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CEO Expertise and the Design of Compensation Contracts: Evidence from Generalist versus Specialist CEOs

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CEO Expertise and the Design of Compensation Contracts: Evidence from Generalist versus Specialist CEOs[*]

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Abstract: Research has shown that generalist CEOs enjoy higher pay than do specialist CEOs. However, the implication of CEO expertise on *how* CEOs are paid is largely unknown. We conjecture that because of information asymmetry, generalist CEOs may overstate their ability when contracting with shareholders. Thus the pay should be more closely linked to firm performance for generalist CEOs than for specialists in an optimal contract. Our results support this conjecture, especially when generalist CEOs are early in their tenure or are less known in the executive labor market or when they are more important for firm performance. The results are robust to endogeneity concerns. Alternative explanations such as risk-taking or price efficiency are unlikely to account for our findings. Overall, our results support the optimal contracting perspective of executive compensation.

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Abstract

Research has shown that generalist CEOs enjoy higher pay than do specialist CEOs. However, the implication of CEO expertise on how CEOs are paid is largely unknown. We conjecture that because of information asymmetry, generalist CEOs may overstate their ability when contracting with shareholders. Thus the pay should be more closely linked to firm performance for generalist CEOs than for specialists in an optimal contract. Our results support this conjecture, especially when generalist CEOs are early in their tenure or are less known in the executive labor market or when they are more important for firm performance. The results are robust to endogeneity concerns. Alternative explanations such as risk-taking or price efficiency are unlikely to account for our findings. Overall, our results support the optimal contracting perspective of executive compensation.

JEL Classification: G34; J24; J33

Keywords: Compensation contract; CEO expertise; Generalists; Specialists

1. Introduction

Recent years have witnessed two interesting trends in the corporate world. First, modern organizations have increasingly emphasized the importance of human capital in creating firm value (Rajan and Zingales 2000). Second, the level of both executive total compensation and incentive pay have increased dramatically over time (Gabaix and Landier 2008; Frydman and Jenter 2010). Given the importance of CEOs in firm business strategy, financial policy, and ultimate firm performance,[1] the implication of CEO expertise on executive compensation becomes an important issue. Murphy and Zabojnik (2004, 2007) and Custódio et al. (2013) find that the required skills of CEOs have changed dramatically and this change has important implications for the evolution of the level of CEO compensation. Custódio et al. (2013) show that generalist CEOs are paid more than specialist CEOs. Although the *level* of executive pay is important, Jensen and Murphy (2010) argue that an equally important question on CEO compensation is how the *structure* (or composition) of pay differs between generalist versus specialist CEOs, which remains largely unknown. This study aims to fill this gap.

To formulate testing hypotheses, we rely on existing theoretical models on how managerial expertise affects pay-performance sensitivity. In particular, the analytical models of Dutta (2008) and Goldmanis and Ray (2014) predict that pay is more sensitive to performance when managerial skills are more general. The rationale is as follows. In the presence of asymmetric information regarding the ability of CEOs, generalist CEOs tend to overstate their ability when negotiating with shareholders for higher pay since they have more outside options.[2] The firm, as the counterparty in the contracting process, rationally anticipates this tendency and thus designs the

[1] See, for example, Hambrick and Mason (1984), Bennedsen et al. (2006), and Bennedsen et al. (2011).

[2] In our setting, outside options can be interpreted as the value of managerial expertise if employed in other firms. Specialists are more likely to have less outside options, either because their skills are specialized *per se*, or because there are not many firms which weight her skill set in a similar way to her current (or past) employer.

compensation contract in a way that closely links CEO pay to firm performance. This contracting feature results in higher pay-performance sensitivity for generalist than for specialist CEOs, which is our main hypothesis.

To shed light on the underlying mechanism, we develop cross-sectional variations from the main hypothesis. The first comes from the board of directors' learning about the CEO's ability over time. As the CEO's ability is gradually revealed over time, adverse selection would become less of a concern to the board of directors. Hence the compensation contract does not need to counteract generalist CEOs' tendency to overstate their ability. It implies that the positive relation between general skills and pay-performance sensitivity would be more pronounced for CEOs whose skills are less known to the corporate board.

The second cross-sectional variation is related to the importance of CEOs for firm value creation. When CEOs are more important in firm value creation, the proportion of incentive pay would increase to curb generalist CEOs' tendency to overstate their abilities. Dutta (2008) argues that generalist and specialist CEOs have different incentives in revealing their expertise. While the incentive to exaggerate their ability and thus to bargain for higher pay dominates for generalists, specialists find it more lucrative to under-report their ability in order to lower boards' expectation of firm performance and to save disutility from effort. The incentive to mis-report becomes stronger when CEO plays a more important role in firm value creation. As a result, for generalists, the pay-performance sensitivity increases with the importance of CEOs.

We then empirically examine how incentive pay varies with CEOs' expertise in the context of information asymmetry. We retrieve CEO compensation for S&P 1,500 firms from ExecuComp and use the general ability index (GA-index) constructed by Custódio et al. (2013) to measure the generality of CEO skills. Our final sample consists of 18,485 CEO-year observations, including

3,868 unique CEOs and 2,256 unique firms from 1993-2007. We summarize the findings as follows. First, consistent with our main prediction, generalist CEOs' pay is more sensitive to performance as measured by scaled delta than specialist CEOs' pay. The result is robust to an alternative measure of pay-performance sensitivity—unscaled delta.[3]

Cross-sectional analysis indicates that the relation between pay-performance sensitivity and the generality of CEO expertise is stronger when CEOs have been in office for a shorter time or are less known in the executive labor market. In addition, the relation between generalist CEOs and pay-performance sensitivity is also stronger when CEOs are more important for firm performance as measured by industry competition and past sales growth. Overall, the results support our hypotheses and unveil the adverse selection and CEO importance mechanisms in the design of an optimal compensation contract given the differences in CEO expertise.

To alleviate the concern of potential endogeneity, we control for CEO fixed effects to take into account the effect of time-invariant CEO characteristics (e.g., attitude towards risk and gender). To further rule out potential selection bias, we conduct two additional tests. The first is based on a propensity score matched sample, where firms with similar characteristics are matched except that one group of firms employs generalist CEOs, while the other matched group consists of specialist CEOs. The second test employs the non-compete agreement enforcement index constructed by Garmaise (2011) as an instrument for the GA-index. The non-compete clause prevents employees from working for competitors of their current employers after they quit, are laid off or fired. The enforcement of the clause differs among states.[4] CEOs in states where the non-compete clause is enforced more stringently would tend to accumulate more general skills to

[3] Scaled delta is a "percent-percent" measure which gauges the percentage change of CEO wealth for each one-percentage change in firm value. Unscaled delta is the dollar change in CEO wealth (in thousands of dollars) associated with a one-percentage change in stock price. See the Appendix for more detailed calculations.
[4] The enforcement of non-compete clause could also change over time within the same state.

preserve outside employment opportunities. The variation in the clause enforcement, however, is unlikely to affect the compensation structure directly. The findings from both tests lend further support to the positive association between CEO general skills and pay-performance sensitivity.

Besides pay-performance sensitivity, we also check how pay mix varies with different CEO expertise. We measure incentive pay as the proportion of non-cash compensation. The results again confirm our main prediction. We find a significantly higher (lower) proportion of incentive pay (cash compensation) awarded to generalist CEOs.

We conduct several tests to rule out alternative explanations such as risk-taking or market inefficiency. Firms that intend to take risks may hire generalist CEOs who have more access to outside options and award them with high-powered incentive contracts. Therefore, the positive association between generalist CEOs and pay-performance sensitivity might arise from risk-taking and generalists' higher tolerance to risks. We use a battery of proxies for risk-taking, such as R&D expenditures, diversification, and among others, and find no significant (or consistent) differences in the relation between CEO general skills and pay-performance sensitivity across most of the risk-taking subsamples.

Another alternative explanation is the difference in stock price efficiency across firms with generalist versus specialist CEOs at the helm. If firm-specific risk accounts for a larger proportion of all risks for firms steered by specialist CEOs,[5] stock price efficiency for these firms may be lower and therefore their pay-performance sensitivity (with the underlying performance measure as stock price) would also be lower according to the "informativeness principle" (Hölmstrom,

[5] In a similar vein, Foucault and Frésard (2016) argue that firms that are remote away from their peers' strategy will receive lower valuation. Since specialist CEOs are more likely to operate firms distant from their peers, it is plausible that firms with specialist CEOs suffers from mispricing and thus receive lower valuation.

1979). We employ several measures of market inefficiency but fail to find a significant correlation between stock price efficiency and CEO skill generality.

To further make sure that our findings are not random, we conduct one placebo test. Specifically, we randomly assign CEOs to different firms in a given year. The results from 5,000 randomization exercises indicate that the effect of CEO expertise on pay-performance sensitivity from real data is much stronger than that from the simulation sample, both statistically and economically. Overall, the results indicate that our findings are most likely capturing the optimal contracting of CEO compensation when there is information asymmetry regarding CEO's expertise and heterogeneous outside options.

This paper makes several contributions to the literature. First, we show that pay-performance sensitivity reflects the expertise of CEOs. Typical principal-agent models are built on the trade-off between incentivizing managerial effort and limiting the risk exposure of managers, which predict that the optimal strength of incentives depends on the quality of performance signals, the cost of managerial effort and managers' risk aversion (e.g., Garen 1994; Haubrich 1994; Aggarwal and Samwick 1999; Himmelberg et al. 1999; Becker 2006). However, less attention is given to the role of incentive pay in resolving information asymmetry between boards and CEOs, especially the adverse selection by CEOs (for moral hazard, see, e.g., Gayle and Miller 2009). The findings in this paper enrich our understanding of the factors shaping executive incentive contracts, which indirectly echoes the debates on whether executives are paid for performance (e.g., Bebchuk and Fried 2003; Goldman and Slezak 2006).

Second, we add to the recent literature on CEO skills by documenting their implications for the design of compensation contracts. The previous studies have generally shown that CEO expertise has both a bright and a dark side and thus will affect firm policies in different ways. For

example, it is shown that general skills are more appreciated by the labor market and generalists are accordingly paid more (Custódio et al. 2013). Besides, generalist CEOs are more likely engaged in innovation (Custódio et al. 2015). However, firms with generalist CEOs may also experience more severe agency problems and therefore investors may demand higher expected returns (Mishra 2014). Given the nontrivial influence of CEOs on firm policies and ultimate performance (Bertrand and Schoar 2003), exploring other implications of the CEO expertise is of great necessity given the limited knowledge we have. Our paper uncovers another important implication of the CEO expertise: incentive contracts, which is instrumental in interpreting the recent trends of both the emphasis on human capital and the increase in incentive pay.

