3330	3289	3330	3289
R^2	0.271	0.321	0.270	0.321	0.267	0.318	0.267	0.317

Table 11:

CEO Human Capital, Firm Policies, and Firm Value: Industry-Level Computer Endowment

This table reports the estimate from the OLS regression analysis using the industry-level computer endowment as a measure of general purpose technology for the whole sample. The dependent variable is the industry-adjusted 2-year cumulative abnormal return. All other explanatory variables were de-median first by subtracting the industry-median from the actual series. In the table, *LTD/TA* is defined as *Long-term Debts/Total Assets*; *RDA/NFA* is defined as *R&D and Advertising Expenditure/Net Fixed Assets*; *DOL* is defined as the *Degree of Operating leverage* calculated as *% Change in Net income/% Change in Net Sales*. We multiply the *DOL* variable by a factor of 1/100 to attenuate the magnitude of the variable. The definitions of all other explanatory variables are the same as in the previous tables. Standard errors are clustered at industry level; *t*-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)	(2)	(3)	(4)	(5)
	Dep. var.: Ind.-adjusted 2-year cumulative abnormal return				
Constant	0.2139	0.2015	0.3062	0.2328	0.3000
	(0.9054)	(0.8023)	(1.4271)	(1.0141)	(1.3613)
$(LTD/TA)_{t+2}$		−0.0572**			−0.0515**
		(−2.3860)			(−2.1690)
$(LTD/TA)_{t+1}$		0.0229			0.0227
		(0.9236)			(0.8764)
$(LTD/TA)_t$		0.0369***			0.0394***
		(3.0624)			(3.0451)
$(RDA/NFA)_{t+2}$			−0.0759*		−0.0503
			(−2.1250)		(−1.3464)
$(RDA/NFA)_{t+1}$			−0.0632****		−0.0479**
			(−5.0339)		(−2.3245)
$(RDA/NFA)_t$			−0.1626*		−0.1940**
			(−1.8394)		(−2.3954)
$(DOL/100)_{t+2}$				−0.0135	−0.0144
				(−1.3987)	(−1.4895)
$(DOL/100)_{t+1}$				0.0040**	0.0041**
				(2.6634)	(2.7280)
$(DOL/100)_t$				−0.0262	−0.0268
				(−0.8900)	(−0.8897)
Computer Endowments	0.3567****	0.3538****	0.3584****	0.3612****	0.3587****
	(6.3266)	(6.0678)	(5.9391)	(6.2431)	(5.7253)
Computer Endowments × *External Hire Dummy*	0.1033***	0.1016***	0.1075***	0.0979****	0.1015***
	(3.9333)	(3.8086)	(3.7602)	(4.2868)	(3.9827)
External Hire Dummy	0.0044	0.0052	0.0078	0.0095	0.0130
	(0.1079)	(0.1253)	(0.1949)	(0.2243)	(0.2975)
Corporate Governance Index	−0.0075	−0.0082	−0.0082	−0.0075	−0.0088
	(−1.0406)	(−1.2737)	(−1.2785)	(−1.0623)	(−1.5297)
Net Sales	−0.3111****	−0.3099***	−0.3132***	−0.3103****	−0.3109***
	(−4.1421)	(−3.9272)	(−3.9999)	(−4.2057)	(−3.8854)
Past 2-Year Cumulative Return on Assets	−0.5535***	−0.5123**	−0.5584***	−0.5658***	−0.5235**
	(−3.1453)	(−2.9211)	(−3.0374)	(−3.1118)	(−2.7274)
CEO Age	−0.0070***	−0.0065**	−0.0072***	−0.0073***	−0.0072***
	(−3.0175)	(−2.8199)	(−3.1194)	(−3.3356)	(−3.3194)
CEO MBA	0.0101	0.0130	0.0141	0.0081	0.0136
	(0.2962)	(0.3725)	(0.5293)	(0.2526)	(0.5061)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed-effects	Yes	Yes	Yes	Yes	Yes
Observations	3330	3330	3330	3330	3330
R^2	0.271	0.272	0.273	0.272	0.277

Table 12: **CEO Human Capital, Firm Policies, and Firm Value: Industry-Level Computerization**

