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Market-Indexed Executive Compensation: Strictly for the Young*

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Abstract

Academics have long argued that incentive contracts for executives should be indexed to remove the influence of exogenous market factors. Little evidence has been found that firms engage in such practices, also termed “relative performance evaluation”. We argue that firms may not gain much by removing market risks from executive compensation because (i) the market provides compensation for bearing systematic risk via the market risk premium and therefore the executive desires positive exposure to such risks, and (ii) the executive can, in principle, adjust her personal portfolio to offset any unwanted market risk imposed by her compensation contract. A testable implication is that stock-based performance incentives will be weaker when idiosyncratic risks are large but that market risks will have little effect. The data tend to support this hypothesis. In the full sample of CEO compensation from ExecuComp, stock-based incentives are strictly decreasing in firm-specific risk. Market-specific risks, however, are insignificantly related to incentives.

The story changes somewhat when we distinguish between younger and older CEOs. Our theory is arguably less applicable to younger CEOs who have more non-tradeable exposure to systematic risk through their human capital. Consistent with this argument, we find that market risks have a negative effect on stock-based incentive pay for younger CEOs, while they don’t for older CEOs. This in turn implies that the traditional argument for indexation is indeed valid for younger CEOs, and we find some evidence in favor of this proposition. Specifically, we find evidence of indexation for younger but not for older CEOs. Even for younger CEOs, however, the effect is far too weak to remove the effects of market risk. This is consistent with our finding that market risk reduces pay-performance for young CEOs, but leaves the question of why there is not more indexing for such executives.

1 Introduction

Researchers are starting to make sense of executive compensation. While there still exists controversy about whether the link between executive compensation and stock price performance is sufficiently strong, there is no doubt that the link exists on average and is becoming stronger over time (Jensen and Murphy (1990), Haubrich (1994), and Hall and Liebman (1998)). Turning to the enormous heterogeneity in pay sensitivities across firms, Aggarwal and Samwick (1999a) find evidence that firms tie their managers' pay more closely to stock values when such values are less volatile. This confirms the most basic tenet of principal-agent theory. However, empirical research has not uncovered any systematic evidence of the next most important result, that the agent should be relieved of risk if this can be done without sacrificing incentives. In particular, Holmstrom (1982) stresses that the *market* component of a firm's returns should be removed as an executive cannot affect it with his actions. There is little evidence of such market indexing, either explicitly in the design of stock options, or implicitly in the determination of option grants and bonuses (see for example, Aggarwal and Samwick (1999a), Antle and Smith (1986), and Janakiraman, Lambert and Larcker (1992)). Thus, while total stock return volatility seems to matter for compensation, more specifically-focussed relative market performance evaluation is seemingly nonexistent.

One explanation for the weak evidence of relative performance evaluation is that some indices are in fact informative of the agent's action. Aggarwal and Samwick (1999b) and Kedia (1999) show that using industry performance as a benchmark can have undesirable strategic consequences for the firm in imperfectly competitive markets. Consistent with this idea, Aggarwal and Samwick (1999b) find that such performance benchmarking is less prevalent in more concentrated industries. The theory, however, is less than satisfactory as an explanation for the lack of relative performance evaluation. First, the theory cannot be fully refuted by the data because strategic considerations could either increase or decrease the attractiveness of benchmarking, depending on whether competition is in quantities or prices. More importantly, it does not explain why broad *market* indices are infrequently used, as no single manager's output or pricing decision could have a large effect on an index such as the S&P 500. This is the subject of our paper. Specifically, we ask:

1. Why might market risks be unimportant for optimal compensation design?
2. Do firms distinguish between the market-specific risks and firm-specific risks inherent in total firm stock returns in their design of compensation packages?

To address these questions, we return to the fundamental issue of the risk-incentive trade-off,

and argue that including the returns on the S&P 500 in a compensation contract need not reduce the risk costs of providing incentives. The reason is that executives also have personal or private holdings of mutual funds and the like, and in principle they could simply undo any undesired market exposure from their incentive contracts by scaling back their own personal exposure (see Feltham and Xie (1994) and Jin (2000) for similar arguments). A potential problem with this argument is that even wealthy executives may face short-sale constraints or significant costs. But the manager need not necessarily short securities to achieve her desired exposure to systematic risk. The market provides compensation for bearing such risks, so even a risk-averse manager would desire some positive exposure to the market. The equity premium coined by Mehra and Prescott (1986), in fact, maintains that such compensation is extremely generous for a manager with reasonable risk aversion. Put another way, despite their significant exposure to the market through stock holdings and stock options in their own firm, doubtless most executives hold personal investments in positive-beta stocks. Thus, they may be able adjust their total market exposure without shorting.¹

Unfortunately, a direct test of this argument would require information on managers' private investment holdings. There is, however, a simple testable implication for the design of incentive compensation. If managers can offset the market component of risk, then this component is costless for incentive contracting. As a consequence, only the *idiosyncratic* component of firm risk will reduce the optimal slope of the pay-performance relationship. An increase in the *systematic* component, however, would have no effect. Our prediction is in stark contrast to Johnson and Tian (2000) who maintain that firms could provide their executives with more high-powered incentives if they were to filter out the market component of risk. We begin with the recognition that firms do *not* generally do such explicit filtration, but do differ in the amount of market and firm-specific risk that they pose for their executives. We can then determine empirically whether firms with a smaller amount of market risk actually do provide more high-powered incentives. Our model predicts that they will not, but that firms with a smaller amount of firm-specific risk will offer more high-powered incentives.