Third, the results shed light on the interaction between the labor market and the design of managerial contracts. When CEOs' outside options are correlated with their ability, they tend to withhold private information of their ability to bargain for favorable pay. The board of directors would design compensation contracts differently based on CEO expertise to mitigate adverse selection and reduce information rents. While Oyer (2004) relies on outside opportunities to explain why firms use non-indexed options to retain executives, we show empirically that outside opportunities associated with skills (which are accumulated during past working experiences) affect optimal incentive pay. Our results are also complementary to those in Lustig et al. (2011) who demonstrate that the increase in pay-performance sensitivity can be explained by growing outside options as a result of more portable organization capital owned by managers.

The remainder of the paper is organized as follows. In the next section, we discuss the related literature and develop our hypotheses. The research design is described in Section 3 and the empirical results are reported in Section 4. Section 5 presents additional analyses. Section 6 reports results from possible alternative explanations. We conclude the paper in Section 7.

2. Related Literature and Hypothesis Development

This study is related to several streams of literature, including the literature on the managerial expertise, pay-performance sensitivity, and the revelation of CEO ability over time. This section is devoted to the discussion of the related literature and develops the hypotheses therein.

2.1 Managerial expertise

As discussed at the outset, the CEO is the most important person in a firm and probably has the most influence on firm performance. The literature has so far identified the effects of firm-specific versus generic skills on CEO pay, firm innovation, and the cost of capital. For example, For example, Murphy and Zabojnik (2004, 2007) demonstrate that a shift in the relative importance of general skills and firm-specific skills has contributed to the observed wage increases of CEOs during the past few decades. Relatedly, Custódio et al. (2013) find that generalist CEOs earn 17% more than specialist CEOs do, indicating the pay premium for general skills[6]. Custódio et al. (2015) further show that generalist CEOs actually spur more innovation because they are tolerant to risk. Specifically, although investment in innovation is risky, generalist CEOs can easily find employment elsewhere should the investment fail and they are fired. Therefore, having many outside options increases generalist CEOs' tendency to take risks. However, firms with generalist CEOs at the helm may suffer from severer agency problems. Investors would demand higher

[6] Similar to Custódio et al. (2013), our paper defines general skills to be those that can be applied both within the firm and to other firms. Firm-specific skills are those which are only valuable to one firm but not transferable to other firms. Note that we evaluate the specificity of managerial skills from firms' perspective, without considering whether skills are industry-specific or not. Although a large portion of firm-specific skills are very likely to be industry-specific, there are various types of skills that might not be transferable to other firms even in the same industry, such as management practice and skills in dealing with stakeholders (e.g., customers or investors) that differ across firms. Even for skills that managers commonly possess in one specific industry, how each firm weight and combine these skills differs, according to the "Skill-weights" view which stems from Lazear (2009).

returns when operations are more complicated and when more anti-takeover provisions exist (Mishra 2014). Taken together, CEO expertise has both a bright and a dark side and will have a corresponding effect on firm policies and other dimensions. Exploring the implication of CEO expertise on the design of compensation contract could enrich our understanding of CEO expertise along this line.

2.2 Pay-performance sensitivity

In the presence of information asymmetry, the separation of ownership and control in modern organizations leads to agency problems (Berle and Means 1932; Shleifer and Vishny 1997; Murphy 1999; Laffont and Martimort 2002; Jensen et al. 2004). Agency problems can arise in the form of adverse selection or moral hazard (Laffont and Martimort 2002) or both. To better align the interests of shareholders and managers, internal and external corporate governance mechanisms can be implemented to mitigate agency problems (Shleifer and Vishny 1997). One notable internal governance mechanism is the design of compensation contracts (Murphy 1999; Jensen et al. 2004), especially the structure of the compensation package (Jensen and Murphy 2010).

Pay-performance sensitivity, as one of the features of incentive contracts, has attracted a lot of attention from academics and practitioners since 1990. This feature of incentive contract is typically interpreted as serving one of the following functions, incentive, retention and sorting (Core and Guay 2001; Ittner et al. 1997; Kedia and Mozumdar 2002; Lazear 2003; Oyer and Schaefer 2005). For example, firms grant incentive pay to employees to incentivize their effort

and retain key personnel. The differences in preference for incentive versus fixed pay could help sort different employers and employees.[7]

Given the importance of incentive pay in incentivizing, retaining and sorting employees, exploration of its determinants could shed new insight into the level of pay performance sensitivity. One overlooked factor is the CEO expertise, which have gained more attention recently. Up to date, it indeed remains largely unexplored whether and how CEO expertise influences pay-performance sensitivity. Although the empirical evidence is scant, theoretical models do provide some guidelines regarding how general skills affect pay-performance sensitivity. The analytical model of Dutta (2008) shows that when managerial skills are largely general, pay-performance sensitivity is higher, suggesting a positive relation between pay-performance sensitivity and CEO general skills. The rationale behind this prediction is as follows. In the presence of asymmetric information, generalist CEOs who have greater access to outside options have a tendency to overstate their ability when negotiating their pay. The firm, as the counterparty in the contracting process, rationally anticipates this tendency and thus designs the compensation contract in a way that links CEO pay closely to firm performance. This contracting feature results in higher pay-performance sensitivity for generalist CEOs.[8] In a similar vein, Goldmanis and Ray (2014) model the sorting effect of performance pay and predict that under asymmetric information, pay-

[7] Yet, there is debate regarding whether the pay-performance sensitivity is at its optimal level. For example, the pay-performance sensitivity estimated by Jensen and Murphy (1990) provides the justification for the argument of "pay without performance" (Bebchuk and Fried 2003). However, as demonstrated by Aggarwal and Samwick (1999), it is critical to take into account the volatility of the firm's performance when estimating executives' pay-performance sensitivity. They show that the compensation of executives in firms with less volatile stock returns is much more sensitive to firm performance than that of executives in firms with more volatile stock returns. Ignoring the volatility of firm performance tends to produce an estimate of the sensitivity of pay to performance that is biased toward zero.

[8] In the existence of information asymmetry regarding the ability of candidates for future CEOs, corporate boards are also likely to "filter" CEO candidates by using high-powered compensation package to mitigate adverse selection. If CEOs with generic skills happen to be more abled ones, we would observe higher pay-performance sensitivity for generalist CEOs, which is not due to these CEOs enjoying more outside options and thus higher bargaining power. We try to exclude this alternative hypothesis in the empirical section of this paper.

performance sensitivity increases with the manager's outside options. Since generalist CEOs enjoy more outside options than their specialist counterparts do, their compensations are more closely linked to firm performance. Based on the discussion above, we develop our main hypothesis as follows.

Hypothesis 1 (H1): *Ceteris paribus, pay-performance sensitivity is more pronounced for generalist CEOs than for specialist CEOs in their compensation contracts.*

However, there is a counter-argument for the positive relation between generalist CEOs and pay-performance sensitivity. Consider, for example, the case of specialist CEOs. The main hypothesis implies that specialist CEOs' pay is less sensitive to performance than generalist CEOs' pay. However, specialist CEOs might actually be more risk averse because of a lack of outside options. Such attitude towards risk may be detrimental to firm performance (John et al. 2008). Therefore, the board of directors may also design a contract featuring higher pay-performance sensitivity for specialist CEOs yet for a completely different reason. This potential counter-argument creates tension for the relation between general skills and pay-performance sensitivity, making it an empirical question.

We now turn to a set of cross-sectional variations derived from the main hypothesis. The first cross-sectional variation comes from the board of directors' learning about the CEO's ability over time. The implicit assumption behind the theoretical predictions of Dutta (2008) and Goldmanis and Ray (2014) lies in the hidden information regarding the CEO's true ability, i.e., the asymmetric information between the CEO and its shareholders about the true ability of the CEO. But over time, the CEO's ability would be revealed through either in-process interaction or ex post realized performance (Murphy 1986; Harris and Hölmstrom 1982; Pan et al. 2015), thereby reducing the

board of directors' concern over adverse selection. So the compensation contract does not actually need to be designed in a way that counteracts generalist CEOs' tendency to overstate their ability. This leads to our second hypothesis.

Hypothesis 2 (H2): *The positive relation between general skills and pay-performance sensitivity is more pronounced for CEOs who have worked for their current employee for shorter time or CEOs who became CEO later than their peers.*

Another cross-sectional variation is related to the importance of the CEO in improving firm performance. Intuitively, if CEOs matter more for firm value creation, the board of directors would be more likely to offer a contract featuring higher pay-performance sensitivity to generalist CEOs. Theoretical analysis makes the same prediction. According to Dutta (2008), when considering moral hazard, managers also have the incentive to underrate her expertise in order to lower owners' performance expectations and thus to extract higher fixed salary. The incentive to under-report dominates the incentive to exaggerate when managerial expertise is firm-specific, since these managers' outside options do not increase with their expertise. Nevertheless, managers tend to exaggerate when their expertise is more general. The importance of CEO expertise to firm performance is positively related to information rents managers can extract in both scenarios. CEOs whose expertise is more important to firm performance tend to under-report in the firm-specific skill scenario, and tend to over-report in the general skill scenario. Firm owners choose pay-performance sensitivity to induce truth-telling. Accordingly, specialist managers whose expertise is more important will receive even less performance pay compared to an average manager whose skills are generic. Generalist managers whose expertise matters more for firm performance would receive even more performance pay. Therefore, we would observe a stronger

association between CEO importance and pay-performance sensitivity when CEOs are generalists. Alternatively, the positive association between general skills and pay performance sensitivity increases with CEO importance. We therefore make the following prediction.

Hypothesis 3 (H3): *The positive association between CEO general skills and pay-performance sensitivity is more pronounced when CEOs matter more for firm performance.*

3. Research Design

3.1 Sample selection

We retrieve CEO compensation from ExecuComp and obtain the CEO general ability index (GA-index) from Custódio et al. (2013).[9] We limit our sample period to 1993-2007, because the CEO GA-index is only available for those years. Our initial sample consists of 24,847 CEO-year observations in the ExecuComp database from years 1993 to 2007 with valid information on total compensation. We then restrict the sample to CEOs whose GA-index is available, which leads to 21,653 observations. The index, constructed from managers' past working experiences, captures how widely managers' expertise can be applied. The financials and stock return data come from Compustat and the Center for Research in Security Prices (CRSP), respectively. Our final sample consists of 18,485 CEO-year observations, covering 3,868 unique CEOs and 2,256 unique firms from 1993-2007.

3.2 Measures of CEO expertise

[9] We thank Miguel A. Ferreira and his coauthors for making the general ability index available at the following link: http://docentes.fe.unl.pt/~mferreira/data/gai.dta. The dataset covers the period from 1993 to 2007.

