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

Abstract

Generalist CEOs enjoy higher pay than specialist CEOs (Custódio et al. 2013). However, the implication of CEO expertise on how CEOs are paid is little known. We conjecture that due to information asymmetry, generalist CEOs may overstate their ability in contracting with shareholders. To design an optimal contract, the pay for generalist CEOs should be more closely linked to firm performance. Our results support this conjecture. The pay-performance sensitivity is higher for generalist than for specialist CEOs, especially when generalist CEOs are younger or in their early years of tenure or when they are more important to firm performance.

JEL Classification: G34; J24; J33

Keywords: Compensation contract; CEO expertise; generalists; specialists

1. Introduction

The modern organizations emphasize more on the importance of human capital in creating firm value (Rajan and Zingales 2000). Looking into the decision-making at the top, the skill set of CEOs is an important topic to investigate given their influence on firm business strategy, financial policy, and ultimate firm performance (Hambrick and Mason 1984; Bennedsen et al. 2006; Bennedsen et al. 2011). The literature so far has identified that CEOs are paid differently based on their set of skills. For example, Custódio, Ferreira, and Matos (2013) find that generalist CEOs are paid more compared to their counterpart specialist CEOs. This highlights the pay premium to general skills and thus helps us understand how the CEO skill set affects the level of executive pay.

Nevertheless, Jensen and Murphy (1990) argue that an equally important question on CEO compensation is the difference in the structure of pay between generalist versus specialist CEOs (i.e., how CEOs are paid), which remains largely unknown. This study fills this gap by providing evidence on the difference in the pay structure between generalist and specialist CEOs.

This study is related to and motivated by several streams of literature. First, the study is motivated by the literature on the CEO skill set. Up to date, the literature has identified the implications of firm-specific versus generic skills on CEO pay, firm innovation, and the cost of capital. The literature generally documents that the different skill set of CEOs has both the bright and dark sides when it comes to firm policies and other aspects. For example, generalist CEOs are paid more (Custódio et al. 2013) and are likely engaged in more innovation (Custódio et al. 2015). However, firms with generalist CEOs may suffer from more severe agency problems and therefore investors require higher expected returns (Mishra 2014). Given the role of CEO skills on firm policies and ultimate performance, it is worthwhile exploring other implications of the

CEO skill set. In particular, how do firms award CEO skills in the design of their compensation contracts?

Second, the study is motivated by the literature on the design of compensation contracts and specifically the pay-performance sensitivity embedded in the labor contract. The design of compensation contracts aims to mitigate agency problems arising from information asymmetry when the ownership and control of corporate assets are separated (Berle and Means 1932). The design should involve not only the level of executive pay, but more importantly, the structure of the pay.

We resort to theoretical models to help us formulate our empirical predictions regarding how general versus special skills affect the pay-performance sensitivity. The analytical models of Dutta (2008) and Goldmanis and Ray (2014) predict that the pay-performance sensitivity should be higher when managerial skills are largely general. The rationale is as follows. In the presence of asymmetric information, since generalist CEOs have more outside options, they tend to overstate their ability to bargain with shareholders for higher pay. The firm, as the counterparty in the contracting process, rationally anticipates such tendency and thus designs the 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. We therefore hypothesize that ceteris paribus, generalist CEOs exhibit higher pay-performance sensitivity in the compensation contract than do specialist CEOs.

Moreover, we also develop cross-sectional variations from our main hypothesis. The first cross-sectional variation comes from the board of directors' learning about CEO ability over time. If the CEO type is gradually revealed over time, the adverse selection problem would be of less concern to the board of directors. The compensation contract will not be designed in a way

to counteract generalist CEOs' tendency to overstate their ability. As a result, the positive relation between general skills and pay-performance sensitivity would be more pronounced for younger CEOs or CEOs with shorter working experience in their current positions. The second cross-sectional variation is related to the importance of CEO to firm value creation. If CEOs matter more to firm value creation, firms will award more powered incentives to CEOs to induce a higher level of effort and performance. Therefore, we expect that ceteris paribus, the positive relation between general skills and pay-performance sensitivity is stronger when CEOs matter more to firm performance.

We then put our hypotheses into empirical tests. Due to the data availability of the CEO general ability index (GA-index) constructed by Custódio et al. (2013), our final sample consists of 18,324 CEO-year observations, with 3,928 unique CEOs and 2,324 unique firms from 1993-2007. Our findings are summarized as follows. First, consistent with our main prediction, generalist CEOs have a higher pay-performance sensitivity as measured by scaled delta. The result is robust to an alternative measure of pay-performance sensitivity, unscaled delta.[1]

Cross-sectional analysis indicates that the relation between the pay-performance sensitivity and the generality of CEO expertise is stronger when CEOs are younger or have shorter tenure in office. This is consistent with the underlying mechanism that contributes to the main findings. More specifically, the lack of knowledge of generalist CEOs' true skills makes the board of directors design the compensation contract in a way that links CEO pay more closely to firm performance to mitigate generalists' tendency to overstate their abilities. In addition, the relation between generalist CEOs and the pay-performance sensitivity is also stronger when CEOs are more important to firm performance as measured by industry competition and past sales growth.

[1] The unscaled delta is the dollar change in CEO wealth (in thousand dollars) associated with a 1% change in stock price. The scaled delta is the unscaled delta scaled by firm size. See the Appendix for more detailed calculations.

Overall, the results support our hypotheses and unveil the mechanisms of optimal contracting in the design of compensation contracts with respect to different sets of CEO skills.

To alleviate the potential endogeneity concern, we control for CEO fixed effects in the main analysis to rule out the effect of time-invariant CEO characteristics (e.g., attitude towards risk and gender) on the relation between general skills and pay-performance sensitivity. To further rule out potential selection bias, we conduct two additional tests. The first test is based on a propensity score matched sample, where firms with similar characteristics are matched except that one group of firms contains generalist CEOs, while the other matched group consists of specialist CEOs. The second test uses the noncompetition agreement enforcement index from Garmaise (2009) as an instrument for the GA-index. The conclusion from both tests remain unchanged that the higher the CEO GA-index, the greater the pay-performance sensitivity.

We also conduct tests to rule out alternative explanations such as the risk-taking or market inefficiency explanation. Firms that prefer risk taking may hire generalist CEOs and award them with high-powered incentive contracts. Therefore, the positive association between generalist CEOs and pay-performance sensitivity can be due to risk-taking rather than the asymmetric information hypothesis about CEO ability as we propose. We use R&D expenditures, diversification, and other dimensions to measure risk taking and find no significant differences across most of the risk-taking subsamples.

The other alternative explanation is the difference in stock price efficiency across firms with generalist versus specialist CEOs. If firms with specialist CEOs contain a larger proportion of firm-specific risk, stock price efficiency for such firms may be lower and therefore their pay-performance sensitivity would also be lower since stock price is less informative (Hölmstrom 1979). We employ several measures to proxy for market inefficiency and fail to find the effect of

market inefficiency on the positive relation between pay-performance sensitivity and CEO generality. Overall, the results rule out the above two alternative explanations.