To test our hypothesis, we use similar data and techniques to Aggarwal and Samwick's (1999a) study which documented the importance of total firm risk for executive compensation. We extend their approach by decomposing risk into its systematic and idiosyncratic components. We find, as does Jin (2000) in contemporaneous work, that idiosyncratic risk has a significantly greater

¹Similar intuitions have been purported elsewhere in economics. Using cross-sectional Italian household survey data, Guiso, Jappelli, and Terlizzese (1996) find that individuals reduce their share of risky assets when their income risk rises. This is consistent with economic theory and the idea we have in mind for CEOs.

negative effect on pay sensitivities than does systematic risk. In fact, the coefficient on market risk is insignificantly different from zero.

The above results hold for our entire sample of executives. We then recognize that at least some executives may not be able to fully offset market risks from their compensation as we have assumed. We argue that younger executives are more likely to be in this position as the value of their human capital is both imperfectly tradeable and faces greater exposure to market changes than that of older executives who have already realized more of the value of their human capital. Consistent with this argument, we find that market risk does have a significant and negative effect on the use of stock-based compensation for younger executives, but has no effect for older executives.² This finding in turn suggests that market indexation is valuable for younger executives.³ We find confirming evidence of relative performance evaluation for younger executives, and no such effect for older executives. Indexation is far from complete, however, meaning that younger executives are still exposed to a substantial amount of market risk despite the fact that such exposure imposes the (observable) cost of weaker pay-for-performance. The Johnson and Tian (2000) argument that stock options should be indexed to remove market movements appears to have merit for younger executives.

The remainder of this paper is organized as follows. Section 2 provides the model of how executives can adjust their market exposure in light of the market risk inherent in their compensation package. Section 3 contains the empirical results supporting our hypothesis that firm-specific risk is more costly than market risk in a stock-based compensation package. Section 4 distinguishes between younger and older executives. Concluding remarks are in Section 5.

2 A Simple Model

We model a firm managed by a single executive with negative exponential utility and a coefficient of risk-aversion of ρ . She exerts effort a which increases firm value at a constant rate of one, but has a strictly convex cost of $C(a)$. We normalize the risk-free rate to zero and denote the market risk premium by r_m with associated variance of σ_m^2 . Contracts can be written on changes in firm value, which are determined by the Capital Asset Pricing Model (CAPM) plus any innovations in

²This argument should be distinguished from that of Gibbons and Murphy (1992) that younger executives may need weaker compensation-based incentives because their career concerns tend to already align their interests with those of their shareholders. We are not asking which type of executive has stronger incentives overall, but rather whether risk has a differential effect on the optimal incentives provided to younger versus older executives. As can be seen in *Tables 6A* and *6B*, overall sensitivities of pay to performance are similar for older and younger CEOs.

³Thanks to Paul Oyer for pointing out this implication of our findings for younger versus older executives.

managerial effort. Thus, the firm's total returns are:

$$r_T = \beta r_m + \varepsilon + (a - E(a)). \quad (1)$$

Shareholders in the firm are fully diversified so the market premium just compensates them for the risk $\beta^2 \sigma_m^2$. They require no compensation for bearing the remaining idiosyncratic risk, which has variance σ_ε^2 . Thus, their utility is determined only by the manager's effort net of its cost, and any risk premium they have to pay her. We restrict attention to linear incentive contracts of the form $W + \alpha r_T$ and normalize the manager's reservation utility to zero. By requiring the firm to place the weight α on all components of firm returns, we are not allowing the firm to use relative performance evaluation. But as we shall soon see, there is no benefit to using such compensation schemes under our assumptions.

The above assumptions are a simplified version of a standard principal-agent model. We depart from the standard approach by allowing the manager to choose her own personal holdings, letting δ denote the fraction of her wealth that she holds in the market portfolio. We do not consider the possibility that the manager can also adjust her exposure to her firm's idiosyncratic risk; see Garvey (1997) and Bettis, Coles and Lemmon (2000) for analyses of how managers might effectively short their own firms to avoid such exposure.⁴ With these considerations in hand, the manager's participation constraint can be written as:

$$U = W + \alpha(a - E(a)) - C(a) + (\alpha\beta + \delta)r_m - \frac{\rho}{2} \left(\alpha^2 \sigma_\varepsilon^2 + (\alpha\beta + \delta)^2 \sigma_m^2 \right) \geq 0. \quad (2)$$

There are two incentive compatibility constraints. The first is that the manager choose effort in her own interest, which can be expressed as the first-order condition:

$$\frac{\partial U}{\partial a} = \alpha - C_a = 0. \quad (3)$$

The second is that the manager choose her own most preferred market holding, which requires:

$$\frac{\partial U}{\partial \delta} = r_m - \rho(\alpha\beta + \delta)\sigma_m^2 = 0, \quad (4)$$

implying that her privately-optimal market exposure is

$$\delta^* = \frac{r_m}{\rho\sigma_m^2} - \alpha\beta. \quad (5)$$

⁴Garvey (1997) shows that firms must generally turn to alternative control mechanisms such as debt when managers can costlessly short their own firms. Bettis, Coles and Lemmon (2000) document the extensive use of firm-specific bans on such trading in addition to the SEC's restriction on insider trading.