Custódio et al. (2013) create an index (general ability index or *GA-index*) based on the past working experience of CEOs in publicly traded firms to measure the generality of CEOs' expertise. They capture the CEO skills that are transferable across firms using five indicators: (1) the number of positions a CEO has held during his career, (2) the number of firms a CEO has worked for, (3) the number of industries (measured at the 4-digit SIC level) that a CEO worked in, (4) the CEO experience indicator, equals to 1 if a CEO was also hired as CEO by another firm in the past, and (5) conglomerate indicator, equals to 1 if a CEO has worked in a conglomerate. CEOs who have higher scores on these dimensions are considered to have more general human capital. To mitigate concerns regarding multi-collinearity and measurement errors, Custódio et al. (2013) combine the multiple variables into one composite index by conducting a principal component analysis and extracting the first common component of these five variates. Among them, the numbers of positions, firms, and industries receive a higher loading than CEO and conglomerate experiences. For easier interpretation of results, the general ability index is standardized to have a mean of zero and a standard deviation of one.

Apart from using the original general ability index to measure the generality of CEO skills, we also construct a dummy variable to categorize sample CEOs each year into *generalists* and *specialists*. Specifically, we categorize a CEO as a generalist if her general ability index is above the 80th percentile of the annual distribution and as a specialist otherwise.[10]

3.3 Measures of pay-performance sensitivity

[10] Defining specialist CEOs using a dummy variable is nontrivial. We choose the 80th percentile to be on the conservative side. As long as the GA-index is a monotonic measure of CEO general skills, such choice would bias against our findings. We use the indicator variable for our main analysis for brevity. Results are similar if we also focus on the categorical version of the general skill measure.

In this study, we rely on two versions of delta to measure pay-performance sensitivity. The first one is unscaled *delta* which is derived from options and stock compensation and gauges the change in CEO pay (in thousands of dollars) for a one-percentage-point change in stock price. The parameter has been adopted extensively as a pay-performance sensitivity measure in prior studies such as Core and Guay (2002), and Coles et al. (2006). Following Coles et al. (2013), we take into account the shares and options that form a part of the CEO's portfolio when calculating *delta*. Our second measure is the scaled pay-performance sensitivity (*scaled delta*) created by Edmans et al. (2009). This "percent-percent" measure gauges the percentage change of CEO wealth for each one-percentage-point change in firm value.[11] Importantly, it is shown to be independent of firm size. To alleviate the concern that firm size may drive the result, we choose *scaled delta* as our major proxy for pay-performance sensitivity. To demonstrate the robustness of our results, we also conduct empirical analysis based on unscaled delta in the main analysis.

3.4 The empirical model

We run the following empirical model to test our hypothesis:

$$PPS_{i,t} = \alpha + \beta \times GA\text{-}index_i + \gamma \times Controls_i + y_t + e_i + \varepsilon_{i,t}, \quad (1)$$

where $PPS_{i,t}$ is the pay-performance sensitivity for CEO i in year t. Since both scaled delta and unscaled delta are highly skewed to the left, we use their natural logarithms as dependent variables. *GA-index* captures how generic the CEO's skills are, following Custódio et al. (2013). The larger the value of this variable, the more likely the CEO is a generalist. As indicated above, we use two versions of this measure, i.e., continuous and categorical. For the categorical measure, we define

[11] Since it is not possible to measure precisely the CEO's total wealth, Edmans et al. (2009) replace it with the current annual pay of the CEO, i.e., scaled delta is calculated as $\frac{\Delta Wealth}{\Delta \ln(Firm\ Value)} \frac{1}{Pay}$.

CEOs whose general ability index is above the 80th percentile of the annual distribution as generalists and the rest are specialists.

Controls are a vector of control variables that aim to control for omitted correlated factors. Following Jayaraman and Milbourn (2012), we first control for the market-to-book ratio (*Market to book*), since growth opportunities can affect how firms design the compensation contract (Gopalan et al. 2014). The firm's capital structure can also affect executive incentives, given the role that debt plays in incentive alignment (Douglas 2006). We therefore control for the firm book leverage ratio (*Leverage*) in the regression. We also consider the effect of firm accounting and stock price performance as both are correlated with executive incentives (Hochberg and Lindsey 2010). Specifically, we control for both accounting performance, measured by return on assets (*ROA*) and operating cash flows (*CFO*), and stock performance (*Stock Return*). Risk can also affect executive incentives and pay-performance sensitivity (Aggarwal and Samwick 1999; Prendergast 2002). We therefore also control for risk using volatility of return on assets (*Sd. ROA*), stock return volatility (*Sd. Return*), volatility of operating cash flow (*Sd. CFO*).[12] The appendix defines the variables in more detail. Besides, pay-performance sensitivity may vary systematically over time and unobserved executive-level characteristics may affect both the accumulation of general skills and the compensation contract. Thus we also control for year (y) and executive (e) fixed effects.[13] Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level.

[12] Results are similar if we include the following additional control variables in all the regressions with pay-performance sensitivity as dependent variables, including total compensation, tenure and CEO age.

[13] Results are similar if we run simple OLS regression (by also including year and industry fixed effect) for our analysis. We control CEO fixed effect to rule out the effect of CEO time-invariant factors that may drive our findings.

4. Empirical Analysis

4.1 Summary statistics

Table 1 presents the summary statistics for key variables used in the paper. The CEOs in our sample are paid on average 4,799 thousand dollars (*Total compensation*) annually.[14] Regarding pay-performance sensitivity, the mean of *delta* is 1,968.94 which correspond to a change of $1,968,943 in CEO pay given a 1% change in stock price. The median, much smaller than the mean, is 213,776. The distribution of *scaled delta* is also highly skewed to the right, with the mean and median equal to 339.035 and 6.888, respectively. The median can be interpreted as follows. CEO at the median can expect her wealth to increase by approximately 7% given a one-percentage-point increase in firm value. These figures are similar to those reported in previous studies (e.g., Jayaraman and Milbourn 2012). The mean of CEO skill generality (i.e., the GA-index) is 0.033, which is close to zero by construction.[15] The standard deviation is close to one (0.987) for the same reason. The natural logarithm of firm size is on average 7.284 (*Log*(*Sales*)) and the market-to-book ratio is on average 1.988. Firms on average finance more than 20% of their assets with debt (*Leverage* = 0.23), while the average return on assets is 13.5%, indicating that firms in the sample are on average making reasonable profits. For annual stock return, the mean is 16.4%. The cash flow from operating activities on average has a volatility of 10%.

Table 2 reports the Pearson correlations among variables in the regression. The correlation between the two pay-performance sensitivity measures (*delta* and *scaled delta*) is 0.994, indicating that they are capturing a similar underlying construct. Size is positively correlated with the two

[14] We use *tdc1* as provided in ExecuComp to measure total pay to executives. This measure differs from *tdc2*, mainly in the equity component of compensation. Specifically, *tdc1* captures how much has been granted, rather than realized. The distribution of CEO pay is highly positively skewed.

[15] The measure by Custódio et al. (2013) is standardized to have a mean of zero and a standard deviation of one. The deviation from mean of zero and standard deviation of one is due to the requirement of non-missing dependent as well as control variables.

pay-performance sensitivity measures, although the magnitude is much smaller for scaled pay-performance sensitivity (correlation coefficient = 0.025).

Table 3 reports the result of a univariate comparison between firms with specialist CEOs versus firms with generalist CEOs at the helm. Firm characteristics differ significantly between firms managed by generalists and those managed by specialists. For instance, firms run by generalists tend to be larger, more leveraged, have less volatile cash flow and stock return. This indicates the importance of including various firm characteristics in the regression analysis.

Generalist CEOs also receive different compensation packages from their specialist counterparts. Consistent with Custódio et al. (2013), generalists are paid more both in cash and other non-cash components. More important to this study, we find that generalist CEOs receive more of their compensation in incentive pay. The fraction of restricted stocks in total compensation for specialist is 8.2%, compared with 10.9% for generalists. Since the percentage of cash compensation is lower for generalists, the sensitivity of their pay to firm performance is significantly higher. A comparison of (unscaled) delta between these two types of CEOs reveals that generalists on average obtain approximately $1,199,600 more for each one-percentage-point increase in their firms' stock price.

4.2 Main findings

Table 4 presents the estimation result of our main model in equation (1). Panel A of Table 4 reports the results when scaled delta (in natural logarithm) is used as a proxy for pay-performance sensitivity. We do not explicitly control for the effect of firm size as the scaled delta has been shown to be independent of firm size by Edmans et al. (2009). Regarding the general ability index, Columns (1) and (2) use the continuous measure (*GA-index*), while Columns (3) and (4) use the

indicator measure (*Generalist*). For the empirical specification, Columns (1) and (3) only control for the CEO fixed effect, while Columns (2) and (4) control for industry, year, and CEO fixed effects.[16] The significantly positive coefficient on the GA-index in column (1) (coeff = 0.139; *t*-stat = 4.37) suggests that generalist CEOs expect a larger increase in their wealth (relative to their current wealth) for every one-percentage-point increase in firm value. The result confirms our prediction in Hypothesis 1 that generalist CEOs' pay is more sensitive to performance.

In terms of control variables, we find that firms with more growth opportunities, higher stock returns and lower stock return volatility offer significantly higher pay for performance. Column (2) of Table 4 shows that in addition to controlling for the CEO fixed effect, if we also control for the year and industry fixed effects, the regression coefficient on the GA-index (coeff = 0.237; *t*-stat = 7.09) becomes much larger. The result suggests the importance of taking into account the effects of year and industry on the association between CEO generality and pay-performance sensitivity. Therefore, in the remaining tests we will control for the CEO, year, and industry fixed effect unless otherwise stated.

Panel B of Table 4 reports the result for our main prediction using an alternative measure of pay for performance—unscaled delta. To minimize the concern that firm size drives the variation in unscaled delta, we additionally control for firm size (the natural logarithm of net sales). The specification in this panel is the same as that in Panel A. For conciseness, we focus on Column (1) to illustrate the result. Column (1) reports a positive and significant coefficient of the GA-index (coeff = 0.349; *t*-stat = 7.03). This further confirms that the positive association between generalist CEOs and pay-performance sensitivity is robust to various measures of pay for performance. The effect of control variables exhibit similar pattern as that in Panel A. Overall, the evidence in both

[16] Hausman test statistic (Chi-squared = 244) indicates that the fixed-effect model provides the consistent estimate of coefficients in Model 1. Therefore, in this paper we will not present results from random-effect models.

Panels of Table 4 collectively support our main hypothesis (Hypothesis 1) that firms design compensation contracts with generalist CEOs in such a way that closely link executive pay to firm performance.

4.3 Cross-sectional analysis[17]

4.3.1 Learning about the CEO's skills

We now investigate whether the relation between CEO skills generality and pay-performance sensitivity is heterogeneous across different types of CEOs. If CEOs are indeed given high-powered incentive pay to mitigate information asymmetry in their true ability, we should observe a more significant effect in settings where information asymmetry between the firm and the CEO is greater (i.e., Hypothesis 2).