We make several contributions to the literature. First, we show that the pay-performance sensitivity reflects the underlying type of manager skills. The findings enrich our understanding of the determinants of executive incentive contracts. This indirectly echoes the debates on whether executives are paid for performance or not (e.g., Bebchuk and Fried 2003; Goldman and Slezak 2006). Second, we add to the recent literature on CEO skills by documenting its implications for the design of compensation contracts. Previous studies focus on the effect of different skills on the compensation level (Custódio et al. 2013) and innovation activity (Custódio et al. 2015). The study uncovers another important implication of the CEO skill set: incentive contracts. Third, the results help us understand the interaction between the labor market and the design of managerial contracts. Generalists are managers who can easily find outside options as they have broad experience in various industries. Therefore, they should have a different package of compensation, compared to their counterpart specialist CEOs.

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 shows results from possible alternative explanations. Finally, Section 7 concludes the paper.

2. Related Literature and Hypothesis Development

This study is related to several streams of literature, including the literature on the managerial skill set, pay-performance sensitivity, and the revelation of agent types over time.

This section is devoted to the discussion of the related literature and develops the hypotheses therein.

2.1 Managerial skill set

As discussed at the outset, a firm's CEO is the most important person in a firm that affects 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, Custódio et al. (2013) find that generalist CEOs earn 17% more than do specialist CEOs, indicating the pay premium for general skills. Custódio et al. (2015) further document that generalist CEOs actually spur more innovation due to their risk-tolerance attitude. Specifically, although investment in innovation is risky, generalist CEOs can be easily reappointed elsewhere should the project fails. Therefore, the more outside options held by generalist CEOs encourage their risk-taking tendency. However, originating from this risk-taking incentive, firms with generalist CEOs may suffer from severer agency problems, exemplified by higher required returns by investors in the presence of more complicated operations and more anti-takeover provisions (Mishra 2014). Taken together, the different skill sets of CEOs have both bright and dark sides when it comes to firm policies and other dimensions.

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). To better align the interest between shareholders and managers, several mechanism are designed to mitigate the potential

agency problems in the form of either adverse selection or moral hazard (Laffont and Martimort 2002) or both, including both internal and external corporate governance (Shleifer and Vishny 1997). One of the notable internal governance mechanisms is the design of compensation contracts (Murphy 1999; Jensen et al. 2004). Moreover, the structure of the compensation package is as important as the level of compensation (Jensen and Murphy 2010).

Pay-performance sensitivity, as one of the incentive contract features, has attracted a lot of attention from academia and practitioners since 1990. 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 in the study 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 wealth of executives in firms with less volatile stock returns is much more sensitive to firm performance, compared to that 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 biases toward zero.

However, it remains unexplored what determines pay-performance sensitivity from the perspective of CEO skills. 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, the pay-performance sensitivity is higher, suggesting a positive relation between pay-performance sensitivity and CEO skills being general. The rationale behind this prediction is as follows. In the presence of asymmetric information, generalist CEOs who have more outside options have the tendency to overstate their ability to bargain for higher pay. The firm, as the counterparty in the

contracting process, rationally anticipates such tendency and thus designs the compensation contract in a way such that CEO pay is more closely linked to firm performance. This contracting feature results in higher pay-performance sensitivity for generalist CEOs. In a similar vein, Goldmanis and Ray (2014) model the sorting effect of performance pay and predict that under asymmetric information, the pay-performance sensitivity increases with the manager's outside options. Since generalist CEOs bear the feature of relatively more outside options, their compensations are more linked to firm performance. Based on the above discussion, we develop our main hypothesis as below.

Hypothesis 1 (H1): Ceteris paribus, the 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, when applied to specialist CEOs, indicates that ceteris paribus, specialist CEOs will have lower pay-performance sensitivity. However, specialist CEOs, who lack outside options, can actually be more risk averse. Such attitude towards risk may not help generate value for shareholders who can enjoy the upside benefits beyond a certain level of firm payoffs (i.e., the face value of debt). Therefore, it can well be the case that the board of directors also designs a higher pay-performance sensitivity contract for specialist CEOs for a totally different purpose. We view this possibility as a potential counter-argument and the tension it creates leaves the relation between general skills and pay-performance sensitivity to be 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 CEO 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 true type of CEO ability, i.e., the asymmetric information between the CEO and its shareholders about the true ability of the CEO. As time goes by, the board of directors would be equipped with more knowledge about the CEO ability through either in-process interaction or ex post realized performance (Murphy 1986; Harris and Hölmstrom 1982; Pan et al. 2015). In other words, the CEO type is revealed over time and therefore the adverse selection would be of less concern to the board of directors. As a result, the compensation contract will not be designed in a way to counteract generalist CEOs' tendency to overstate their ability, which leads to our second hypothesis.

Hypothesis 2 (H2): The positive relation between general skills and the pay-performance sensitivity is more pronounced when CEOs are younger or have shorter working experience in their current position.

Another cross-sectional variation is related to the importance of CEO in improving firm performance. If CEOs matter more to firm value creation, we would expect that the board of directors would be more likely to grant a higher pay-performance sensitivity contract to generalist CEOs when the CEOs matter more to firm performance, which leads to our last hypothesis.

Hypothesis 3 (H3): The positive relation between the pay-performance sensitivity and generalist CEOs is stronger when CEOs matter more to firm performance.

This prediction is also consistent with the recent findings by Pan et al. (2015) who document that declines in stock return volatility with respect to CEO tenure is sharper when CEO ability is

more important to firm value creation. We measure the importance of CEOs to firm value creation by industry competition and past sales growth.

3. Research Design

3.1 Sample selection

The CEO compensation data come from ExecuComp and the CEO general ability index (GA-index) comes from Custódio et al. (2013).[2] 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. The sample is then narrowed down to CEOs for whom the GA-index is available. The index, constructed from managers' past working experience, captures how generally the 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 18,324 CEO-year observations, with 3,928 unique CEOs and 2,324 unique firms from 1993-2007.

3.2 Measures of generalist versus specialist CEOs.

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 the CEOs' skill set. Five indicators are selected to capture CEO skills that are transferable across firms: namely, (1) the past number of positions, (2) the past number of firms, (3) the past number of industries, (4) the CEO experience dummy, and (5) whether the manager has worked in a

[2] We acknowledge the generosity of the 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.

conglomerate. CEOs who have higher scores in these indicators are considered to have more general human capital. To mitigate concerns regarding multi-collinearity and measurement errors, they combine the multiple indicators into one composite index by conducting a principal component analysis and extracting the first common component of these five indicators. Of the five indicators, the past numbers of positions, firms, and industries are assigned a higher loading than do the past CEO and conglomerate working experiences. To make the results easier to interpret, 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 as a measure of the generality of CEO skills, we also construct a dummy variable to categorize the sample CEOs each year into generalists and specialists. Generalist CEOs are those with the general ability index above the 80% percentile of the annual distribution and the rest are specialist CEOs.[3]

3.3 Measures of pay-performance sensitivity

In this study, we resort to delta to measure pay-performance sensitivity, which is derived from compensation data and gauges the change in CEO wealth (in thousands) for a 1% change in stock price. It is adopted extensively as a pay-performance sensitivity measure in prior studies such as Core and Guay (2002), Coles, Daniel, and Naveen (2006), etc. Following Coles, Daniel, and Naveen (2013), we take into account shares and options existing in a CEO's portfolio when calculating the delta. Specifically, the delta (called unscaled delta) is the sum of the delta of current year options, the delta of the portfolio of previously-granted options (both vested and unvested), and the delta from the shares owned by the executive. To alleviate the concern that

[3] The way to define specialist CEOs using a dummy variable is nontrivial. We choose the 80 percentile to be conservative. As long as the GA-index is a monotonic measure of CEO general skills, such choice would bias against our findings.

firm size may drive the result, we choose scaled price-performance sensitivity (scaled delta) created by Edmans, Gabaix, and Landier (2009) as our major proxy for pay-performance sensitivity.[4] There is less concern that firm size drives the result for using scaled delta, since this measure is already scaled by firm size. To show the robustness of the result, we also conduct the empirical analysis based on unscaled delta in the main analysis and cross-sectional tests.