Substituting δ^* into the participation constraint yields:

$$U = W + \alpha(a - E(a)) - C(a) + \left(\frac{r_m}{\rho\sigma_m^2}\right)r_m - \frac{\rho}{2} \left(\alpha^2\sigma_\varepsilon^2 + (r_m/\rho\sigma_m)^2\right) \geq 0. \quad (6)$$

The first-order condition for the optimal choice of the manager's pay-performance sensitivity α can be written as:

$$\frac{1}{C_{aa}}(1 - \alpha) - \rho(\alpha\sigma_\varepsilon^2) = 0, \quad (7)$$

thereby implying that the optimal sharing rule is

$$\alpha^* = \frac{1}{1 + C_{aa}\rho\sigma_\varepsilon^2}. \quad (8)$$

Thus, optimal pay-performance depends only on idiosyncratic risk. The key to the result of course is the manager's private holding $\delta^* = \frac{r_m}{\rho\sigma_m^2} - \alpha\beta$ completely offsets any incremental market exposure from the incentive contract, $\alpha\beta$. The manager could encounter short-sales constraints if the required δ^* is negative. But as documented by Mehra and Prescott (1986), the average premium on the market is approximately 7.5%, while the volatility is only around 12%, translating into a variance of 1.44%. This is known as the equity premium puzzle since the manager would rationally choose to short risk-free assets rather than the market portfolio even if her aversion to risk was extremely high (see also Kulatilaka (1996)).

For our purposes, the implication is that the first term in the manager's optimal market holdings (see (5)), $\frac{r_m}{\rho\sigma_m^2}$, may well exceed her proportional exposure to the market from her incentive contract $\alpha\beta$, even if the manager is offered high-powered incentives. In more common-sense terms, most CEOs are likely to hold mutual funds or other private exposure to the market even when their wealth is tightly linked to their firm's stock returns. While we do not have data on executives' private holdings, we can however test the implications of the model for the pay-performance relationship. In what follows, we delineate the model's testable predictions and confront them with the data.

3 Data and Basic Empirical Results

3.1 Hypotheses to be tested

A direct implication of our model is that the market component of risk has no effect on stock incentives, while idiosyncratic risk has a significant, negative effect. Our tests can now be formulated as a simple extension of the specification in Aggarwal and Samwick (1999a). They estimate the relationship

$$\text{Compensation} = K + b_1 r_T + b_2 \sigma_T^2 + b_3 (r_T \times \sigma_T^2),$$

where *Compensation* is the change in the CEO's firm-related wealth, r_T is the dollar return to shareholders and σ_T^2 is the cdf of the total variance of dollar returns. They transform total risk (stock return volatility) into a cumulative density function (cdf) where firms with the lowest volatility are in the low end of the cdf, and firms with high risk are in the high end. In their regression specification, the first coefficient, b_1 , is the executive's pay-performance for a firm with the lowest risk, and b_2 is the direct effect of risk on pay. The coefficient b_3 is of greatest interest as it captures the extent to which stock-based incentives are reduced when total firm risk is greater. Aggarwal and Samwick (1999) find as hypothesized that b_3 is negative in the data.

Our model dictates a similar specification, but we argue that firm-specific and market-specific risk have different costs. Thus, a direct test of our amended model is to estimate the following augmented specification:

$$Compensation = K + b_1 r_T + b_2 \beta^2 \sigma_M^2 + b_3 \sigma_\varepsilon^2 + b_4 (r_T \times \beta^2 \sigma_M^2) + b_5 (r_T \times \sigma_\varepsilon^2), \quad (9)$$

where $\beta^2 \sigma_M^2$ is the cdf of the market component of firm dollar returns, and σ_ε^2 is the cdf of the idiosyncratic component of dollar returns. With this specification, we can distinguish between a weak-form and a strong-form implication of our model, analogous to Janakiraman, Lambert and Larcker (1992). The weak-form implication is that while both b_4 and b_5 are negative, b_4 is smaller in absolute value, meaning that systematic risk has a *smaller* effect on compensation than does firm-specific risk. The strong-form implication is that b_4 is zero, meaning that risk has *no effect* on stock-based incentives when it stems from market sources.

The strong-form hypothesis requires executives to be able to fully offset unwanted market exposure from their incentive contracts. Consider, however, the position of a young executive who has a large fraction of his wealth tied up in his firm's shares and options, and whose human capital has a beta of one and represents a fraction θ of his wealth. Such an executive would need to set his personal financial holdings at $\delta = (r_m / \rho \sigma_m^2) - \alpha \beta - \theta$. If this value is negative, or if it is so small as to threaten his ability to invest in tax-preferred retirement vehicles, he may be effectively averse to market risk from his employer. Market risk would be costly for incentive contracting with such an executive, and we would expect to find that it has a negative effect on estimated stock-based incentives along with the firm-specific piece. On the other hand, older CEOs have most likely realized many of the returns on their human capital and consequently are less averse to market risk. We test these hypotheses in what follows.