We examine whether the effect is stronger for CEOs who have had a shorter tenure and CEOs who started their executive career later than the average. The two measures capture two different dimensions of information asymmetry regarding CEO ability: one is specific to the current employment contract (i.e., current employer-employee relationship), and the other one is related to the labor market knowledge of the CEO. Arguably, shareholders are exposed to higher asymmetric information regarding the true ability of CEOs who are early in office or have a shorter executive career. Table 5 presents the results from regressions in which GA-Index is interacted with measures of CEO tenure and the length of current CEO's executive career.[18] In column (1),

[17] Besides the learning of CEO ability and the importance of CEO, we also examine whether corporate governance could affect the observed relationship between GA-index and pay-performance sensitivity. The optimal contracting perspective we take in the paper would predict a more pronounced association between general skills and incentive pay in better-governed firms. We indeed find consistent evidence with this conjecture when we use percentage of independent directors, E-index, and G-index as proxies of corporate governance.

[18] We use the year when the current CEO first appears in ExecuComp as a Chief Executive Officer as the starting year of her executive career. Since ExecuComp starts to collect compensation information only after 1992, if a CEO is found to start her career at year 1992, we exclude this CEO from our sample. Results are similar if we choose the year when the current CEO first appears in ExecuComp, either as a CEO or any other executives.

we modify model (1) by including one dummy variable indicating CEOs with longer tenure in their current position than the median of annual distribution, and its interaction with GA-index. Consistent with our prediction, the significantly negative coefficient on the interaction term (*GA-index* × *dummy(CEOs with a longer tenure)*, coeff = -0.056; *t*-stat = -2.01) indicates that the effect of generalist skills on pay performance sensitivity is more pronounced when CEOs work for the current employer for a shorter time. The evidence here is consistent with the finding in Pan et al. (2015) that the learning of CEO's ability is more prominent when there is higher uncertainty about his/her true ability.[19]

Columns (2) report the result of cross-sectional analysis according to the number of years that elapsed since the CEO became the Chief Executive Officer for the first time in her career. Presumably CEOs who started their career earlier are better known in the executive labor market. Adverse selection is therefore less of a concern for these CEOs, making it less necessary to use performance pay to reduce information rents of generalist CEOs. This is exactly what we find, i.e., the significantly negative coefficient on the interaction term (*GA-index* × *dummy(*CEOs with a longer career*)*, coeff = -0.054; *t*-stat = -1.79).

Taken together, the evidence in Table 5 is consistent with Hypothesis 2.[20] More specifically, because the board of directors lacks knowledge about generalists' true skills, it would design compensation contracts in a way that links CEO pay closely to firm performance to prevent generalists from overstating their abilities.

[19] We also try the partition based on CEO's own tenure in the firm. The conclusions are similar, i.e., when CEOs are in the early years (based on their total time of stay within the firm), the results are more pronounced. This lends further support to our conjectured information asymmetry mechanism.

[20] The results are qualitatively similar if we use unscaled delta to measure pay-performance sensitivity and are available upon request.

4.3.2 Importance of CEO ability for firm performance

To shed more light on possible channels through which CEO expertise determines the composition of the compensation package, we examine whether the relation between generalist CEOs and pay-performance sensitivity varies with the importance of CEOs for firm performance (i.e., Hypothesis 3). Recall that we predict that if CEO ability is more important for firm value creation, optimal contracting would call for higher pay-performance sensitivity to encourage CEOs to make more effort to improve firm performance. This would reinforce the positive relation between generalist CEOs and pay-performance sensitivity. The different reporting incentive by generalist versus specialist CEOs, as indicated in Dutta (2008), also lead to the same prediction. We therefore test the conjecture based on archival data. Specifically, we measure the importance of CEO for firm performance along the following two dimensions: industry competition and firm past sales growth. Li et al. (2014) find that CEO power has a positive effect on firm value in competitive and rapidly changing product market. The idea is that CEO's ability to lead the management team and to implement efficiency-enhancing and value-increasing measures is critical for firms to compete in the product market. To measure product market competition, we use Herfindahl-Hirschman Index (HHI) based on three-digit SIC industries.[21]

Table 6 reports the results of empirically examining such a contention. The results are consistent with the predictions of Hypothesis 3. We use the interaction between GA-index and the two CEO importance measures to examine how the effect of the generality of CEO skills on pay-performance sensitivity varies with CEO importance. Column (1) of Table 6 uses the Herfindahl and Hirschman index (HHI) as an inverse measure of industry competition. Column (1) reports the regression coefficient of -0.275 (*t*-stat = -1.98) on the interaction term, suggesting that the

[21] Results are similar if we calculate HHI based on two-digit SIC. The use of three-digit SIC in measuring industry competition follows Giroud and Mueller (2010).

positive relation between generalist CEOs and pay-performance sensitivity is stronger for firms in more competitive industries than firms in more concentrated industries. Column (2) of Table 6 also documents that the positive relation is significantly more pronounced for firms with higher sales growth (coeff = 0.054; *t*-stat = 2.39).

5. Additional Tests

5.1 The effect of CEO skills on incentive pay

In this section we consider an alternative measure of incentive pay, i.e., the compensation mix, and predict that the proportion of incentive pay increases with the generality of CEO skills. We first examine the proportion of cash pay in total compensation which should be negatively correlated with pay-performance sensitivity. Then we look into the proportion of restricted stocks. We measure the restricted stock value following Coles et al. (2013). Since public firms in the U.S. have been reporting compensation in a new format starting from fiscal year 2007, we use a different method to calculate restricted stock pay after fiscal year 2006. Specifically, the fair value of stock awarded (*stock_awards_fv*) is used after fiscal year 2006.

The results are reported in Table 7. Columns (1)–(2) control for year and industry fixed effects, while Columns (3)–(4) control for year, industry and CEO fixed effects. We find a very consistent pattern that generalist CEOs have a lower proportion of cash-based compensation and a higher proportion of stock-based compensation. This evidence supports the prediction that generalist CEOs enjoy higher incentive-based pay than specialist CEOs, which is consistent with the contention that the board of directors would design the optimal contract to reduce rent-seeking by generalist CEOs.

5.2 Propensity score matching

One empirical concern of this study is the endogenous matching between firms and CEOs. Controlling for CEO fixed effects takes into account the time-invariant variations in pay-performance sensitivity across CEOs. However, it cannot address the matching based on time-varying CEO and firm characteristics. We use propensity score matching to tackle the endogenous matching between firms and CEOs, following Custódio et al. (2013). Specifically, we use net sales, the conglomerate dummy, leverage ratio, R&D/asset ratio, return on assets, market-to-book ratio, cash-to-asset ratio, and capital expenditures to predict the likelihood of firms' hiring a generalist CEO. We estimate a probit model in which the dependent variable is a dummy indicating whether the newly hired CEO is a generalist. Each newly hired generalist CEO is then matched to one specialist CEO hired in the same year, using nearest-neighbor matching.[22]

In total 336 newly hired generalist CEOs are matched to the same number of specialist CEOs. Panel A of Table 8 compares firm characteristics between the generalist and specialist CEO group. None of these firm characteristics exhibits statistically significant difference, indicating that we have identified a reasonably comparable control group.

Using the matched sample, we estimate the treatment effect of hiring a generalist CEO on the pay-performance sensitivity of the compensation contract. We control the same set of variables used in Table 4 and include CEO, industry and year fixed effects as well. The *scaled delta* (in its natural logarithm) calculated by Edmans et al. (2009) as well as *unscaled delta* (in its natural logarithm) is used as proxies for the sensitivity of CEO pay to firm performance. The results are reported in Panel B of Table 8.

[22] The results are qualitatively similar if we perform a one-to-two matching and are available upon request.

Results in column (1) and (2) indicate that the incentive strength of compensation contracts offered by firms which hire generalist CEOs is approximately 10-12% stronger than that offered by otherwise similar firms within the same industry which hire specialists in the same year. The result is similar in magnitude to the estimate obtained from the original sample reported in Table 4. Moreover, the conditional difference in pay-performance sensitivity measured by unscaled delta between generalists and specialists is also significant and consistent with our baseline results, as shown in column (5) and (6). Besides, the coefficient of the general ability index is always positive and significant in the matched sample, according to columns (3)-(4) and (7)-(8). Overall, the findings from the matched sample indicate that firms offer generalist CEOs compensation contracts with higher pay-performance sensitivity than that would otherwise be offered to specialists.

5.3 Instrumental variable estimation

To further address the endogenous concern over the relationship between CEO general skills with pay-performance sensitivity, we use the non-compete agreement enforcement index from Garmaise (2011) as an instrument for the general ability index.[23] The non-compete agreement aims to prevent CEOs (or employees in general) from working for their current employers' competitors after they leave their job, which would encourage CEOs to accumulate more general skills in states with a higher enforcement index of the non-compete clause. In other words, the non-compete enforcement indexes in states where the current CEO has worked should be positively associated with the current level of the generality of CEO skills, but it would not directly affect the level of

[23] Note that the sample period shrinks to the period between 1993 and 2004 since the non-compete agreement enforcement index offered by Garmaise (2011) stops at year 2004.

current pay-performance sensitivity. We therefore contend that the state-level enforceability of the non-compete clause can serve as a valid instrument for CEO general skills.

Specifically, we average the state-level non-compete enforcement index in the states where the CEO used to hold an executive position during his/her past career. This is to mitigate the concern that CEOs may selectively work in states with a lower enforcement index. It also circumvents the endogeneity issue involved in the relation between the enforcement of non-competition clause in the state where managers are currently working in and the compensation contract she is currently granted with.[24] We run a two-stage least squares (2SLS) regression, with the historical state-level average of enforcement index as the instrument for the GA-index in the first stage. The results are reported in Table 9.

Column (1) of Table 9 shows that after controlling for firm-level characteristics, as well as CEO, year, and industry fixed effects, the state-level non-compete clause enforcement index is significantly and positively associated with CEO skill generality (coeff = 0.046; *t*-stat = 1.98). Thus the state-level non-compete enforcement index can indeed serve as a valid instrument for CEO general skills.[25] Column (2) of Table 9 reports the result from the second-stage regression. We find that the instrumented General Ability Index is positively associated with the level of pay-performance sensitivity and is highly significant (coeff = 1.387; *t*-stat = 9.29). Overall, the results

[24] It is possible that firms design compensation contracts in such a way that the low redeployment of managers' human capital within the state is compensated. For instance, since stringent enforcement of non-competition clause leads to fewer outside options for managers and thus makes managers' human capital largely firm-specific, the board may give managers relatively less stocks and more cash to lower managers' exposure to firm idiosyncratic risks.