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 and measures the sensitivity of the change in CEO wealth (in thousand dollars) to the 1% change in stock price. Since both scaled delta and unscaled delta are highly skewed to the left, we use the natural logarithm of them as dependent variables. GA-index is the CEO general ability index, which follows Custódio et al. (2013) and intends to capture how CEO general skills are. The larger is the value of this variable, the more likely the CEOs are generalists. We use two versions of this measure, i.e., continuous and categorical. Controls are a vector of control variables that aims to control for omitted correlated factors. Following prior literature (e.g., Jayaraman and Milbourn 2012), we first control for the market to book ratio (Market to book), since growth opportunity can affect how firms design the compensation contract (Gopalan et al. 2014). Firm capital structure can also affect executive incentives, given the role that debt plays in the incentive alignment (Douglas 2006). We therefore control for the firm leverage ratio (Leverage) in the regression. We also control for firm accounting and stock price performance as it is correlated with

[4] It is calculated as $\frac{\Delta Wealth}{\Delta \ln Firm\ Value \times Wage}$. See Appendix B in Edmans, Gabaix, and Landier (2009) for details.

executive incentives (Hochberg and Lindsey 2010). Specifically, we control for both accounting performance (Profitability) 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 it using volatility in cash flow from operating activities (CF volatility). To control for the time-series variation in pay-performance sensitivity and the effect of executive-level characteristics, we also control for year (y) and executive (e) fixed effects. Heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level.

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 4,894 thousand dollars (Total compensation).[5] Regarding pay-performance sensitivity, delta and scaled delta are 1,353 and 323.89, which correspond to $1,353,000 and $323,889 changes in CEO wealth given a 1% change in stock price, which is similar to the reported number in previous studies (e.g., Jayaraman and Milbourn 2012). The mean of CEO general skills (i.e., the GA-index) is -0.005, which is close to zero by construction.[6] The standard deviation is close to one (0.995) for the same reason. CEOs on average work for 7.659 years in their current positions, while the firms in the sample are on average 55.486 years old. The natural logarithm of firm size is on average 7.528 (Log(Assets)) and the market to book ratio is on average 1.984. Firms on average finance more than 20% of

[5] 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 pays is highly positively skewed.
[6] The measure by Custódio et al. (2013) is standardized to have a mean of zero and a standard deviation of one.

their assets using debt (Leverage = 0.229), while the average profitability is 12.9%, indicating that firms in the sample are on average making profit to a reasonable extent. For stock return, the mean is 17.3%. The cash flow from operating activities on average has a volatility of 11.3%.

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 0.797, indicating that they are capturing the similar underlying concept. Regarding other variables, size is positively correlated with the two pay-performance sensitivity measures, although the magnitude is much smaller for scaled pay-performance sensitivity (correlation coefficient = 0.027). Both measures are also positively correlated with CEO tenure. Since the absolute values of correlation coefficient among all other variables are below 0.41, suggesting that multicollinearity is not a concern in our study.

Table 3 reports the result of a univariate comparison between firms with specialist CEOs and firms with generalist CEOs. There are significant differences in firm characteristics between firms managed by generalists and specialists. For instance, firms run by generalists tend to be bigger, more levered, and invest more in R&Ds.[7] Generalist CEOs themselves are older, have shorter tenure, and are more likely to hold chairman of the board. This indicates the importance of controls for various firm characteristics in multivariate regression analysis.

Generalist CEOs are also different in terms of the compensation. Consistent with Custódio, Ferreira, and Matos (2013), generalists are paid higher both in cash and other non-cash components. More important to this study, we find that generalist CEOs have more of their compensation in incentive pay. The fraction of restricted stocks in total compensation for specialist is 7%, compared with 10% for generalists. Since the percentage of cash compensation is lower for generalists, the sensitivity of their wealth to firm performance is significantly higher.

[7] This is consistent with the findings in Custódio et al. (2015) that specialist CEOs are more engaged in innovation.

The comparison of delta between these two types of CEOs reveals that generalists on average obtain around $371,000 more per a 1% increase in firms' stock prices.

4.2 Main findings

Table 4 presents the estimation result of our main model which links CEO skill generality to the pay-performance sensitivity. Panel A of Table 4 reports the results when scaled delta (in its natural logarithm) is used as a proxy for pay-performance sensitivity. We do not explicitly control for the effect of firm size given the fact that it is embedded in the dependent variable. Regarding the general ability index, Columns (1) and (2) use the continuous measure (GA-index), while Columns (3) and (4) use an indicator measure (Generalist). For the empirical specification, Columns (1) and (3) control for the CEO fixed effect, while Columns (2) and (4) control for industry, year, and CEO fixed effects. Since the results across the four columns are similar, we focus on the result reported in Column (1). The significantly positive coefficient on the GA-index (coeff = 0.138; t-stat = 3.08) suggests that generalist CEOs have significantly higher scaled delta, compared to specialist CEOs. The result confirms our prediction in Hypothesis 1 that generalist CEOs have higher pay-performance sensitivity. In terms of control variables, we find that firms with more growth opportunities and higher stock returns also have 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 = 0.282; t-stat = 6.44) is slightly more than double. The result suggests the importance of the effects of year and industry on the positive association between CEO generality and pay-performance sensitivity. Therefore, in the remaining tests, if no specifically mentioning, we will control the CEO, year, and industry fixed effects.

Panel B of Table 4 reports the result for our main prediction using an alternative measure of pay for performance, i.e., unscaled delta. To minimize the concern that firm size drives the variation in unscaled delta, we additionally control for firm size (using the natural logarithm of total assets). The specification in this panel is the same as that in Panel A. Specifically, Columns (1) and (3) control for the CEO fixed effects, while Columns (2) and (4) control for industry, year, and CEO fixed effects. To make it concise, we focus on Column (1) for the illustration of the result. Column (1) reports that the coefficient on the GA-index is positive and significant (coeff = 0.291; t-stat = 6.26). This further confirms that the positive association between generalist CEOs and pay-performance sensitivity is robust to the measure of pay-for-performance. In terms of control variables, we find that larger firms, firms with more growth opportunity, higher leverage, and better operating and stock performance have higher pay-performance sensitivity. Overall, the evidence in both Panels A and B collectively support our main hypothesis (Hypothesis 1) that firms design compensation contracts with generalist CEOs in a way that closely link executive pay to firm performance.