This table reports the estimate from the OLS regression analysis using the industry-level computerization as a measure of general purpose technology for the whole sample. The dependent variable is the industry-adjusted 2-year cumulative abnormal return. All other explanatory variables were de-median first by subtracting the industry-median from the actual series. In the table, *LTD/TA* is defined as *Long-term Debts/Total Assets*; *RDA/NFA* is defined as *R&D and Advertising Expenditure/Net Fixed Assets*; *DOL* is defined as the *Degree of Operating leverage* calculated as *% Change in Net income/% Change in Net Sales*. We multiply the *DOL* variable by a factor of 1/100 to attenuate the magnitude of the variable. The definitions of all other explanatory variables are the same as in the previous tables. Standard errors are clustered at industry level; t-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)	(2)	(3)	(4)	(5)
	Dep. var.: Ind.-adjusted 2-year cumulative abnormal return				
Constant	0.4628^{**}	0.4481^{*}	0.5568^{**}	0.4834^{**}	0.5490^{**}
	(2.1924)	(1.9163)	(2.9359)	(2.3674)	(2.6940)
$(LTD/TA)_{t+2}$		-0.0551^{**}			-0.0494^{*}
		(-2.3884)			(-2.1249)
$(LTD/TA)_{t+1}$		0.0211			0.0209
		(0.8711)			(0.8259)
$(LTD/TA)_{t}$		0.0365^{***}			0.0391^{***}
		(3.0334)			(3.0906)
$(RDA/NFA)_{t+2}$			-0.0717^{*}		-0.0476
			(-1.8698)		(-1.2215)
$(RDA/NFA)_{t+1}$			-0.0636^{****}		-0.0485^{**}
			(-5.0541)		(-2.3749)
$(RDA/NFA)_{t}$			-0.1664^{*}		-0.1966^{**}
			(-1.8262)		(-2.3639)
$(DOL/100)_{t+2}$				-0.0124	-0.0133
				(-1.1903)	(-1.2814)
$(DOL/100)_{t+1}$				0.0039^{**}	0.0040^{**}
				(2.8044)	(2.8644)
$(DOL/100)_{t}$				-0.0251	-0.0257
				(-0.8274)	(-0.8326)
Speed of Computerization	0.2948^{****}	0.2878^{****}	0.2965^{****}	0.2945^{****}	0.2881^{****}
	(7.1722)	(6.9217)	(6.9178)	(6.6905)	(6.1474)
Speed of Computerization × *External Hire Dummy*	0.0960^{***}	0.0946^{***}	0.1008^{***}	0.0906^{****}	0.0950^{***}
	(3.8859)	(3.7555)	(3.7177)	(4.3512)	(4.0103)
External Hire Dummy	0.0623	0.0623	0.0687	0.0638	0.0701
	(1.3959)	(1.3442)	(1.5187)	(1.3899)	(1.4376)
Corporate Governance Index	-0.0088	-0.0095	-0.0096	-0.0089	-0.0101^{*}
	(-1.2964)	(-1.5514)	(-1.5804)	(-1.3211)	(-1.8536)
Net Sales	-0.3085^{***}	-0.3074^{***}	-0.3106^{***}	-0.3077^{***}	-0.3084^{***}
	(-4.0496)	(-3.8488)	(-3.9038)	(-4.1108)	(-3.7995)
Past 2-Year Cumulative Return on Assets	-0.5460^{***}	-0.5060^{**}	-0.5500^{***}	-0.5579^{***}	-0.5161^{**}
	(-3.1552)	(-2.9311)	(-3.0513)	(-3.1250)	(-2.7421)
CEO Age	-0.0071^{***}	-0.0067^{**}	-0.0074^{***}	-0.0074^{***}	-0.0073^{***}
	(-3.1873)	(-2.9714)	(-3.3105)	(-3.4948)	(-3.4882)
CEO MBA	0.0075	0.0104	0.0115	0.0057	0.0110
	(0.2259)	(0.3053)	(0.4393)	(0.1805)	(0.4194)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed-effects	Yes	Yes	Yes	Yes	Yes
Observations	3330	3330	3330	3330	3330
R^2	0.270	0.272	0.273	0.272	0.276

Table 13: **CEO Human Capital, Firm Policies, and Firm Value: Industry-Level IT Endowment**