[25] According to the "rule of thumb" suggested by Stock et al. (2002) regarding the reliability of the inference based on the two-stage least squares estimator, the F-statistics of the first-stage regression should exceed 10. The F-statistic reported at the bottom of Table 9 indicates that the noncompetition enforcement index serves as a strong instrumental variable.

in Table 9 lend further support to our main prediction that more general skills lead to higher pay-performance sensitivity.[26]

5.4 Placebo test

We base our main prediction on the theoretical argument by Dutta (2008), which implies the optimal contracting view of the compensation structure. Given that firms will not deviate from the equilibrium outcome, it is unlikely to observe similar patterns should we randomly switch CEOs from one firm to another. To lend further support to the conjecture and ensure our non-randomized findings, we conduct the following placebo test. We first get the firm-CEO spell from our testing sample and then reassign CEOs to different firms in each year. We then run the regression following equation (1).[27] This exercise is repeated for 5,000 times and the coefficient estimates of GAI as well as the corresponding standard errors are retrieved. We report in Figure 1 the distribution of t-statistics for the coefficient of GAI that we obtain from the randomization exercise. The mean of the t-statistics is 0.280 and the standard deviation is 0.855. Only in 5.7% cases can we find statistically significant coefficient of GAI if we set the threshold of t-statistics as 1.645. This number drops to 2.4% if we require t-statistics is no less than 1.960. Moreover, none of the t-statistics from the placebo test exceeds that in our main analysis using the actual sample. In terms of economic magnitude, the mean of the GAI coefficient is 0.011, indicating that the coefficient estimated from the randomized sample is much smaller than that in our main result

[26] In untabulated analysis, we propose two additional instruments for CEO general ability index, namely the average GAI of CEOs whose firms are located in the same state and an industry-level mean of GAI. While there might be some firm-level preferences that determine both the pay-performance sensitivity and the type of CEOs hired, it is hard to argue that these preferences have an impact on the average skill set of CEOs hired either in the same state or in the same industry. Employing either the state- or industry-level mean of GAI along with our original IV as instruments generates a qualitatively similar second-stage estimate.

[27] We use natural logarithm of the scaled delta proposed by Edmans et al. (2009) as the dependent variable. Using unscaled delta yields similar results.

using real data.[28] Taken together, we conclude that the observed relationship between CEO general skills and pay-performance sensitivity is non-random. Instead, it is the equilibrium outcome of optimal contracting (Fama 1980; Garen 1994; Haubrich 1994; Edmans and Gabaix 2009).

6. Alternative Explanations

6.1 Risk-taking

A possible explanation for our results could be that the board of directors is prone to risk-taking. If the generality of skills is correlated with CEO's risk attitude and consistent with firm inherent risk-seeking tendency, then optimal contracting would require higher pay-performance sensitivity for CEOs with more general skills. Admittedly, we cannot completely rule out this possibility by controlling for CEO fixed effects or through matching estimation. In this section, we rely on a cross-sectional test to check whether the effect of CEO generality on pay-performance sensitivity is stronger for risk-seeking firms.

We measure the riskiness of firm policies in two ways, following Cassell et al. (2012). First, we adopt two volatility-based measures that increase with the riskiness of firm operational and financial policies: the volatility of cash flows (CF volatility) and the volatility of stock returns. To filter out market-wide fluctuations which have nothing to do with firm-specific policies, we estimate a market model and obtain the idiosyncratic volatility of stock returns (Idiosyncratic volatility).

The second type of measure captures the inherent riskiness of firm investment and financial policies. R&D spending and the extent of diversification are two plausible proxies for the riskiness

[28] For comparison, the GAI coefficient estimated from the actual sample is 0.237. For completeness, we also provide detailed statistics of GAI coefficients estimated from the randomization exercise. The median and standard deviation are 0.011 and 0.034, while the top and bottom quartile are 0.034 and -0.012, respectively.

of firm investment policies. Firms that make R&D investment more aggressively or are less diversified are naturally riskier. R&D spending is defined as R&D expenditures scaled by total sales. The extent of diversification is an entropy-form measure and is calculated using segment sales information. Its calculation is described in the Appendix. We use the leverage ratio and the proportion of working capital (Working capital/Total assets) to capture the riskiness of financial policies. A higher proportion of working capital implies a smaller liquidation loss in the value of assets during bankruptcy.

We apply the main specification to sub-samples formed based on the level of firm riskiness. The results are shown in Table 10. For conciseness, we only report results based on scaled delta. In general, there is no evidence suggesting that our results in Table 4 are driven by firms that are more prone to risk-taking. The positive effect of the GA-index on pay-performance sensitivity is significantly larger in fact for a few firms whose policies are less risky. For example, for firms with less volatile cash flow (which indicates lower risk-taking), the relation between the GA-index and pay-performance sensitivity is actually significantly more positive than for those firms whose cash flow is more volatile. The evidence therefore suggests that risk-taking is unlikely to be the channel through which general skills affect pay-performance sensitivity.

6.2 Stock price efficiency

Another alternative explanation concerns the information efficiency of stock prices according to which almost all CEOs are compensated. If the stock price of firms that hire specialists is systematically less efficient at incorporating new information, then optimal contracting implies that the compensation of CEOs in these firms should be less linked to the stock price (Hölmstrom

1979). We directly test this hypothesis by examining the difference in the information efficiency of stock prices between firms hiring generalist CEOs and those hiring specialist CEOs.

We use six conventional measures to capture the information efficiency of stock prices. Firms with a high level of discretionary accruals, opacity, PIN, Amihud illiquidity, analyst forecast dispersion, and firms covered by fewer analysts are more likely to be less efficient at incorporating new information. *Discretionary accrual* is calculated using the modified Jones model (1991). *Opacity* is measured as the sum of the absolute value of discretionary accrual from year *t*-2 to year *t*. *Amihud illiquidity* measures the price impact of a certain level of trading volume and is calculated using daily return and trading volume data following Amihud (2002).[29] *Log*(*#Analyst*) is the natural logarithm of the total number of analysts following the firm, which is extracted from the Institutional Brokers' Estimate System (I/B/E/S). *Analyst forecast dispersion* is defined as the standard deviation of analyst earnings forecasts scaled by the absolute value of the consensus earnings forecast, following Diether et al. (2002) and Cen et al. (2015). *PIN* is the probability of information-based trades and measures the asymmetric information between insiders and investors. The calculation of PIN follows Venter and de Jongh's (2004) extension of the Easley, Kiefer, O'Hara, and Paperman (EKOP 1996) model.

We check how the information efficiency of stock prices vary across CEO skill generality, controlling for firm characteristics as well as firm and year fixed effects.[30] The result from the fixed effect regression is presented in Table 11. We do not find any difference in price information

[29] We examine the differences in liquidity between the two types of firms since Chordia et al. (2008) document the positive association between liquidity and market efficiency.
[30] We control for firm age, the market-to-book ratio, leverage, return on assets, cash flow volatility, R&D spending, the number of business segments and the industry sales concentration measured by HHI.

efficiency between firms hiring generalist CEOs and those hiring specialist CEOs, suggesting that price efficiency is unlikely to be the explanation.[31]

7. Conclusion

Building on theoretical predictions, we test how CEO skill generality and pay-performance sensitivity are linked. Theory predicts that since generalist CEOs have more outside options than specialist CEOs, they would tend to overstate their true ability when negotiating for higher pay. The optimal compensation contract will link a generalist CEO's pay closely to firm performance because of asymmetric information between the CEO and shareholders about the former's true ability. Our empirical results support the prediction that generalist CEOs' pay is more sensitive to performance than specialist CEOs' pay. Our results are robust to alternative measures of pay-performance sensitivity, selection bias (by using propensity score matching), and the endogeneity issue about the formation of generic human capital (by using instrumental variable estimation).

In addition, theory also predicts a stronger positive relation between CEO generality and pay-performance sensitivity when information about the CEO's true ability is more asymmetric or the CEO is more important for firm performance. Our results are also consistent with these predictions. More specifically, the positive effect of CEO skill generality on pay-performance sensitivity is stronger when less is known about the CEO's true ability as is the case with CEOs who have had a shorter tenure and those who started their career as CEO later than the average. The positive association between CEO skill generality and pay-performance sensitivity is also more pronounced when CEOs are more important for firm value creation as is the case for firms in more competitive industries or firms with higher sales growth.

[31] In the untabulated result, we also find no evidence suggesting that the effect of the GA-index on pay-performance sensitivity is stronger for firms whose stock price is more informationally efficient.

We also rule out the concern that the positive relation might arise from differences in CEO risk-taking attitudes or in stock price efficiency. We find that the positive relation between CEO skill generality and pay-performance sensitivity is not associated with risk-taking behavior or the efficiency of stock prices.

This study contributes to the literature in several ways. First, it fills a gap in the previous literature by examining *how* generalist CEOs are paid, i.e., the pay structure. Second, it highlights the implications of CEO skills for the design of compensation contracts. Most compensation contract theories focus on CEO effort and asymmetric information between shareholders and the CEO about the latter's effort and the realization of outcome. Future contract theoretical models should also incorporate our empirical finding that CEO skills and incentive compensations should be aligned. Finally, the evidence also sheds light on how the labor market interacts with the design of managerial compensation contracts.