4.3 Cross-sectional analysis

4.3.1 Learning CEOs' skills

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

We first examine whether the effect is stronger for younger CEOs and CEOs with shorter tenure. Younger CEOs and CEOs with shorter tenure give shareholders the exposure to higher asymmetric information regarding CEO true ability. Table 5 presents the results from the regressions of scaled delta on the GA-index for firms sorted by CEO tenure or CEO age.[8] Columns (1) and (2) report the result for CEOs with shorter versus longer tenure, respectively. Consistent with our prediction, the significantly positive relation between scaled delta and the GA-index only survives when CEOs are in their early tenure period (coeff = 0.374; t-stat = 5.93). The effect is also statistically and economically larger for CEOs early in office, according to the Wald test (p-value = 0.042).

Columns (3) and (4) report the result for younger versus older CEOs. We continue to find that the positive relation between the GA-index and pay-performance sensitivity only exists in the case when less information about CEOs is acquainted to the firm, i.e., younger CEOs (coeff = 0.317; t-stat = 4.94). Besides, how CEO expertise determines the wealth-performance sensitivity seems to be significantly different between younger and older CEOs as shown in the Wald test (p-value = 0.001). The evidence in Table 5 is also consistent with the finding in Pan et al. (2015) that lower uncertainty of CEO ability facilitates the market learning of CEOs' ability.

Taken together, the evidence in Table 5 is consistent with Hypothesis 2. More specifically, the lack of knowledge about generalists' true skills makes the board of directors design compensation contracts in a way that links CEO pay more closely to firm performance to mitigate generalists' tendency to overstate their abilities.

4.3.2 Importance of CEO ability in firm performance

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

To shed more light on the possible channel 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 to firm performance (i.e., Hypothesis 3). Recall that we predict that if CEO ability is more important to firm value creation, optimal contracting would call for higher pay-performance sensitivity to encourage CEOs to make more efforts to improve firm performance. This would reinforce the positive relation between generalist CEOs and pay-performance sensitivity. We measure the importance of CEO to firm performance using the following two measures: industry competition (Li et al. 2014) and firm past sales growth.[9]

Table 6 reports the results that empirically examine such a contention and finds that the results are consistent with the predictions of Hypothesis 3. We use the indicator variable (Generalist) to measure CEO generality. We then use its interaction with industry competition or sales growth to measure the effect of CEO importance to firm performance on the association between CEO general skills and pay-performance sensitivity. Column (1) of Table 6 uses the Herfindahl and Hirschman index (HHI) as an inverse measure of industry competition. Column (1) reports that the regression coefficient on the interaction term is -1.566 (t-stat=2.93), suggesting that the 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 documents that the positive relation is also significantly more pronounced for firms with higher sales growth than firms with lower sales growth (coeff = 0.184; t-stat = 2.43).

[9] We also try the same specification using R&D expenditures to proxy for the importance of CEOs in firm value generation as suggested by Pan et al (2015). Firms with more R&D expenditures seem to award higher pay-performance sensitivity compensation to CEOs with more general skills (coefficient=0.072 with t-statistic=0.13), although the partition does not yield a significant difference. We choose not to report the result here, since R&D expenditures are probably a better proxy for risk-taking which we will discuss later.

5. Additional Tests

5.1 The effect of CEO skills on incentive pay

In this section we consider several other measures of incentive pay and predict that the proportion of incentive pay increases with the generality of CEO skills. The first measure is the proportion of cash pay in total compensation which should be negatively correlated with pay-performance sensitivity. The second measures the proportion of stock pay. We measure the restricted stock value following the note by Coles, Daniel, and Naveen (2013). Since public firms in the U.S. report compensation in a new format starting from fiscal year 2007, we use a different method to calculate the restricted stock pay after fiscal year 2006. Specifically, the fair value of stock awarded (stock_awards_fv) is used after fiscal year 2006 to replace the corresponding value in the previously reported item.

The results are reported in Table 7. Columns (1), (3), and (5) report the regression results for the cash-to-total compensation ratio and Columns (2), (4), and (6) for stock-to-total compensation ratio. The measure of generality is the GA-index in Columns (1)–(4) and the Generalist dummy in Columns (5)–(6). Columns (1)–(2) control for the year and industry fixed effects, while Columns (3)–(6) control for the 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 design the optimal contract to reduce the 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 a propensity score matching to tackle the endogenous matching between firms and CEOs. Specifically, we run a probit model in which the dependent variable is the dummy for generalist CEOs. Again, CEOs whose general ability index is above the 80% percentile of the annual distribution is defined as generalists and the rest are specialists. Following Custódio, Ferreira, and Matos (2013), we use book assets, the conglomerate dummy, leverage ratio, R&D/Asset ratio, return on assets, the market-to-book ratio, cash-to-asset ratio, and capital expenditures to predict the likelihood of firms hiring a generalist CEO. Each new generalist CEO is matched to one specialist CEO hired in the same year, using the nearest neighborhood matching.[10]

There are in total 2,474 newly hired generalist CEOs who are matched to the same number of specialist CEOs. Panel A of Table 8 compares firm characteristics between the generalist and specialist CEO groups. The difference is statistically insignificant except for firm size. One potential reason is that firms which recruit generalists tend to be larger, as evidenced in the descriptive statistics in Table 3.

We estimate a fixed effect regression of pay-performance sensitivity on CEO generality in the matched sample, including the same set of variables used in Table (4) as controls. In Panel B of Table 8, the scaled delta (in its natural logarithm) calculated by Edmans, Gabaix, and Landier (2009) is used as the proxy for the sensitivity of CEO wealth to firm performance. As shown in Columns (1) and (2), the coefficient on general ability index (GA-index) is still statistically

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

significant and positive. Interestingly, compared with the case in which only CEO fixed effect is controlled, controlling for industry, year, and CEO fixed effects actually increases the slope coefficient on the GA-index from 0.126 (t-stat = 1.98) to 0.308 (t-stat = 5.08), which is more than double, which has the same pattern as shown in Table 4. The finding indicates that firms similar in observable characteristics offer compensation contracts with a higher delta when they recruit a CEO whose expertise can be more generally applied. Columns (3) and (4) use the dummy variable as the measure for CEO skill generality. We find that controlling for industry, year, and CEO fixed effects, the magnitude of the difference in pay-performance sensitivity between generalist and specialist CEOs is around 20%, which is similar to the estimate obtained from the original sample reported in Table 4.[11]

5.3 Instrumental variable estimation

As an additional robustness check for the endogenous issue that associates CEO general skills with pay-performance sensitivity, we use the noncompetition agreement enforcement index from Garmaise (2009) as an instrument for the general ability index. The noncompetition agreement aims to prevent CEOs (or employee in general) from working in the same industry, which would encourage CEOs to accumulate more general skills in states with a higher enforcement index of the noncompetition clause. In other words, the state-level noncompetition enforcement index should be positively associated with the level of CEO general skills, but it would not directly affect the level of pay-performance sensitivity. We therefore contend that the state-level enforceability of the noncompetition clause can serve as a valid instrument for CEO general skills.