3.2 Data and Descriptive Statistics

Our data come from two primary sources. Firm betas and returns are estimated from CRSP, and the compensation data come from Standard and Poors' ExecuComp. Our sample period is from 1992 to 1998, beginning in the first year of the ExecuComp data and extending two years longer than Aggarwal and Samwick (1999a). *Table 1* summarizes the basic variables of interest. Our study uses just over 1,400 large American firms, which pay their CEOs a salary and a bonus that both average approximately \$600,000 per year. As is well-known, stock option grants are the largest component of compensation, at least if they are valued according to Black-Scholes. Our firms granted options with an average Black-Scholes value of nearly \$1.4 million each year, but the median is far more modest at just under \$400,000. This divergence, plus the extremely large maximum grant value, indicate the presence of some extreme outliers in the data. To reduce the effect of such outliers on our inferences, we follow Aggarwal and Samwick (1999a) and estimate median regressions as well as OLS regressions on winsorized data.⁵

Our beta and standard deviation values are computed using the preceding five years of monthly data. The betas reported in this paper use a simple OLS regression of log returns on the returns to the value-weighted CRSP index. Results are virtually identical if we compute Scholes-Williams beta values. Not surprisingly, since our sample includes virtually the entire S&P 500 and other prominent firms, the average and median betas are essentially one. Betas vary widely in the sample, which is important for our purposes as we need to identify the effect of the market component of firm risk on compensation and how it potentially differs from the firm-specific component.

The simple correlations reported in *Table 2* reveal few surprises. All components of compensation are positively related to one another and are positively related to firm size. Larger firms also tend to be less risky as measured by percent stock returns, and in our sample period the small firm effect has largely disappeared. The various components of pay are all positively related to stock returns, although our interest is in how this relationship varies across the sample and we now turn to this task.

3.3 Effects of systematic versus firm-specific risk

To insure that our extended data sample concur with the Aggarwal and Samwick (1999a) findings, we first replicate their results in *Table 3*. The dependent variable is the change in the manager's

⁵The youngest CEO in our sample was the 24-year old CEO of Carson Pierie Scott in 1995, who lasted only one year. Michael Dell was the second-youngest CEO at 29 in 1993. Our oldest CEO is Norman E. Alexander of the Sequa Corporation who was 84 years old in 1998.

wealth stemming from firm sources, defined as the sum of cash compensation, the Black-Scholes value of new options granted, the value of restricted stock, long-term incentive payments, and changes in the value of existing options and shares. Since we are interested in changes in CEO wealth, we end up with six years of pay changes data from the 1992-1998 time series. Similar to Aggarwal and Samwick (1999a), we use dollar values for both returns and for risk measures as this is the correct unit in theory.⁶ We also follow their convenient normalization of transforming the variance of dollar returns into its empirical cumulative density function, so that the estimated coefficient on the interaction of dollar returns and the cdf of dollar risk represents the effect on pay-performance of moving from the least to the most risky firm in our sample. We also include year dummies to control for changes in pay levels over time.

In the first column of *Table 3*, we estimate an OLS regression with robust standard errors. We find that the pay-for-performance sensitivity is \$47 per \$1,000 increase in market capitalization for a CEO in a firm with the lowest total variance. The firm with median variance awards its CEO with a pay-for-performance sensitivity of $\$47 - \frac{1}{2} \times \$45.2 = \$24.4$. For the firm with the maximum variance, the pay sensitivity is $\$47 - \$45.2 = \$1.8$. Turning to the median regression in the second column, we replicate almost exactly Aggarwal and Samwick's finding that the sensitivity of pay to stock price performance is strongly negatively related to firm risk, so that a firm with the highest level of risk has almost no sensitivity of pay to the stock price. Observe that we estimate a somewhat smaller median pay-performance sensitivity of \$12.33 (Aggarwal and Samwick's (1999a) median pay sensitivity is \$14.52), but our sample period is longer.

Table 4 contains the empirical analysis of our model's prediction that market risk should *not* matter for performance pay. Market risk is specified as the empirical cdf of the dollar variance that is due to the market, and firm risk is the cdf of the remaining dollar risk. Under the OLS and median regressions in the first and second columns, we find support for our hypothesis that market risk has *no effect* statistically on incentive-based pay compensation. In the case of the median regression, the estimated pay sensitivity is

$$\$22.06 - \$15.4 \times cdf(\text{firm-specific variance}) - \$0 \times cdf(\text{market-specific variance}).$$

Therefore, a CEO in a firm with the median level of firm-specific variance is awarded a pay sensitivity of $\$22.06 - \$15.4 \times \frac{1}{2} = \14.36 , irrespective of the firm's level of market-specific variance. The OLS estimates are also consistent with the strong-form implication of our model, and thus

⁶It is well-known (see, e.g., Garen (1994)) that percentage risk often has a positive rather than a negative effect on pay-performance. However, the theory is inconclusive with respect to this measure. The risk imposed on an executive from tying his pay to the firm is correctly specified in dollar terms.

the data are very encouraging for our model’s prediction that firms do adjust pay sensitivities to firm-specific risk much more than to market-specific risks.

3.4 Assessment of the results

Our empirical results are arguably quite strong. Moreover, the measurement error that undoubtedly exists in our tests tends against our findings. To see this, consider the following. Even if we have avoided problems of bid-ask bounce and time-varying risk by using monthly returns and a five-year window, our estimates of the market component of risk are sure to be noisy. Additionally, our market index is not a perfect measure of the market portfolio, and second our β estimates are just that, estimates. Such errors will tend to bring the estimated effects of the two types of risks closer together. There are then two possibilities. First, we might be underestimating the market component. This will inflate the risk component without affecting its covariance with the manager’s pay, thereby reducing the estimated coefficient on the idiosyncratic component without affecting our estimate of the market component’s effect on incentive pay. Second, a similar effect occurs in cases where we overestimate the market component. Now we will incorrectly label some of the idiosyncratic risk as market risk, therefore erroneously obtaining a negative coefficient on the market as well as the idiosyncratic component.