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Appendix

Variable	Definition	Source
CEO pay		
Cash pay	Sum of salary and bonus (in thousands of dollars).	ExecuComp
Non-cash pay	Total compensation excluding cash pay.	ExecuComp
Equity pay	Restricted stock amount is equal to restricted stock grant (*rstkgrnt*) before fiscal year 2006 and to grant date fair value of stock awarded (*stock_awards_fv*) after fiscal year 2006 following Coles et al. (2013).	ExecuComp
Option pay	CEO option value is option value provided by ExecuComp calculated using Black-Scholes (*option_awards_blk_value*) before fiscal year 2006 and grant date fair value of options (*option_awards_fv*) after fiscal year 2006 following Coles et al. (2013).	ExecuComp
Delta	The dollar change of executives' pay for a 1% change in stock price (measured in thousands), defined by Core and Guay (2002).	ExecuComp
Scaled delta	Scaled pay-performance sensitivity, calculated as $\frac{\Delta Wealth}{\Delta \ln(Firm\ Value)} \frac{1}{Pay}$ by Edmans et al. (2009). This "percent-percent" measure gauges the percentage change of CEO wealth for each one-percentage change in firm value.	ExecuComp
CEO characteristics		
GA-index	General ability index extracted from Custódio et al. (2013). It is the first factor from principal component analysis of five proxies of general management ability: (1) number of past positions (X1), (2) number of past firms (X2), (3) number of industries (X2), (4) dummy for CEO experience (X4), (5) dummy for conglomerate experience (X5). The general ability index (GA-index) is calculated by applying the scores of each component to the standardized general ability component. Specifically, GA-index = 0.268×X1 + 0.312×X2 + 0.309×X3 + 0.218×X4 + 0.153×X5	Custódio et al. (2013)
Generalist	Dummy taking the value of one if the CEO has a GA-index that is within the top quintile and zero otherwise.	Custódio et al. (2013)
CEO tenure	Number of years as CEO of the current firm.	ExecuComp
Career length	Number of years that elapsed since the current CEO first appears in ExecuComp as CEO in S&P 1500 firms.	ExecuComp
Non-compete enforcement index	The average of the state-level non-compete enforcement indexes in the states where the CEO used to hold an executive position during his/her career. The non-compete enforcement index is extracted from Garmaise (2011).	Garmaise (2011)
Firm characteristics		
Log(Sales)	Natural logarithm of net sales (in millions) i.e., log(*sale*)	Compustat

Market to book	Market value of assets divided by book value of assets, calculated as (*at*-(*at*-*lt*+*txditc)*+(*prcc_f*×*csho*))/*at*.	Compustat
Stock return	Annual stock return, calculated as monthly compound return starting from the fourth month after fiscal year end of *t*-1 to the third month after fiscal year end of *t*.	CRSP
Leverage	Leverage ratio, defined as total liabilities divided by total assets, i.e., (*dlc* + *dltt*)/*at.*	Compustat
Working capital	Defined as current assets minus current liabilities, scaled by the book value of total assets, i.e., (*act*-*lct*)/*at*	
ROA	Return on assets, defined as EBITDA divided by total assets, i.e., *oibdp/at.*	Compustat
CFO	Operating cash flows scaled by total assets, i.e., *oancf/at*	Compustat
Sd. ROA	The standard deviation of return on assets in the past five years	Compustat
Sd. CFO	The standard deviation of operating cash flows (scaled by total assets) in the past five years	Compustat
Sd. Return	The standard deviation of daily stock returns in the previous 36 months.	CRSP
Idiosyncratic volatility	Defined as the variance of daily residual returns in fiscal year *t*, where the parameter is estimated using return data in the previous 36 months.	CRSP
Sales growth	Average annual sales (*sale*) growth in the past two years.	Compustat
R&D	R&D expenses (*xrd*) scaled by book assets (*at*).	Compustat
Diversification	Diversification (entropy) is calculated as $Entropy = \sum P_s Ln(1/P_s)$, where P_s is the proportion of the firm's total sales in industry segment s. Segment sales information is extracted from the Compustat Segment file.	Compustat
HHI	Herfindahl and Hirschman index of industry net sale which is defined as the sum of the squared market shares of firms in each Fama-French 48 industry.	Compustat
Log(#Analyst)	Natural logarithm of one plus the total number of analysts following the firm at year *t*, which is extracted from the I/B/E/S.	I/B/E/S
Forecast dispersion	Analyst forecast dispersion, defined as the standard deviation of analyst earnings forecasts scaled by the absolute value of the consensus earnings forecast.	I/B/E/S
Accrual	Defined as income before extraordinary items (*ib*) minus net operating cash flow from operating activities (*oancf*), scaled by lagged total asset (*at*).	Compustat
Opacity	Measured as sum of the absolute value of discretionary accrual from *t-2* to *t*, where discretionary accrual is estimated using the modified Jones (1991) model.	Compustat
PIN	Probability of informed trade based on Venter and de Jongh's (2004) extension of the EKOP (1996) model, and measured over	CRSP

	the annual period beginning eight months before the firm's fiscal year end and expressed as a percentage.[32]	
Amihud	Amihud illiquidity measure is calculated as $Amihud_{ij} = \frac{1}{N_{ij}} \sum \left(\frac{\lvert r_{ijt} \rvert}{Vol_{ijt}} \right)$, where r_{ijt} is the stock return of day *t* in year *j* for stock *i*, and Vol_{ijt} is the corresponding trading dollar volume, N_{ij} is the number of trading days in year *j* for stock *i*. Trading volume is expressed in million dollars and stock return in basis points.	CRSP

[32] We thank Stephen Brown for making the PIN data publicly available at the following website: http://scholar.rhsmith.umd.edu/sbrown/pin-data.

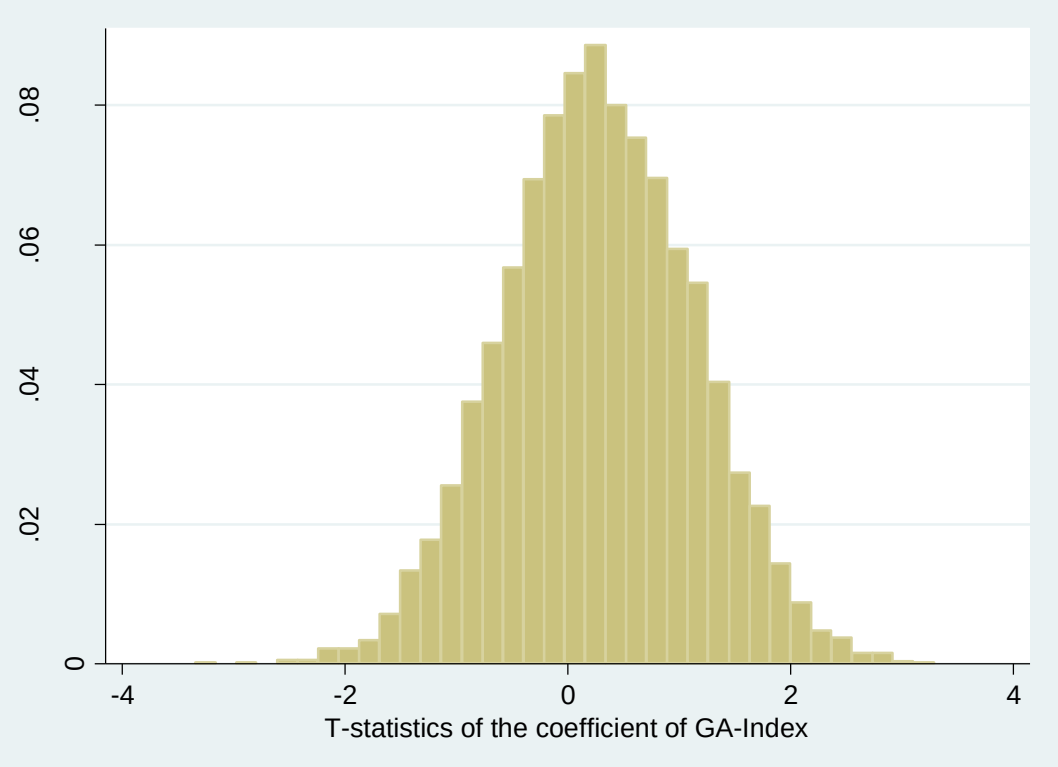

Figure 1: Distribution of t-statistics of the coefficients on GAI from randomization test

Table 1: Summary Statistics

This table presents the summary statistics for key variables used in the empirical analysis. The sample consists of CEO-year observations from fiscal years 1993 to 2007, for which compensation information is available from ExecuComp and CEO expertise can be measured from their past working experiences. In total there are 18,485 CEO-year observations, covering 3,868 unique CEOs and 2,256 unique firms. Detailed variable definitions are described in the Appendix.

Variable	N	Mean	Std. Dev.	P25	P50	P75
Total compensation	18,485	4799.547	10818.350	1177.335	2398.216	5133.898
Cash compensation	18,485	1336.817	1635.786	595.932	940.360	1541.416
Non-cash compensation	18,485	3462.729	10339.170	345.490	1252.565	3536.820
Restricted stock	18,216	692.992	5364.032	0.000	0.000	228.600
Option value	18,216	2191.536	8250.430	0.000	596.510	2000.000
Cash/Total compensation	18,454	0.484	0.283	0.251	0.442	0.687
Non-cash/Total compensation	18,454	0.516	0.283	0.313	0.558	0.749
Stock/Total compensation	18,185	0.088	0.171	0.000	0.000	0.101
Option/Total compensation	18,185	0.317	0.285	0.000	0.287	0.532
Delta	18,485	1968.943	84038.840	78.501	213.776	615.428
Scaled delta	18,485	339.035	30465.600	3.199	6.888	15.861
GA-index	18,485	0.033	0.987	-0.706	-0.118	0.593
Log(Sales)	18,485	7.284	1.576	6.249	7.214	8.313
Market to book	18,485	1.988	1.428	1.153	1.530	2.253
Leverage	18,485	0.230	0.182	0.072	0.220	0.346
ROA	18,485	0.135	0.111	0.090	0.134	0.189
CFO	18,485	0.096	0.103	0.054	0.095	0.143
Stock return	18,485	0.164	0.520	-0.135	0.097	0.354
Sd. ROA	18,485	0.080	0.078	0.031	0.055	0.100
Sd. CFO	18,485	0.100	0.096	0.044	0.074	0.122
Sd. Return	18,485	0.026	0.013	0.017	0.023	0.031

Table 2: Correlation Matrix

This table presents the Pearson correlation among variables in the regression analysis in the period 1993-2007. [a], [b] and [c] denote significance at the 1%, 5% and 10% levels, respectively. Variable definitions can be found in the Appendix.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	GA-Index														
(2)	Total compensation	0.155[a]													
(3)	Cash/Total	-0.187[a]	-0.322[a]												
(4)	Equity/Total	0.120[a]	0.140[a]	-0.338[a]											
(5)	Delta	0.013[c]	0.013[c]	0.000	-0.007										
(6)	Scaled delta	0.010	-0.004	0.004	-0.005	0.994[a]									
(7)	Log(Sales)	0.275[a]	0.281[a]	-0.215[a]	0.180[a]	0.037[a]	0.025[a]								
(8)	Market to book	-0.056[a]	0.093[a]	-0.107[a]	-0.073[a]	0.017[b]	0.002	-0.172[a]							
(9)	Leverage	0.112[a]	0.026[a]	-0.012	0.080[a]	-0.011	-0.007	0.193[a]	-0.254[a]						
(10)	ROA	-0.059[a]	0.031[a]	0.022[a]	-0.005	0.003	-0.002	0.222[a]	0.262[a]	-0.132[a]					
(11)	CFO	-0.048[a]	0.037[a]	-0.020[a]	0.010	0.004	-0.002	0.174[a]	0.214[a]	-0.207[a]	0.805[a]				
(12)	Stock return	-0.025[a]	-0.001	0.044[a]	-0.031[a]	0.005	0.001	-0.052[a]	0.244[a]	-0.061[a]	0.090[a]	0.094[a]			
(13)	Sd. ROA	-0.025[a]	-0.020[a]	-0.045[a]	-0.064[a]	-0.007	-0.006	-0.387[a]	0.209[a]	-0.168[a]	-0.149[a]	-0.090[a]	0.060[a]		
(14)	Sd. CFO	-0.062[a]	-0.038[a]	-0.008	-0.069[a]	-0.009	-0.007	-0.381[a]	0.259[a]	-0.135[a]	-0.230[a]	-0.199[a]	0.045[a]	0.614[a]	
(15)	Sd. Return	-0.082[a]	0.001	-0.043[a]	-0.146[a]	-0.011	-0.009	-0.394[a]	0.150[a]	-0.073[a]	-0.278[a]	-0.229[a]	-0.048[a]	0.422[a]	0.380[a]