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

Specifically, we average the state-level noncompetition enforcement index in the states where the CEO has held an executive position during his/her whole career. This is to mitigate the concern that CEOs may selectively work in states with a lower enforcement index. We run a two-stage least squares (2SLS) regression, with the enforcement index as the instrument for the GA-index in the first stage. The results are reported in Table 9. To be consistent, we control for the same set of variables in both stages and heteroskedasticity- and autocorrelation-robust standard errors are adjusted for clustering at the firm level. 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 noncompetition enforcement index is significantly and positively associated with the level of CEO general skills (coeff = 0.012; t-stat = 2.94). It confirms our presumption that the state-level noncompetition enforcement index can serve as a valid instrument for CEO general skills.[12]

Column (2) of Table 9 reports the result from the second-stage regression. We find that the general skill index is positively associated with the level of pay-performance sensitivity and is highly significant (coeff = 2.351; t-stat=10.95). Overall, the results in Table 9 lend further support to our main prediction that general skills lead to higher pay-performance sensitivity.

6. Possible Alternative Explanations

6.1 Risk taking

A possible explanation for our results can be that the board of directors selectively hires less risk-averse CEOs to add more risk to the firm. If the generality of skills is correlated with CEO's

[12] According to the "rules 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.

risk attitude, then optimal contracting will induce higher pay-performance sensitivity for CEOs with more general skills. Admittedly, we cannot completely rule out this possibility by controlling for the CEO fixed effects or employing a 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 firms that have higher risk.

We measure the riskiness of firm policies in two ways, following Cassell et al (2012). First, we adopt two volatility-based measures which increase with the riskiness of firm operational and financial policies, i.e., 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 of firm investment policies. Firms that are more aggressive in making R&D investment or less diversified are considered to be 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. Details regarding how it is calculated are 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 less 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 supporting that our results in Table 4 are driven by firms that are

more prone to risk-taking. There are even a few cases where the positive effect of the GA-index on pay-performance sensitivity is significantly larger for firms whose policies are of lower levels of riskiness. For example, for firms with less volatile cash flow (which indicates lower risk-taking) or lower idiosyncratic return volatility, the relation between the GA-index and pay-performance sensitivity is actually significantly more positive than those firms whose cash flow or stock return 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 rewarded. If the stock price of firms that hire specialists is systematically less efficient in 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 that hire generalist CEOs and those hire specialist CEOs.

We use five conventional measures to capture the information efficiency of stock prices. Firms with a high level of discretionary accruals, opacity, PIN, and analyst forecast dispersion, and firms covered by fewer analysts are more likely to be less efficient in incorporating new information. Discretionary accrual is calculated using the modified Jones model (1991). Opacity is measured as the sum of absolute value of discretionary accrual over t-2 to t. 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 forecast scaled by the absolute value of the earnings forecast, following Diether, Malloy, and Scherbina (2002). PIN is the probability of information-based trades and measures the asymmetric information between insiders and investors. The calculation of PIN follows the one suggested by the Venter and de Jongh (2004) extension of the Easley, Kiefer, O'Hara, and Paperman (EKOP 1996) model.

We regress the information efficiency of stock prices on CEO skill generality, controlling for firm characteristics as well as firm and year fixed effects.[13] The result from the fixed effect regression is presented in Table 11. We find that there is no evidence that a difference in price information efficiency exists between firms hiring generalist CEOs and those hiring specialist CEOs, suggesting that price efficiency is unlikely to be the alternative explanation.[14]

7. Conclusion

Building on the theoretical predictions, we test how generalist CEOs and pay-performance sensitivity are linked. The theory predicts that since generalist CEOs have more outside options, they have a tendency to overstate their true ability for higher pay. The optimal compensation contract will link a generalist CEO's pay more to firm performance due to asymmetric information between the CEO and shareholder about the CEO true ability. Empirical analysis supports the prediction that generalist CEOs have higher pay-performance sensitivity than do specialist CEOs. Our results are robust to the alternative measures of pay-performance sensitivity, the selection bias by using the propensity score matching, and the endogeneity issue about the measure of CEO general ability by using the instrumental variable estimation.

[13] 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.
[14] In the untabulated result, we also find that there is also no evidence supporting that the effect of the GA-index on pay-performance sensitivity is stronger for firms whose stock price is more informationally efficient.

In addition, the theory also predicts that the positive relation between CEO generality on pay-performance sensitivity should be stronger when the asymmetric information about the CEO true ability is more severe or the CEO is more important to firm performance. Our results are also consistent with these predictions. More specifically, the positive effect of CEO generality on pay-performance sensitivity is stronger when the knowledge of the CEO true ability is less certain such as younger CEOs or CEOs with shorter tenure or when the CEOs are more important to firm value creation such as firms in more competitive industries or firms with higher sales growth.

We also rule out two potential alternative explanations that the positive relation is inherited from the differences in CEO risk-taking attitudes or in stock price efficiency. We find that the positive relation between CEO generality and pay-performance sensitivity is not associated with CEO risk-taking behavior or the efficiency of stock prices.

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

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Appendix

Variable	Definition	Source
CEO pay		
Cash pay	The 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 equal to grant date fair value of stock awarded (stock_awards_fv) after fiscal year 2006 following Coles, Daniel, and Naveen (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, Daniel, and Naveen (2013).	ExecuComp
Delta	The sensitivity of executives' wealth for 1% change in stock price (measured in thousands), defined by Core and Guay (2002).	ExecuComp
Scaled delta	Scaled wealth-performance sensitivity, calculated as $\frac{\Delta Wealth}{\Delta \ln Firm\ Value}\frac{1}{Wage}$ by Edmans, Gabaix, and Landier (2009).	ExecuComp
Ln(Scaled delta)	The natural logarithm of scaled wealth-performance sensitivity.	ExecuComp
CEO characteristics		
GA-index	General ability index extracted from Custódio, Ferreira, and Matos (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 having been a CEO (X4), (5) dummy for having worked in a conglomerate (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 that takes the value of one if the CEO has a GA-index that is above the annual median of GA-index and zero otherwise.	Custódio et al. (2013)
CEO age	The age of CEOs in year t.	ExecuComp
CEO tenure	The number of years as a CEO in the current firm.	ExecuComp
Duality	Dummy that is equal to one if the CEO also serves as the chairman of the board.	ISS (formerly RiskMetrics)
Firm characteristics		
Log(Assets)	The natural logarithm of Total Assets (in millions) i.e., log(at)	Compustat
Market to book	The market value of assets divided by the book value of assets,	Compustat,

	calculated as (at-(at-lt+txditc)+(prcc_f*csho))/at.	CRSP
Stock return	Annual stock return, calculated as monthly compound return starting from the fourth month after fiscal year end of t-1 to the three months after fiscal year end of t.	CRSP
Leverage	Leverage ratio, defined as total liabilities / 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	
Profitability	Firm profitability, defined as EBITDA / total assets, i.e. oibdp/at.	Compustat
CF volatility	Variance of EBITDA (oibdpq, scaled by total assets (at)) calculated using observations in the past eight quarters.	Compustat
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	The 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 extractSed from the Compustat Segment file.	Compustat Segment File
HHI	Herfindahl and Hirschman index of industry net sale which is defined as the sum of the squared market shares of firms in each two-digit SIC industries.	Compustat
Log(#Analyst)	The natural logarithm of 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 the sum of absolute value of discretionary accrual over t-2 to t, where discretionary accrual is estimated using the modified Jones (1991) model.	Compustat
PIN	The probability of informed trade based on the Venter and de Jongh (2004) extension of the EKOP (1996) model, and measured over the annual period beginning 8 months before the firm's fiscal year end and expressed as a percentage.[15]	CRSP

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

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 in ExecuComp and CEO expertise can be measured based on their past working experience. Detailed variable definitions are described in the Appendix.