This table reports the estimate from the OLS regression analysis using the industry-level information technology (IT) endowment as a measure of general purpose technology for the whole sample. The dependent variable is the industry-adjusted 2-year cumulative abnormal return. All other explanatory variables were de-median first by subtracting the industry-median from the actual series. In the table, *LTD/TA* is defined as *Long-term Debts/Total Assets*; *RDA/NFA* is defined as *R&D and Advertising Expenditure/Net Fixed Assets*; *DOL* is defined as the *Degree of Operating leverage* calculated as *% Change in Net income/% Change in Net Sales*. We multiply the *DOL* variable by a factor of 1/100 to attenuate the magnitude of the variable. The definitions of all other explanatory variables are the same as in the previous tables. Standard errors are clustered at industry level; t-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)	(2)	(3)	(4)	(5)
	Dep. var.: Ind.-adjusted 2-year cumulative abnormal return				
Constant	−0.1010	−0.1167	−0.0161	−0.0784	−0.0215
	(−0.2522)	(−0.2706)	(−0.0411)	(−0.1993)	(−0.0520)
$(LTD/TA)_{t+2}$		−0.0526**			−0.0464*
		(−2.1811)			(−1.8997)
$(LTD/TA)_{t+1}$		0.0227			0.0223
		(0.9073)			(0.8565)
$(LTD/TA)_{t}$		0.0437**			0.0461***
		(2.7965)			(3.1100)
$(RDA/NFA)_{t+2}$			−0.0922**		−0.0688*
			(−2.5669)		(−1.7698)
$(RDA/NFA)_{t+1}$			−0.0609****		−0.0449**
			(−4.9351)		(−2.2894)
$(RDA/NFA)_{t}$			−0.1506*		−0.1854**
			(−1.8956)		(−2.4847)
$(DOL/100)_{t+2}$				−0.0127	−0.0135
				(−1.3022)	(−1.3729)
$(DOL/100)_{t+1}$				0.0037**	0.0038**
				(2.7848)	(2.8689)
$(DOL/100)_{t}$				−0.0266	−0.0270
				(−0.9144)	(−0.9069)
Information Technology (IT) Endowments	0.2040	0.1978	0.2070	0.2032	0.1998
	(1.6102)	(1.5521)	(1.6192)	(1.6055)	(1.5637)
IT Endowments × External Hire Dummy	0.1074****	0.1059****	0.1102****	0.1018****	0.1041****
	(6.8564)	(6.0219)	(7.2372)	(9.5961)	(8.5088)
External Hire Dummy	−0.2170****	−0.2128****	−0.2189****	−0.2004****	−0.2015****
	(−5.2610)	(−5.1571)	(−5.3541)	(−5.3707)	(−5.4795)
Corporate Governance Index	−0.0076	−0.0080	−0.0082	−0.0077	−0.0085
	(−1.1745)	(−1.3356)	(−1.4650)	(−1.2197)	(−1.6548)
Net Sales	−0.3064***	−0.3050***	−0.3085***	−0.3055***	−0.3060***
	(−3.8611)	(−3.7031)	(−3.7201)	(−3.9112)	(−3.6449)
Past 2-Year Cumulative Return on Assets	−0.5494***	−0.5009**	−0.5572***	−0.5604***	−0.5143**
	(−3.1230)	(−2.9253)	(−3.0187)	(−3.0995)	(−2.7435)
CEO Age	−0.0059*	−0.0055*	−0.0061*	−0.0062**	−0.0061**
	(−2.0252)	(−1.9024)	(−2.0983)	(−2.2001)	(−2.2067)
CEO MBA	0.0110	0.0124	0.0152	0.0092	0.0133
	(0.3193)	(0.3649)	(0.5610)	(0.2805)	(0.5116)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed-effects	Yes	Yes	Yes	Yes	Yes
Observations	3330	3330	3330	3330	3330
R^2	0.267	0.269	0.270	0.269	0.273

Table 14: **CEO Human Capital, Firm Policies, and Firm Value: Industry-Level IT Intensity**