A related problem in our empirical specifications is the multicollinearity between our alternative measures of risk. While multicollinearity is inevitable when using interaction terms, there is another less obvious issue when we decompose returns into their components. While it is theoretically correct to use dollar values for both types of risk, this inevitably introduces a significant positive correlation between market and firm-specific risk. Large firms tend to have the highest values for both types of risk. Apparently, however, we can still estimate distinct coefficients for the two variables.

Turning to theoretical considerations, Prendergast (2000) argues that the importance of CEO effort may be positively correlated with risk, making it difficult to separately identify the negative and direct effect of risk on stock-based pay. Like Aggarwal and Samwick (1999a), we are able to estimate a negative coefficient, at least for firm-specific risk. Prendergast’s (2000) argument can explain our results if CEO effort is more positively correlated with systematic than with idiosyncratic risk. We see no reason why this should be the case, but like Jin (2000), our results are robust to crude controls for the importance of CEO effort such as tobin’s q or the CEO’s length of service (see also Gibbons and Murphy (1992)).⁷

⁷Tenure is positively associated with age, all else equal, but does not provide as plausible a measure of the

Jin (2000) reports similar results to ours in a regression that uses estimated pay-performance sensitivity as the dependent variable. He also reports tests controlling for executive and firm fixed-effects. While he finds that the results are qualitatively similar, we are skeptical of such controls for our purposes because they restrict attention to changes over time in betas and in risk. To reduce measurement error, we have estimated these variables using five-year windows so that year-to-year changes are muted. Equally important, it is well known that estimated volatilities tend to be mean-reverting, while compensation contracts should presumably be set based on stable firm parameters.

This is not, however, to say that executive attributes are unimportant to our results. The critical assumption of the theory is that executives have no demand for employer-provided insurance from systematic risk as they can arrange this for themselves. As argued earlier, this assumption is less plausible for younger executives who are most likely less diversified in both their human capital and financial capital. To test this argument, we now decompose our sample according to the age of the executive.

4 The differences between younger and older CEOs

4.1 Effects of CEO Age on Pay-Sensitivities

In *Tables 5A* and *5B*, we replicate the Aggarwal and Samwick (1999a) method for younger CEOs (those who are no older than 56) and older CEOs (those who are older than 56). We obtain similar results if we use a continuous measure of age and interact it with our risk measures, but the results here are more intuitive and allow all coefficients to differ according to age. The pay sensitivity for the CEO of a firm with median firm variance appears to be nearly identical for the younger and older CEOs. OLS gives a pay sensitivity for a firm with median variance at \$23.75 for younger CEOs, and \$25.0 for median older CEOs. In the median regression for younger CEOs, the median sensitivity is \$12.45, and is \$12.65 for the older CEOs. Thus, Aggarwal and Samwick's (1999a) results are not particularly sensitive to CEO age.

Given that the effects of total firm variance are not CEO age-dependent, we now test our more general specification on the two age groups. In *Tables 6A* and *6B*, we estimate the relationship between changes in CEO wealth on both firm-specific and market-specific risks for CEOs below and above the median age. In both regression models, market-specific risks are significantly related

importance of market-sensitive human capital. Also, the correlation between tenure and age is less than 15% in our sample.

to pay sensitivities for *younger* CEOs. In fact, in the median regression, firm-specific risks are no longer important. Their importance does remain in the OLS specification and in a robust regression available from the authors upon request. We conclude from the empirical results in *Table 6A* that market risks and firm-specific risks are important for younger CEOs. This supports the idea that younger CEOs are less diversified and prefer some insurance from the firms for which they work. Turning to the older CEOs, the analysis contained in *Table 6B* shows that market-specific risks do not affect pay sensitivities for older CEOs. Neither of the specifications exhibit a significant coefficient for market risk. This is consistent with older CEOs having less of their wealth in the form of non-marketable human capital and in turn being better able to better able to offset unwanted market risks imposed by their employers' compensation packages.

4.2 Evidence of indexing for younger and older executives

To this point we have *presumed* that firms do not index executive compensation. This is a reasonable presumption based on past research and on the fact that executive stock option plans almost without exception have an exercise price that is fixed at grant date rather than linked to any market index. The results in Section 3 suggest that this practice has little cost for the average firm. However, the results on younger and older CEOs reported in the previous subsection modify this conclusion; market-indexed compensation may be valueless for firms with older executives, but exposure to market risks seems to impose a cost for firms with younger executives.

Table 7 confirms the standard finding that the average firm does not filter out the effects of market movements in determining executive compensation. The first two columns use the simplest possible benchmark; the return the firm would have achieved if it had exactly tracked the value-weighted S&P 500. If firms used such a benchmark in evaluating their executives, we would find a negative coefficient on this index. The intuition is that a given level of firm performance is less impressive when the overall market has performed better. We find no evidence of such an effect in the data. The last two columns in *Table 7* follow basic finance theory and the theory of relative performance evaluation more closely; in order to remove the market component of their returns it is necessary to adjust for the firm's exposure to such risks. Accordingly, the new dependent variable is the expected dollar return the firm should have produced in a given year according to the capital asset pricing model. The results do not indicate that firms make use of such an index either.