Variable	N	Mean	Median	StdDev	Min	Max
Total compensation	21,653	4,894	2,391	11,116	0.000	655,448
Cash compensation	21,653	1,352	939	1,664	0.000	51,750
Non-cash compensation	21,653	3,542	1,251	10,615	0.000	650,848
Restricted stock	21,376	692	0.000	5,022	0.000	650,812
Option value	21,376	2,279	600.003	8,780	0.000	600,347
Cash/Total compensation	21,616	0.485	0.443	0.284	0.000	1.000
Non-cash/Total compensation	21,616	0.515	0.557	0.284	0.000	1.000
Stock/Total compensation	21,339	0.088	0.000	0.171	0.000	0.791
Option/Total compensation	21,339	0.318	0.285	0.285	0.000	0.942
Delta	19,404	1,353	233.371	11,987	0.000	709,829
Scaled delta	21,641	323.889	7.164	28,190	0.000	4,126,727
GA-index	21,653	-0.005	-0.182	0.995	-1.504	7.230
CEO tenure	20,869	7.659	6.000	7.106	0.000	57.000
CEO age	20,711	55.486	56.000	7.402	29.000	91.000
Log(Assets)	21,402	7.528	7.154	1.676	1.619	14.598
Market to book	21,358	1.984	1.480	1.519	0.298	12.192
Leverage	21,513	0.229	0.216	0.182	0.000	0.938
Profitability	21,062	0.129	0.129	0.112	-1.145	0.416
Sales growth	21,105	0.148	0.092	0.342	-0.786	3.973
Investment	20,344	0.058	0.043	0.055	0.000	0.372
R&D	21,653	0.028	0.000	0.063	0.000	0.887
CF volatility	18,732	0.113	0.063	0.186	0.000	3.500
Stock return	21,653	0.173	0.102	0.529	-0.878	3.062
Duality	21,653	0.502	1.000	0.500	0.000	1.000
E-index	14,711	2.207	2.000	1.299	0.000	6.000

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)	(15)	(16)
(1)	log(Assets)																
(2)	Market to book	-0.211[a]															
(3)	Leverage	0.269[a]	-0.249[a]														
(4)	Profitability	0.000	0.276[a]	-0.131[a]													
(5)	Stock return	-0.065[a]	0.239[a]	-0.063[a]	0.096[a]												
(6)	CF volatility	-0.286[a]	0.229[a]	-0.084[a]	-0.204[a]	0.046[a]											
(7)	Sales growth	-0.023[a]	0.198[a]	-0.011	0.048[a]	0.098[a]	0.094[a]										
(8)	R&D	-0.281[a]	0.365[a]	-0.172[a]	-0.359[a]	0.031[a]	0.392[a]	0.092[a]									
(9)	HHI	-0.055[a]	0.021[a]	-0.005	0.023[a]	0.007	-0.003	-0.020[a]	0.032[a]								
(10)	GA-index	0.280[a]	-0.042[a]	0.110[a]	-0.035[a]	-0.022[a]	0.012	-0.033[a]	0.012[b]	0.021[a]							
(11)	Age	0.107[a]	-0.080[a]	0.041[a]	0.017[b]	-0.022[a]	-0.116[a]	-0.034[a]	-0.099[a]	0.009	0.129[a]						
(12)	CEO tenure	-0.068[a]	0.047[a]	-0.056[a]	0.049[a]	0.010	-0.030[a]	0.038[a]	-0.012	-0.021[a]	-0.128[a]	0.405[a]					
(13)	Total compensation	0.314[a]	0.087[a]	0.027[a]	0.034[a]	-0.001	-0.004	0.052[a]	-0.004	-0.008	0.165[a]	0.004	-0.006				
(14)	Cash/Total	-0.262[a]	-0.105[a]	-0.017[b]	0.018[b]	0.052[a]	-0.059[a]	-0.022[a]	-0.097[a]	0.021[a]	-0.189[a]	0.118[a]	0.141[a]	-0.327[a]			
(15)	Stock/Total	0.198[a]	-0.069[a]	0.074[a]	-0.007	-0.034[a]	-0.045[a]	-0.012[c]	-0.086[a]	-0.010	0.122[a]	-0.030[a]	-0.093[a]	0.150[a]	-0.345[a]		
(16)	Delta	0.104[a]	0.164[a]	-0.044[a]	0.048[a]	0.037[a]	-0.003	0.028[a]	0.014[b]	-0.011	0.024[a]	0.009	0.103[a]	0.117[a]	-0.010	-0.024[a]	
(17)	Scaled delta	0.027[a]	0.002	-0.007	-0.002	0.002	-0.004	0.003	-0.003	-0.009	0.011	0.024[a]	0.038[a]	-0.005	0.004	-0.006	0.797[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 5th quintile of annual GA-index distribution and the rest of CEOs are categorized as specialists (Specialists). Column (3) and (4) displays the difference in the mean and the corresponding significance level of t-test, respectively. Column (5) shows the correlation between each variable and the general ability index (GA-index), and Column (6) shows the significance level. ***, ** and * denote significance at the 1 %, 5 % and 10 % levels, respectively.

Variable	Specialists	Generalists	Difference = (2) – (1)		Correlation	
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Assets)	7.212	7.938	0.726	***	0.253	***
Market to book	2.084	1.920	-0.164	***	-0.064	***
Leverage	0.213	0.244	0.031	***	0.109	***
Profitability	0.135	0.130	-0.005	***	-0.039	***
Sales growth	0.135	0.120	-0.015	***	-0.035	***
Invest	0.061	0.054	-0.008	***	-0.080	***
RD/Assets	0.025	0.029	0.004	***	0.025	***
Stock return	0.182	0.166	-0.016	***	-0.023	***
CEO age	54.660	56.330	1.677	***	0.134	***
CEO tenure	8.640	6.966	-1.658	***	-0.130	***
CEO as Chairman	0.463	0.542	0.079	***	0.108	***
Total compensation (tdc1)	3,575	6,221	2,647	***	0.163	***
Cash compensation	1,155	1,551	395.590	***	0.161	***
Non-cash compensation1	2,420	4,672	2,252	***	0.146	***
Stock/Total	0.072	0.104	0.031	***	0.116	***
Cash/Total	0.422	0.354	-0.068	***	-0.152	***
Delta	1,168	1,540	371.480	**	0.029	***
Scaled delta	121.810	660.980	539.170	*	0.011	
Vega	96.510	194.690	98.170	***	0.202	***