Table 3: General Managerial Ability, Executive Compensation and Firm Characteristics

This table presents the mean of CEO and firm characteristics for generalist and specialist CEOs. Generalist CEOs (*Generalists*) are defined as CEOs whose general ability index (GA-index) is within the top quintile of the annual GA-index distribution and the remaining CEOs are categorized as specialists (*Specialists*). Column (3) displays the difference in the mean between generalist and specialist CEOs. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Variable	Specialists	Generalists	Dif = (2) – (1)
	(1)	(2)	(3)
Log(Sales)	7.124	7.930	0.806***
Market to book	2.015	1.882	-0.133***
Leverage	0.225	0.254	0.029***
ROA	0.137	0.128	-0.009***
CFO	0.097	0.089	-0.008***
Stock return	0.168	0.147	-0.021**
Sd. ROA	0.081	0.077	-0.004***
Sd. CFO	0.102	0.090	-0.012***
Sd. Return	0.026	0.024	-0.002***
Total compensation	4165.0	7364.5	3199.5***
Cash compensation	1246.5	1702.0	455.5***
Non-cash compensation	2918.5	5662.5	2744.0***
Cash/Total	0.405	0.336	-0.069***
Stock/Total	0.082	0.109	0.026***
Delta	1079.3	2278.9	1199.6***
Scaled delta	78.80	1391.0	1312.2**

Table 4: CEO Expertise and Pay-Performance Sensitivity

This table reports the result of regressions of the pay-performance sensitivity of CEO compensation on CEO skill generality. The sample contains all CEOs in ExecuComp from 1993 to 2007 with valid information on compensation. The dependent variable in Panel A is the natural logarithm of scaled pay-performance sensitivity (*scaled delta*), which is proposed by Edmans et al. (2009). In Panel B, the dependent variable is the natural logarithm of *delta*, calculated in the same way as Coles et al. (2013). The two measures used to capture the generality of CEO skills are: a continuous variable *GA-index* and a dummy variable *Generalist* which is equal to one if the GA-index of the CEO is within the top quintile of the annual GA-index distribution of sample CEOs and zero otherwise. Column (1) controls for CEO fixed effects, and Column (2) for CEO, industry, and year fixed effects. Column (3) and (4) replicate the specification of the first two columns, but replace GA-Index with the dummy variable (Generalist) indicating whether the CEO is a generalist. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A: Regression analysis using scaled delta

Dependent variable: log(scaled delta)	(1)	(2)	(3)	(4)
GA-index	0.139***	0.237***		
	(4.37)	(7.09)		
Generalist			0.101**	0.168***
			(2.00)	(3.27)
Market to book	0.133***	0.135***	0.134***	0.135***
	(9.36)	(9.27)	(9.31)	(9.19)
Leverage	-0.023	0.043	-0.007	0.065
	(-0.24)	(0.46)	(-0.08)	(0.70)
ROA	0.133	0.185	0.078	0.094
	(0.85)	(1.20)	(0.50)	(0.61)
CFO	-0.089	-0.065	-0.066	-0.035
	(-0.70)	(-0.50)	(-0.52)	(-0.27)
Stock return	0.113***	0.089***	0.110***	0.088***
	(7.50)	(5.79)	(7.33)	(5.67)
Sd. ROA	-0.321	-0.517**	-0.299	-0.463**
	(-1.53)	(-2.50)	(-1.42)	(-2.22)
Sd. CFO	0.186	0.095	0.170	0.073
	(1.10)	(0.58)	(1.01)	(0.45)
Sd. Return	-10.026***	-11.050***	-9.953***	-10.898***
	(-10.61)	(-11.67)	(-10.55)	(-11.50)
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
CEO FE	Yes	Yes	Yes	Yes
N	18,485	18,485	18,485	18,485
Adj. R-squared	0.723	0.731	0.723	0.730

Table 4 – Continued

Panel B: Regression analysis using unscaled delta

Dependent variable: log(delta)	(1)	(2)	(3)	(4)
GA-index	0.349***	0.415***		
	(7.03)	(8.79)		
Generalist			0.300***	0.304***
			(4.78)	(4.81)
Log(Sales)	0.728***	0.723***	0.795***	0.802***
	(19.55)	(19.47)	(22.48)	(22.40)
Market to book	0.276***	0.275***	0.278***	0.277***
	(22.03)	(22.07)	(21.94)	(22.02)
Leverage	-0.461***	-0.383***	-0.451***	-0.370***
	(-3.50)	(-3.05)	(-3.36)	(-2.89)
ROA	0.146	0.231	-0.048	-0.007
	(0.75)	(1.19)	(-0.25)	(-0.04)
CFO	-0.015	-0.010	0.012	0.010
	(-0.10)	(-0.07)	(0.08)	(0.07)
Stock return	0.138***	0.143***	0.139***	0.146***
	(9.83)	(10.40)	(9.93)	(10.58)
Sd. ROA	0.155	0.224	0.255	0.344
	(0.63)	(0.92)	(1.03)	(1.40)
Sd. CFO	0.132	0.157	0.129	0.148
	(0.64)	(0.77)	(0.60)	(0.69)
Sd. Return	-11.583***	-10.746***	-11.179***	-10.354***
	(-9.72)	(-9.16)	(-9.40)	(-8.83)
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
CEO FE	Yes	Yes	Yes	Yes
N	18,485	18,485	18,485	18,485
Adj. R-squared	0.820	0.828	0.819	0.825

Table 5: CEO expertise and pay-performance sensitivity: Learning about the CEO's skills

This table shows how the relation between pay-performance sensitivity and CEO expertise (GA-index) varies among CEOs differing in tenure and number of years holding a CEO position. The dependent variable is the natural logarithm of scaled pay-performance sensitivity (*scaled delta*), which is proposed by Edmans et al. (2009). The General Ability Index is then interacted with dummy variables indicating a longer tenure or a longer executive career. The dummy for a longer tenure is equal to one if the CEO has a tenure longer than the median in the annual distribution and zero otherwise. The dummy for a longer executive career is equal to one if the CEO first appeared in ExecuComp as Chief Executive Officers earlier than the annual median. Each regression controls for year, industry, and CEO fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
GA-index	0.222***	0.227***
	(6.23)	(4.79)
GA-index × dummy(CEOs with a longer tenure)	-0.056**	
	(-2.01)	
dummy(CEO with a longer tenure)	0.157***	
	(5.92)	
GA-index × dummy(CEOs with a longer career)		-0.054*
		(-1.79)
dummy(CEOs with a longer career)		0.124***
		(4.21)
Market to book	0.135***	0.145***
	(9.31)	(8.85)
Leverage	0.065	-0.007
	(0.71)	(-0.06)
ROA	0.267*	0.264
	(1.77)	(1.48)
CFO	-0.066	-0.132
	(-0.52)	(-0.93)
Stock return	0.089***	0.085***
	(5.66)	(4.72)
Sd. ROA	-0.568***	-0.475**
	(-2.75)	(-2.00)
Sd. CFO	0.120	0.094
	(0.74)	(0.50)
Sd. Return	-10.491***	-11.152***
	(-11.22)	(-10.55)
Industry FE	Yes	Yes
Year FE	Yes	Yes
CEO FE	Yes	Yes
N	17,942	15,229
Adj. R-squared	0.735	0.735

Table 6: Managerial Expertise and Pay-Performance Sensitivity: The Importance Of CEOs

This table examines how the relation between CEO skill generality and pay-performance sensitivity might change depending on the CEO's importance for the firm. The dependent variable is the natural logarithm of scaled delta which is constructed by Edmans et al. (2009). The differential effect is captured by the interaction between the GA-index and two measures of the CEO's importance: HHI and sales growth. *HHI* is calculated using net sales of firms in the same SIC-3 industries. *Sales growth* is the average firm-level growth rate of sales in the past two years. All specifications control for CEO, year, and industry fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
GA-index	0.271***	0.231***
	(7.28)	(6.94)
GA-index × HHI	-0.275**	
	(-1.98)	
HHI	0.210	
	(1.05)	
GA-index × Sales growth		0.054**
		(2.39)
Sales growth		0.048*
		(1.76)
Market to book	0.135***	0.133***
	(9.26)	(9.20)
Leverage	0.038	0.027
	(0.41)	(0.29)
ROA	0.192	0.140
	(1.24)	(0.87)
CFO	-0.069	-0.051
	(-0.53)	(-0.39)
Stock return	0.090***	0.090***
	(5.80)	(5.77)
Sd. ROA	-0.517**	-0.538***
	(-2.50)	(-2.60)
Sd. CFO	0.089	0.106
	(0.55)	(0.64)
Sd. Return	-10.982***	-10.914***
	(-11.58)	(-11.56)
CEO FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
N	18,485	18,391
Adj. R-squared	0.731	0.731

Table 7: Compensation Mix and Managerial Expertise

This table presents the result of regressions linking the compensation mix of CEOs to their expertise as measured by the general ability index (GA-index). The sample consists of 3,868 unique CEOs in 2,256 unique firms from 1993-2007. The compensation mix includes the proportion of cash (salary+bonus) and restricted stock compensation. Columns (1)-(2) control for year and industry (2-digit SIC) fixed effects. Columns (3)-(4) control for CEO, industry and year fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Type of pay	Cash	Stocks	Cash	Stocks
GA-index	-0.029***	0.011***	-0.026**	0.023***
	(-8.60)	(5.15)	(-2.52)	(3.78)
Log(Sales)	-0.051***	0.013***	-0.044***	0.021***
	(-19.14)	(7.98)	(-6.72)	(5.34)
Market to book	-0.028***	-0.004***	-0.020***	-0.000
	(-8.42)	(-2.74)	(-6.05)	(-0.33)
Leverage	-0.053***	0.056***	0.009	-0.016
	(-2.59)	(4.94)	(0.33)	(-0.93)
ROA	0.224***	-0.012	0.112**	-0.022
	(4.97)	(-0.54)	(2.28)	(-0.79)
CFO	-0.127***	0.012	-0.070	-0.002
	(-3.03)	(0.59)	(-1.59)	(-0.08)
Stock return	0.019***	0.006**	0.023***	0.004*
	(4.09)	(2.43)	(4.66)	(1.79)
Sd. ROA	-0.177***	0.007	0.014	-0.011
	(-3.52)	(0.28)	(0.22)	(-0.29)
Sd. CFO	0.006	0.013	-0.022	-0.007
	(0.16)	(0.69)	(-0.44)	(-0.27)
Sd. Return	-1.683***	-0.288**	-2.200***	-0.869***
	(-5.47)	(-1.98)	(-7.72)	(-5.69)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
CEO FE	No	No	Yes	Yes
N	18,454	18,185	18,454	18,185
Adj. R-squared	0.210	0.178	0.449	0.416