Table 8 returns to the simple S&P 500 benchmark but distinguishes between younger and older executives. The results of Section 3 imply that ignoring this benchmark has little cost for firms

with older executives, but that this practice is costly with a younger executive. Consistent with this, we find evidence of indexation for the younger, but not for the older subsample of CEOs. If indexation were complete, however, the negative coefficient on the index would be of the same magnitude as the positive coefficient on firm returns. In no specification is the effect of the index even one-fifth as large as that of firm returns.

One explanation for this last result is that we have incorrectly specified the index. Theory does not suggest that firms should simply take out the returns from a market index. Rather, they should also account for their own firm's exposure to such an index. *Table 9* recognizes this by replacing the S&P benchmark with the CAPM dollar expected return for each firm i , defined as the market capitalization at the beginning of the year t times $r_{ft} + \beta_{it}(r_{mt} - r_{ft})$. The risk-free rate is the 30-year t-bill rate for the year, the beta is estimated for each firm-year using the previous five years of monthly data, and the return on the market is the realized return on the value-weighted S&P 500 as used in *Table 8*. While this index is better grounded in theory, the empirical results are somewhat weaker than those using the simple market index. We confirm that such theoretically-preferred relative performance is used in practice for younger and not for older executives, but also confirm that younger executives are still exposed to significant market risk.

The results reported in this section use the simplest possible specification to assess the use of relative performance evaluation. We obtain the same conclusion if we use the more elaborate methods of Janakiraman, Lambert and Larcker (1992) or Aggarwal and Samwick (1999a): (i) there is no evidence of relative performance evaluation for older executives and (ii) there is such evidence for younger executives, but the indexation is far from complete. This second finding is consistent with our earlier result that market risk is negatively associated with the use of stock-based pay for younger executives. If indexation were complete, we would not find such an effect; employers would provide young executives with the same level of insurance from market risks that older executives can apparently provide for themselves.

5 Concluding remarks

Market-indexed incentive pay is only valuable if executives have a demand for employer-provided insurance from systematic risk. Our empirical results suggest that many executives have little demand for such insurance. There is evidence that younger CEOs do have some such demand, and market-indexed compensation schemes such as options could be valuable in this setting. We find some evidence that such indexation is used in practice, but not nearly to the extent predicted by

other theories (e.g., Holmstrom (1982)).

It should be emphasized that our results apply only to the use of broad market indices. Our theoretical arguments do not necessarily apply to narrower industry indices because (i) trading in such indices may not be well-developed and (ii) such indices may not provide positive expected returns so that the executive desires no exposure to such risks and would need to short-sell in order to offset exposure from the compensation contract.

We should also stress that we use a traditional principal-agent setting where the cost of providing incentives to the executive is inefficient risk bearing. An alternative view is that the executive's participation constraint does not bind so that the cost of incentive pay is actually the dollar value of the stock or option that the executive is granted. In such a setting, indexation may appear more appealing. For example, Johnson and Tian (2000) show that by indexing the exercise price of a stock option, the firm can significantly reduce its value to the executive without greatly reducing its hedge ratio, that is, its sensitivity to changes in the stock price. Our empirical results still call this interpretation into question, since we find that firms are more willing to provide stock-based pay when risks are driven by the market rather than firm-specific factors. The alternative would have to be that boards simply have little concern for the fact that they are "giving away" shareholders' money by so doing. Of course, such an interpretation is a radical departure from standard principal-agent theory in which contracts are set to maximize shareholder wealth subject to constraints of effort and risk.

6 References

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Table 1: Descriptive Statistics

Salary and Bonus represent the CEO's yearly salary and bonus values. Option Value represents the Black-Scholes value of the options granted to the CEO in the year. CEO Age is the CEO's age in the data year. Stock return is the percentage return for the firm over its fiscal year. Market Cap of Equity is the firm's market capitalization at the end of the firm's fiscal year. Our beta and standard deviation values are computed using the preceding five years of monthly data. The betas reported in this paper use a simple OLS regression of log returns on the returns to the value-weighted CRSP index. Compensation data and market value are in millions of yearly dollars.

Variable	Obs	Mean	Median	SD	Min	Max
Salary	6,488	0.577	0.525	0.306	0	3.65
Bonus	6,488	0.584	0.308	1798	0	102
Option Value (Black-Scholes)	6,461	1.39	0.353	4917	0	193.5
Age of CEO (years)	6,488	51.7	56	17.0	24	84
Stock return (%)	6,483	19.70	13.25	100.4	-97.2	7150
Market Cap of Equity	6,488	4030	1054	10.41	1.51	239.6
Beta	5,961	1.106	1.051	0.577	-1.96	5.50
Standard deviation of % returns	5,961	33.93	30.51	15.4	7.59	177

Table 2: Simple Correlations

Salary and Bonus represent the CEO's yearly salary and bonus values. Option Value represents the Black-Scholes value of the options granted to the CEO in the year. CEO Age is the CEO's age in the data year. Stock return is the percentage return for the firm over its fiscal year. Market Cap of Equity is the firm's market capitalization at the end of the firm's fiscal year. Our beta and standard deviation of returns (SD returns) values are computed using the preceding five years of monthly data. The betas reported in this paper use a simple OLS regression of log returns on the returns to the value-weighted CRSP index.