Table 4: CEO Expertise and Wealth-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. The dependent variable in Panel A is the natural logarithm of scaled wealth-performance sensitivity (scaled delta), which is proposed by Edmans, Gabaix, and Landier (2009). In Panel B, the dependent variable is the natural logarithm of delta, calculated in a way following Coles, Daniel, and Naveen (2013). 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 a CEO is within the 5th quintile of annual GA-index distribution of sample CEOs and zero otherwise. Column (1) controls for the CEO fixed effect, and Column (2) for the CEO, industry, and year fixed effects. Column (3) and (4) replicates the specification of the first two columns, but use 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	0.138***	0.282***		
	(3.08)	(6.44)		
Generalist			0.118*	0.213***
			(1.76)	(3.16)
Market to book	0.136***	0.136***	0.136***	0.136***
	(7.62)	(7.46)	(7.60)	(7.39)
Leverage	-0.243	-0.169	-0.230	-0.145
	(-1.32)	(-0.90)	(-1.24)	(-0.77)
Profitability	0.357	0.462	0.320	0.382
	(1.15)	(1.49)	(1.04)	(1.23)
Stock return	0.211***	0.177***	0.208***	0.175***
	(9.01)	(7.97)	(8.85)	(7.87)
CF volatility	0.015	-0.121	0.025	-0.097
	(0.18)	(-1.31)	(0.29)	(-1.04)
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
CEO FE	Yes	Yes	Yes	Yes
N	18,324	18,324	18,324	18,324
Adj. R-squared	0.583	0.591	0.583	0.590

Table 4 – Continued

Panel B: Regression analysis using unscaled delta

Dependent variable: log(delta)	(1)	(2)	(3)	(4)
GA-index	0.291***	0.346***		
	(6.26)	(7.51)		
Generalist			0.286***	0.303***
			(4.69)	(4.91)
Log(Assets)	0.830***	0.830***	0.886***	0.897***
	(27.50)	(30.27)	(30.10)	(32.76)
Market to book	0.281***	0.283***	0.285***	0.286***
	(23.04)	(23.04)	(23.24)	(23.35)
Leverage	0.869***	0.717***	0.870***	0.720***
	(-6.99)	(-6.33)	(-6.98)	(-6.31)
Profitability	1.422***	1.515***	1.355***	1.426***
	(7.99)	(8.49)	(7.52)	(7.93)
Stock return	0.179***	0.185***	0.179***	0.186***
	(13.82)	(14.37)	(13.82)	(14.48)
CF volatility	-0.112	-0.102	-0.060	-0.048
	(-1.10)	(-0.97)	(-0.70)	(-0.55)
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
CEO FE	Yes	Yes	Yes	Yes
N	16,856	16,856	16,856	16,856
Adj. R-squared	0.880	0.888	0.879	0.887

Table 5: CEO expertise and wealth-performance sensitivity: Learning CEOs' skills

This table presents the relation between wealth-performance sensitivity and CEO expertise (GA-index) in sub-samples which differ with respect to CEO tenure and age. The dependent variable is the natural logarithm of scaled wealth-performance sensitivity (scaled delta), calculated by Edmans, Gabaix, and Landier (2009). The whole sample is divided into two equal sub-samples based CEO tenure or CEO age. The sub-sample in Column (1) (Column (2)) includes CEOs whose tenure is shorter (longer) than the median of CEO tenure in the annual distribution. Column (3) (Column (4)) includes CEOs with an age younger (older) than the median of CEO age in the annual distribution. A Wald-test is conducted to test whether the coefficient on the GA-index is equal between each pair of sub-samples and the corresponding p-value is presented. Year, industry, and CEO fixed effects are controlled in each regression. 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)
	CEO tenure		CEO age	
	Shorter	Longer	Younger	Older
GA-index	0.374***	0.065	0.317***	0.131
	(5.97)	(0.86)	(4.94)	(1.42)
Market to book	0.164***	0.136***	0.115***	0.188***
	(5.71)	(5.89)	(4.97)	(5.79)
Leverage	0.093	-0.312	-0.175	-0.328
	(0.28)	(-1.29)	(-0.61)	(-0.95)
Profitability	0.515	0.609	0.169	0.322
	(0.81)	(1.57)	(0.34)	(0.70)
Stock return	0.187***	0.165***	0.172***	0.190***
	(5.29)	(5.20)	(6.22)	(4.20)
CF volatility	-0.129	-0.136	-0.244	-0.007
	(-1.01)	(-0.85)	(-1.63)	(-0.04)
Test for equal coefficients	p-value = 0.042***		p-value = 0.001***	
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
CEO FE	Yes	Yes	Yes	Yes
N	9,621	8,118	9,439	8,122
Adj. R-squared	0.529	0.618	0.573	0.585

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 differs with respect to CEO's importance to the firm. Generalist is a dummy variable, which equals one if the GA-index of a CEO is within the 5th quintile of annual GA-index distribution and zero otherwise. The dependent variable is the natural logarithm of scaled delta which is constructed by Edmans, Gabaix, and Landier (2009). The differential effect is captured by the interaction between the dummy variable Generalist and two measures of CEO's importance: HHI and Sales growth. HHI is calculated using net sales of firms in the same Fama-French 48 industry. Sales growth is the average growth rate of sales in the past two years. The CEO, year, and industry fixed effects are controlled in all specifications. 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)
Generalist	0.306***	0.171**
	(3.80)	(2.50)
Generalist × HHI	-1.566***	
	(-2.93)	
HHI	-0.320	
	(-0.49)	
Generalist × Sales growth		0.184**
		(2.43)
Sales growth		0.006
		(1.61)
Market to book	0.136***	0.137***
	(7.39)	(7.50)
Leverage	-0.137	-0.123
	(-0.71)	(-0.65)
Profitability	0.377	0.369
	(1.21)	(1.17)
Stock return	0.171***	0.164***
	(7.68)	(8.07)
CF volatility	-0.096	-0.089
	(-1.04)	(-0.96)
CEO FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
N	18,203	17,908
Adj. R-squared	0.586	0.624

Table 7: Compensation Mix and Managerial Expertise

This table presents the result of OLS regressions linking the compensation mix of CEOs to their expertise as measured by the General Ability Index (GA-index). Generalist is a dummy variable, which equals one if the GA-index of a CEO is within the 5th quintile of annual GA-index distribution and zero otherwise. The sample consists of 3,928 unique CEOs in 2,324 unique firms from 1993-2007. The compensation mix includes the proportion of cash (salary+bonus) and restricted stock compensation. Columns (1) and (2) control for the year and industry fixed effects and Columns (3)-(6) control for the CEO, industry (2-digit SIC) 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)	(5)	(6)
Dependent variable	Cash/Total	Stock/Total	Cash/Total	Stock/Total	Cash/Total	Stock/Total
GA-index	-0.026***	0.011***	-0.021**	0.022***		
	(-7.80)	(5.17)	(-2.00)	(3.40)		
Generalist			-0.061***	0.022***	-0.027*	0.022**
			(-8.79)	(5.33)	(-1.90)	(2.25)
Log(Assets)	0.053***	0.014***	-0.020***	-0.000	-0.065***	0.048***
	(-20.27)	(9.05)	(-5.95)	(-0.36)	(-9.91)	(11.91)
Market to book	0.025***	0.004***	-0.013	-0.033*	-0.020***	-0.000
	(-7.35)	(-2.81)	(-0.47)	(-1.86)	(-6.03)	(-0.20)
Leverage	-0.020	0.049***	0.046	0.035	-0.012	-0.039**
	(-1.01)	(4.28)	(1.08)	(1.49)	(-0.43)	(-2.07)
Profitability	0.086**	0.036**	0.019**	0.002	0.050	0.041
	(2.49)	(2.46)	(2.23)	(0.39)	(1.17)	(1.62)
Sales growth	-0.003	-0.002	-0.226***	-0.012	0.020**	-0.005
	(-0.38)	(-0.50)	(-2.82)	(-0.26)	(2.37)	(-1.16)
CF volatility	0.088***	0.005	0.033	-0.022	-0.220***	0.053
	(-4.13)	(0.67)	(1.00)	(-1.53)	(-2.75)	(1.16)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
CEO FE	No	No	Yes	Yes	Yes	Yes
N	17,794	17,529	17,794	17,529	17,794	17,529
Adj. R-squared	0.224	0.177	0.429	0.385	0.429	0.385