Table 8: Managerial Expertise and Pay-Performance Sensitivity: Propensity Score Matching

This table presents estimates of the difference in CEO pay-performance sensitivity between generalist CEOs and the matched specialists. A CEO is defined as a generalist (*Generalist*) if his/her general ability index (GA-index) is within the top quintile of the annual GA-index distribution and the remaining CEOs are defined as specialists. The matched sample is formed using propensity score matching in which a probit model is estimated to predict the likelihood of firms' hiring a generalist CEO. Net sales, conglomerate dummy, leverage ratio, R&D/asset ratio, return on assets, market-to-book ratio, cash-asset ratio and capital expenditures are used to predict firms' decision to hire generalists. Each new generalist CEO is matched to one specialist CEO hired in the same year, using nearest-neighbor matching. *Generalist* is a dummy variable if the CEO is a generalist and zero otherwise. Panel A compares the firm characteristics between the generalist CEO sample and the matched specialist CEO sample, with the p-value reported in the last column. Panel B examines whether pay-performance sensitivity differs between generalists and the matched specialists. Both the *scaled delta* (in its natural logarithm form) proposed by Edmans et al. (2009) and *unscaled delta* (also in its natural logarithm form) is used as proxies for the sensitivity of CEO pay to firm performance. Columns (1)-(4) use scaled delta as the dependent variable and the unscaled version is used in columns (5)-(8). Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A: Descriptive statistics for the propensity score matched sample

Firm characteristics	Specialists	Generalists	Difference	p-value
Log(Sales)	7.615	7.737	-0.121	0.396
Conglomerate	0.309	0.321	-0.012	0.754
Leverage	0.249	0.234	0.015	0.343
R&D	0.043	0.045	-0.002	0.751
Profitability	0.107	0.103	0.004	0.772
Stock return	0.070	0.062	0.008	0.845
Market to book	1.788	1.871	-0.082	0.485
Cash/Assets	0.124	0.125	-0.001	0.965
CAPEX/Assets	0.056	0.055	0.001	0.795

Table 8 – Continued

Panel B: Regression analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Measure	Scaled Delta				Unscaled Delta			
Generalist	0.118***	0.102***			0.184***	0.180***		
	(3.38)	(3.01)			(4.00)	(4.05)		
GA-index			0.231***	0.326***			0.496***	0.547***
			(3.04)	(4.43)			(4.39)	(4.89)
Market to book	0.179***	0.182***	0.214***	0.202***	0.318***	0.311***	0.404***	0.366***
	(5.17)	(5.13)	(13.52)	(12.86)	(7.11)	(7.13)	(19.65)	(17.86)
Leverage	-0.112	-0.073	-0.612***	-0.700***	-0.163	0.054	-1.055***	-0.986***
	(-0.44)	(-0.29)	(-5.81)	(-5.93)	(-0.44)	(0.15)	(-7.62)	(-6.36)
ROA	0.045	-0.088	0.682**	0.035	0.331	0.382	-0.075	-0.409
	(0.12)	(-0.23)	(2.37)	(0.12)	(0.68)	(0.77)	(-0.20)	(-1.10)
CFO	-0.261	-0.224	-0.082	0.047	-0.102	-0.054	0.259	0.211
	(-0.94)	(-0.81)	(-0.29)	(0.18)	(-0.26)	(-0.14)	(0.70)	(0.60)
Stock return	0.156***	0.103***	0.207***	0.125***	0.145***	0.156***	0.220***	0.271***
	(5.13)	(3.32)	(5.73)	(3.42)	(3.39)	(3.69)	(4.67)	(5.64)
Sd. ROA	-0.614	-1.152**	-0.981***	-1.172***	-0.065	0.020	-0.010	-0.597
	(-1.15)	(-2.25)	(-3.12)	(-3.83)	(-0.11)	(0.03)	(-0.02)	(-1.49)
Sd. CFO	0.598	0.573	-0.307	-0.523**	0.222	0.573	-0.455	-0.517
	(1.38)	(1.49)	(-1.20)	(-2.10)	(0.46)	(1.18)	(-1.35)	(-1.58)
Sd. Return	-6.189***	-8.000***	2.214	-8.781***	-12.672***	-12.331***	-3.939*	-15.760***
	(-3.03)	(-3.88)	(1.39)	(-4.78)	(-4.00)	(-3.89)	(-1.89)	(-6.54)
log(Sales)					0.641***	0.642***	0.498***	0.483***
					(7.33)	(7.14)	(31.22)	(29.50)
CEO FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
N	3,206	3,206	3,206	3,206	3,206	3,206	3,206	3,206
Adj. R-squared	0.696	0.725	0.226	0.349	0.792	0.800	0.372	0.472

Table 9: Instrumental variable regressions

This table presents the results from the two-stage least squares regressions. Column (1) reports the result from the first-stage regression, and Column (2) shows second-stage estimates. The *non-compete enforcement index* is used as the instrument for the general ability index (the GA-index). In the second-stage regression, the natural log of *scaled delta* is regressed on the GA-index estimated from the first stage. The sample includes all CEOs in ExecuComp from 1993 to 2004 for whom the GA-index from Custódio et al. (2013) is available. *The non-compete enforcement index* is the average of the state-level non-compete enforcement indexes in states where the CEO used to hold an executive position during his/her career. The non-compete enforcement index is extracted from Garmaise (2011). All specifications control for CEO, year, and industry fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	First stage	Second stage
	GA-index	log(Scaled delta)
GA-index		1.387***
		(9.29)
Market to book	0.003	0.126***
	(0.88)	(9.22)
Leverage	0.060	-0.727***
	(1.57)	(-5.72)
ROA	-0.085	1.100***
	(-1.49)	(6.02)
CFO	-0.050	-0.299**
	(-1.16)	(-2.32)
Stock return	-0.011***	0.168***
	(-2.58)	(10.25)
Sd. ROA	0.157**	-1.069***
	(2.22)	(-4.15)
Sd. CFO	-0.039	1.227***
	(-0.63)	(6.88)
Sd. Return	0.752**	-3.851***
	(2.22)	(-3.13)
Non-compete enforcement index	0.046**	
	(1.98)	
CEO FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
Endogeneity Test Chi2	8.467***	
F-statistic	26.66	45.57
N	13,388	13,388
Adj. R-squared	0.948	0.772

Table 10: Managerial Expertise and Risk-Taking

This table presents the result of regressions linking CEO pay-performance sensitivity (delta) to CEO skill generality (GA-index) for firms whose investment and financial policies are characterized by different levels of riskiness. The sample contains all CEOs in ExecuComp from 1993 to 2007 with valid compensation information. The dependent variable is the natural logarithm of *scaled delta*. The sample is divided into two equal groups based on six measures of firm policy riskiness. *R&D* is annual R&D expenditures divided by total assets. *Diversification* (entropy) is calculated as $Entropy = \sum P_s Ln(1/P_s)$, where P_s is the proportion of the firm's total sales in industry segment *s*. *Working capital* is defined as current assets minus current liabilities, scaled by the book value of total assets. *Leverage* is total liabilities divided by total assets. *Cash flow volatility* is the standard deviation of operating cash flows during the five years prior to the current fiscal year *t*. *Idiosyncratic volatility* is defined as the variance of daily residual returns in fiscal year *t*, where the parameter is estimated using return data in the previous 36 months. Control variables are the same as those in Table 4: Market to book, Leverage, Return on assets, Operating cash flow, Stock return, Volatility of return on assets, Volatility of operation cash flows and Stock return volatility. A Wald-test is conducted to test whether the coefficients are the same for each pair of sub-samples and the corresponding p-value is presented. Each specification controls for year, industry and CEO fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance level at the 1%, 5% and 10% levels, respectively.

	R&D		Diversification		Working capital		Leverage		Cash flow volatility		Idiosyncratic volatility	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GA-index	0.227***	0.263***	0.216***	0.267***	0.271***	0.267***	0.266***	0.221***	0.332***	0.151***	0.326***	0.170***
	(4.51)	(4.41)	(4.19)	(5.31)	(3.79)	(5.26)	(3.90)	(4.63)	(6.19)	(3.08)	(6.64)	(2.76)
Test for equality in coefficients	p-value=0.778		p-value =0.994		p-value=0.655		p-value =0.457		p-value =0.005***		p-value =0.083*	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	8,769	7,463	7,355	11,110	7,600	7,607	8,120	8,112	9,249	9,239	9,236	9,233
Adj. R-squared	0.759	0.702	0.740	0.741	0.737	0.735	0.731	0.716	0.749	0.738	0.736	0.745

Table 11: Managerial Expertise and Price Efficiency

This table presents the result of regressions linking the information efficiency (or inefficiency) embedded in stock prices to CEO skill generality (GA-index). *Discretionary accrual* is calculated using the modified Jones model. *Opacity* is measured as the sum of the absolute value of discretionary accrual from *t-2* to *t*. *PIN* is the probability of information-based trades, following Venter and de Jongh's (2004) extension of the EKOP (1996) model. *Amihud* is annual stock illiquidity measure calculated using daily return and trading volume data from CRSP, following Amihud (2002). *Log*(*#Analyst*) is the natural logarithm of the total number of analysts following the firm, which is extracted from the I/B/E/S. *Analyst forecast dispersion* is defined as the standard deviation of analyst earnings forecasts scaled by the absolute value of the consensus earnings forecast, following Diether et al. (2002). We control for firm age, the market-to-book ratio, leverage, return on assets, cash flow volatility, R&D spending, the number of business segments and industry sales concentration measured by HHI. Each specification controls for firm and year fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. The t-statistics are shown in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable =	Accrual	Opacity	PIN	Amihud	Log(#Analyst)	Forecast dispersion
	(1)	(3)	(5)	(7)	(9)	(11)
GA-index	-0.002	-0.001	0.000	-14.103	-0.004	-0.007
	(-0.95)	(-0.16)	(0.47)	(-1.07)	(-0.32)	(-0.53)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	15,313	15,302	18,165	18,388	12,692	12,560
Adj. R-squared	0.228	0.495	0.679	0.2048	0.782	0.179

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