	Salary	Bonus	Option Grants	CEO Age	Returns	Market Cap	Beta	SD Returns
Salary	1							
Bonus	0.192	1						
Option Grants	0.189	0.189	1					
CEO Age	0.226	0.073	0.033	1				
Returns	0.013	0.098	0.103	0.014	1			
Market Cap	0.473	0.175	0.175	0.109	-0.030	1		
Beta	-0.043	0.065	0.065	-0.068	0.057	-0.054	1	
SD Returns	-0.281	0.033	0.033	-0.176	0.020	-0.215	0.540	1

Table 3: Changes in CEO Wealth – Total Firm Risk

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, the interaction of dollar returns and the cdf of total firm dollar variance, the cdf of total firm dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level, ** at the 5% level and *** at the 10% level.

Variable	OLS Regression	Median Regression
Intercept	−1,353.6 (1,208.6)	−33.7 (120.9)
Dollar returns	47.0* (5.26)	22.43* (1.45)
\$ Returns × cdf of total dollar variance	−45.2* (5.5)	−20.2* (1.73)
cdf of total dollar variance	8,993.2* (1,781.6)	2,430.5* (188.5)
R^2	0.2439	0.0946
Sample Size	5,931	5,931

Table 4: Changes in CEO Wealth – Firm and Market Risk

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, the interaction of dollar returns and the cdf of firm-specific dollar variance, the interaction of dollar returns and the cdf of systematic dollar variance, the cdf of firm-specific dollar variance, the cdf of systematic dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. For the OLS regression, the data were winsorized at the 1% tails and robust standard errors are calculated. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level.

Variable	OLS Regression	Median Regression
Intercept	−1,544.1 (1,438.4)	−155.6 (133.3)
Dollar returns	46.2* (5.12)	22.06* (1.49)
\$ Returns × cdf of firm-specific dollar variance	−37.3* (7.62)	−15.4* (4.0)
\$ Returns × cdf of systematic dollar variance	−7.12 (7.38)	−4.4 (4.38)
cdf of firm-specific dollar variance	5,852.8 (4,591.0)	929.2 (553.2)
cdf of systematic dollar variance	3,369.6 (4,650.2)	1,597.2* (613.5)
R^2	0.2432	0.0946
Sample Size	5,931	5,931

Table 5A: Changes in CEO Wealth for Younger CEOs – Total Risk

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, the interaction of dollar returns and the cdf of total firm dollar variance, the cdf of total firm dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. For the OLS regression, the data were winsorized at the 1% tails and robust standard errors are calculated. This sample contains all CEOs whose age is at or below the median age of 56 years old. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level, ** at the 5% level, and *** at the 10% level.

Variable	OLS Regression	Median Regression
Intercept	-1,063.0 (1,661.3)	174.6 (275.1)
Dollar returns	45.2* (6.8)	22.2* (2.7)
\$ Returns \times cdf of total dollar variance	-42.9* (7.2)	-19.5* (3.56)
cdf of total dollar variance	10,416.4* (2,467.9)	2,896.1* (463.1)
R^2	0.2340	0.075
Sample Size	2,768	2,768

Table 5B: Changes in CEO Wealth for Older CEOs – Total Risk

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, the interaction of dollar returns and the cdf of total firm dollar variance, the cdf of total firm dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. For the OLS regression, the data were winsorized at the 1% tails and robust standard errors are calculated. This sample contains all CEOs whose age is above the median age of 56 years old. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level and ** at the 5% level.

Variable	OLS Regression	Median Regression
Intercept	−1,453.4 (1,860.5)	−436.3 (324.8)
Dollar Returns	48.3* (5.7)	23.6* (1.84)
\$ Returns × cdf of total dollar variance	−46.6* (5.9)	−21.9* (2.19)
cdf of total dollar variance	8,051.0** (3,069.9)	2,523.6* (567.0)
R^2	0.2497	0.1185
Sample Size	2,742	2,742

Table 6A: Changes in CEO Wealth for Younger CEOs – Firm and Market Risk

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, the interaction of dollar returns and the cdf of firm-specific dollar variance, the interaction of dollar returns and the cdf of systematic dollar variance, the cdf of firm-specific dollar variance, the cdf of systematic dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. For the OLS regression, the data were winsorized at the 1% tails and robust standard errors are calculated. This sample contains all CEOs whose age is at or below the median age of 56 years old. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level, ** at the 5% level, and *** at the 10% level.

Variable	OLS Regression	Median Regression
Intercept	−1,048.2 (1,823.8)	194.2 (330.1)
Dollar returns	43.8* (6.8)	23.2* (3.75)
\$ Returns × cdf of firm-specific dollar variance	−24.4** (11.9)	0.08 (8.1)
\$ Returns × cdf of systematic dollar variance	−17.2*** (8.9)	−21.0** (9.0)
cdf of firm-specific dollar variance	6,935.8 (5,333.2)	1,640.0*** (938.3)
cdf of systematic dollar variance	3,635.9 (5,516.2)	1,167.6 (1,062.6)
R^2	0.2345	0.0758
Sample Size	2,768	2,768

Table 6B: Changes in CEO Wealth for Older CEOs – Firm and Market Risk

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, the interaction of dollar returns and the cdf of firm-specific dollar variance, the interaction of dollar returns and the cdf of systematic dollar variance, the cdf of firm-specific dollar variance, the cdf of systematic dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. For the OLS regression, the data were winsorized at the 1% tails and robust standard errors are calculated. This sample contains all CEOs whose age is above the median age of 56 years old. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level and *** at the 10% level.