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

This table presents estimates of the difference in CEO wealth-performance sensitivity between generalist CEOs and matched specialists. The matched sample is formed using propensity score matching in which a probit model is used to predict the likelihood of firms hiring a generalist CEO. The book assets, conglomerate dummy, leverage ratio, R&D/Asset ratio, return on assets, the 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 the nearest neighborhood matching. A CEO is defined as a generalist (Generalist) if his/her general ability index (GA-index) is above the 80% percentile within the annual GA-index distribution. In Panel B, 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. In Panel B, the scaled delta (in its natural logarithm form) proposed by Edmans, Gabaix, and Landier (2009) is used as the proxy for the sensitivity of CEO wealth to firm performance. Columns (1) and (3) control for the CEO fixed effect. Columns (2) and (4) control for the 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.

Panel A: Descriptive statistics for the propensity score matched sample

	Specialists	Generalists	Difference	p-value
Log(Assets)	7.853	8.061	0.208	0.000
Conglomerate	0.325	0.300	-0.025	0.065
Leverage	0.246	0.253	0.007	0.165
R&D	0.031	0.029	-0.002	0.337
Profitability	0.135	0.133	-0.002	0.429
Stock return	0.198	0.182	-0.016	0.267
Market to book	1.974	1.919	-0.055	0.182
Cash/Assets	0.120	0.117	-0.003	0.561
CAPEX/Assets	0.057	0.055	-0.002	0.255

Table 8 – Continued

Panel B: Regression analysis

	(1)	(2)	(3)	(4)
GA-index	0.126**	0.308***		
	(1.98)	(5.00)		
Generalist			0.109	0.201**
			(1.14)	(2.09)
Market to book	0.137***	0.139***	0.137***	0.140***
	(4.69)	(4.65)	(4.65)	(4.56)
Leverage	-0.133	0.108	-0.107	0.171
	(-0.57)	(0.51)	(-0.45)	(0.83)
Profitability	0.637**	0.933***	0.596*	0.827***
	(2.05)	(3.26)	(1.93)	(2.92)
Stock return	0.207***	0.169***	0.204***	0.165***
	(5.22)	(4.18)	(5.12)	(4.08)
CF volatility	0.036	-0.194	0.060	-0.125
	(0.21)	(-1.04)	(0.35)	(-0.70)
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
CEO FE	Yes	Yes	Yes	Yes
N	7,782	7,782	7,782	7,782
Adj. R-squared	0.694	0.722	0.694	0.719

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) from the second-stage regression. The noncompetition enforcement index is used as the instrumental for the general ability index (the GA-index). In the second-stage regression, the natural log of the scaled delta is regressed on the estimated GA-index 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 noncompetition enforcement index is the average of the state-level noncompetition enforcement index in the states where the CEO has held an executive position during his/her whole career. The noncompetition enforcement index is extracted from Garmaise (2009). The CEO, year, and industry fixed effects are controlled in all specifications. 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) First stage	(2) Second stage
	GA-index	log(Scaled delta)
GA-index		2.351***
		(10.95)
Market to book	-0.014**	0.177***
	(-2.08)	(10.57)
Leverage	0.478***	-1.449***
	(8.33)	(-8.29)
Profitability	-0.122	1.051***
	(-1.35)	(4.30)
Stock return	-0.037**	0.247***
	(-2.27)	(12.74)
CF volatility	-0.031	0.097
	(-0.59)	(1.03)
Noncompetition enforcement index	0.012***	
	(2.94)	
CEO FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
F-statistic	52.30	37.05
N	15,374	15,374
Adj. R-squared	0.586	0.624

Table 10: Managerial Expertise and Risk Taking

This table presents the result of regressions linking CEO wealth-performance sensitivity (delta) to his/her skill generality (GA-index) for firms with different levels of riskiness in investment and financial policies. The sample contains all CEOs in ExecuComp from 1993 to 2007. 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 R&D expenditures divided by total assets. Diversification (entropy) is calculated as $\sum P_s Ln(1/P_s)$, 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 volatility of cash flows during the last 8 quarters prior to 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, Profitability, Stock return, and CF volatility. A Wald-test is conducted to test whether the coefficients are equal between each pair of sub-samples and the corresponding p-value is presented. Year, industry and CEO fixed effects are controlled in each specification. 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	0.264***	0.299***	0.299***	0.287***	0.352***	0.297***	0.407***	0.354***	0.439***	0.180**	0.456***	0.162**
	(3.76)	(4.65)	(4.69)	(4.12)	(4.75)	(4.19)	(5.49)	(3.32)	(6.64)	(2.40)	(7.39)	(2.00)
Test for equal coefficients	p-value=0.628		p-value =0.337		p-value=0.846		p-value =0.221		p-value =0.012**		p-value =0.014**	
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	8,866	7,137	7,132	10,455	7,264	7,271	8,004	7,999	9,166	9,158	9,157	9,149
Adj. R-squared	0.597	0.593	0.608	0.651	0.644	0.596	0.720	0.416	0.697	0.467	0.820	0.635

Table 11: Managerial Expertise and Price Efficiency

This table presents the result of regressions that link the information efficiency (or inefficiency) embedded in stock prices to the CEO skill generality (GA-index). Generalist is a dummy variable, which equals one if the GA-index of a CEO is within the 5th quintile of annual GA-index distribution and zero otherwise. Discretionary accrual is calculated using the modified Jones model. Opacity is measured as the sum of absolute value of discretionary accrual over t-2 to t. PIN is the probability of information-based trades, following the Venter and de Jongh (2004) extension of the EKOP (1996) model. 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, Malloy, and Scherbina (2002). We control for firm age, the Market-to-Book ratio, leverage, return on assets, the cash flow volatility, R&D spending, the number of business segments and the industry sales concentration measured by HHI. Firm and year fixed effects are controlled in each specification. 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		Log(#Analyst)		Forecast dispersion	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GA-index	-0.002		-0.001		0.000		-0.004		-0.007	
	(-0.95)		(-0.16)		(0.47)		(-0.32)		(-0.53)	
Generalist		-0.002		-0.005		0.003*		-0.005		-0.021
		(-0.60)		(-0.54)		(1.77)		(-0.20)		(-0.76)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	15,313	15,313	15,302	15,302	18,165	18,163	12,692	12,692	12,560	12,560
Adj. R-squared	0.228	0.228	0.495	0.495	0.679	0.679	0.782	0.782	0.179	0.179