This table reports the estimate from the OLS regression analysis using the industry-level information technology (IT) intensity as a measure of general purpose technology for the turnover sample. The dependent variable is the industry-adjusted 2-year cumulative abnormal return. All other explanatory variables were de-median first by subtracting the industry-median from the actual series. In the table, *LTD/TA* is defined as *Long-term Debts/Total Assets*; *RDA/NFA* is defined as *R&D and Advertising Expenditure/Net Fixed Assets*; *DOL* is defined as the *Degree of Operating leverage* calculated as *% Change in Net income/% Change in Net Sales*. We multiply the *DOL* variable by a factor of 1/100 to attenuate the magnitude of the variable. The definitions of all other explanatory variables are the same as in the previous tables. Standard errors are clustered at industry level; t-statistics are reported in parentheses; * refers to significance at the 10%, ** refers to 5%, *** refers to 1%, and **** refers to significance at the 0.1% level.

	(1)	(2)	(3)	(4)	(5)
	Dep. var.: Ind.-adjusted 2-year cumulative abnormal return				
Constant	0.3269	0.3154	0.4351	0.3505	0.4294
	(1.1384)	(0.9430)	(1.5874)	(1.2405)	(1.3735)
$(LTD/TA)_{t+2}$		-0.0523^{*}			-0.0464^{*}
		(-2.1369)			(-1.8853)
$(LTD/TA)_{t+1}$		0.0227			0.0224
		(0.9098)			(0.8583)
$(LTD/TA)_{t}$		0.0436^{**}			0.0461^{***}
		(2.8357)			(3.1443)
$(RDA/NFA)_{t+2}$			-0.0871^{**}		-0.0645^{*}
			(-2.4925)		(-1.8084)
$(RDA/NFA)_{t+1}$			-0.0613^{****}		-0.0453^{**}
			(-4.9947)		(-2.2994)
$(RDA/NFA)_{t}$			-0.1518^{*}		-0.1865^{**}
			(-1.8644)		(-2.4459)
$(DOL/100)_{t+2}$				-0.0130	-0.0138
				(-1.3510)	(-1.4299)
$(DOL/100)_{t+1}$				0.0036^{**}	0.0037^{**}
				(2.8098)	(2.8909)
$(DOL/100)_{t}$				-0.0264	-0.0269
				(-0.9023)	(-0.9001)
Speed of IT Adoption	0.0736	0.0583	0.0615	0.0708	0.0479
	(0.7017)	(0.5087)	(0.5792)	(0.6619)	(0.4108)
Speed of IT Adoption × External Hire Dummy	0.1127^{****}	0.1113^{****}	0.1163^{****}	0.1060^{****}	0.1090^{****}
	(6.0042)	(5.6343)	(5.9560)	(7.3242)	(6.5435)
External Hire Dummy	-0.1290^{***}	-0.1260^{***}	-0.1293^{***}	-0.1165^{***}	-0.1156^{***}
	(-3.5741)	(-3.4905)	(-3.6110)	(-3.1800)	(-3.1100)
Corporate Governance Index	-0.0095	-0.0098	-0.0102^{*}	-0.0096	-0.0104^{*}
	(-1.5077)	(-1.6882)	(-1.8252)	(-1.5510)	(-2.0449)
Net Sales	-0.3030^{***}	-0.3022^{***}	-0.3056^{***}	-0.3022^{***}	-0.3037^{***}
	(-3.6584)	(-3.5055)	(-3.5413)	(-3.7070)	(-3.4628)
Past 2-Year Cumulative Return on Assets	-0.5578^{***}	-0.5091^{**}	-0.5649^{***}	-0.5685^{***}	-0.5216^{**}
	(-3.0753)	(-2.8810)	(-2.9882)	(-3.0532)	(-2.7170)
CEO Age	-0.0062^{**}	-0.0057^{*}	-0.0064^{**}	-0.0065^{**}	-0.0063^{**}
	(-2.1971)	(-2.0483)	(-2.2635)	(-2.3795)	(-2.3607)
CEO MBA	0.0090	0.0104	0.0131	0.0072	0.0113
	(0.2657)	(0.3094)	(0.4884)	(0.2239)	(0.4318)
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed-effects	Yes	Yes	Yes	Yes	Yes
Observations	3330	3330	3330	3330	3330
R^2	0.267	0.269	0.269	0.268	0.273