Variable	OLS Regression	Median Regression
Intercept	−1,752.8 (2,186.9)	−774.1* (252.7)
Dollar returns	48.0* (5.3)	24.1* (2.02)
\$ Returns × cdf of firm-specific dollar variance	−51.7* (7.4)	−23.0* (4.35)
\$ Returns × cdf of systematic dollar variance	5.44 (8.52)	0.44 (3.57)
cdf of firm-specific dollar variance	5,919.0 (6,450.4)	181.3 (1,130.6)
cdf of systematic dollar variance	−2,245.2 (6,790.5)	2,736.1* (957.0)
R^2	0.2508	0.1192
Sample Size	2,742	2,742

Table 7: Testing for Benchmarking Effects on the Full Sample

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, benchmark dollar returns, the interaction of dollar returns and the cdf of firm-specific dollar variance, the interaction of dollar returns and the cdf of systematic dollar variance, the cdf of firm-specific dollar variance, the cdf of systematic dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. Benchmark dollar returns in the S&P 500 regressions use the return on an equivalent sized investment in the value-weighted S&P 500 and the benchmark. Benchmark dollar returns in the CAPM regressions are based on expected dollar returns using the 30-year T-bill rate as the riskless rate and firm-specific betas. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level.

Variable	OLS	Median	OLS	Median
	S&P 500	S&P 500	CAPM	CAPM
Intercept	-6,206 (4,307)	-280 (148)	-5,288 (3,196)	-152 (158)
Dollar returns, firm	48.9* (6.60)	21.9* (2.31)	49.1* (6.62)	22.0* (2.47)
Dollar returns, benchmark	-1.38 (1.71)	-0.252 (0.153)	-0.164 (1.40)	-0.007 (0.297)
\$ Returns \times cdf of firm-specific dollar variance	-36.4* (7.76)	-14.8* (4.84)	-38.7* (7.89)	15.0 (5.14)
\$ Returns \times cdf of systematic dollar variance	-6.65 (7.85)	-4.76 (4.12)	-6.42 (7.73)	-4.43 (4.43)
cdf of firm-specific dollar variance	8,265 (5,123)	1,065 (559)	7,035 (4,810)	939 (466)
cdf of systematic dollar variance	3,728 (5,206)	1,541* (568)	2,178 (5,319)	1,600* (576)
R^2	0.252	0.095	0.251	0.095
Sample Size	5,931	5,931	5,931	5,931

Table 8: Testing for Differential Benchmarking Effects
Between Younger and Older CEOs (S&P 500 Benchmark)

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, benchmark dollar returns, the interaction of dollar returns and the cdf of firm-specific dollar variance, the interaction of dollar returns and the cdf of systematic dollar variance, the cdf of firm-specific dollar variance, the cdf of systematic dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. Benchmark dollar returns are estimated as the return on an equivalent sized investment in the value-weighted S&P 500 and the benchmark. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. This sample contains all CEOs whose age is at or below the median age of 56 years old. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level, ** at the 5% level, and *** at the 10% level.

Variable	OLS	OLS	Median	Median
	Younger	Older	Younger	Older
Intercept	-1,799 (2,686)	-1,705 (2,689)	171 (307)	-698** (257)
Dollar returns, firm	44.0* (8.13)	48.6* (5.12)	23.6* (3.52)	23.7* (2.45)
Dollar returns, S&P 500	-7.05* (2.81)	0.167 (1.93)	-1.08* (0.096)	-0.021 (0.47)
\$ Returns \times cdf of firm-specific dollar variance	-25.6* (11.8)	-52.2* (7.75)	0.194 (7.57)	-22.4* (4.82)
\$ Returns \times cdf of systematic dollar variance	-16.8* (8.22)	5.68 (18.2)	-20.3* (9.42)	0.761 (3.13)
cdf of firm-specific dollar variance	6,885 (6,421)	5,895 (6,470)	1,703* (832)	206 (1,072)
cdf of systematic dollar variance	3,082 (5,421)	-2,314 (6,330)	1,193 (1,046)	2,637* (1,087)
R^2	0.243	0.263	0.077	0.118
Sample Size	2,768	2,742	2,768	2,742

Table 9 Testing for Differential Benchmarking Effects
Between Younger and Older CEOs (CAPM Benchmark)

This table contains an OLS regression and a median regression with bootstrapped standard errors of changes in CEO wealth regressed on firm dollar returns, benchmark dollar returns, the interaction of dollar returns and the cdf of firm-specific dollar variance, the interaction of dollar returns and the cdf of systematic dollar variance, the cdf of firm-specific dollar variance, the cdf of systematic dollar variance, and year dummies. Changes in CEO wealth is defined as cash compensation plus the Black-Scholes value of new options granted plus the value of restricted stock plus long-term incentive payments, plus changes in the value of existing options and shares. Benchmark dollar returns are estimated based on expected dollar returns using the 30-year T-bill rate as the riskless rate and firm-specific betas. For the OLS regression, the data are winsorized at the 1% tails and robust standard errors are calculated. This sample contains all CEOs whose age is at or below the median age of 56 years old. Standard errors are in parentheses for both methods and the Pseudo- R^2 is reported for the median regression. Estimated coefficients for the year effects are suppressed. * indicates different from zero at the 1% level, ** at the 5% level, and *** at the 10% level.

Variable	OLS	OLS	Median	Median
	Younger	Older	Younger	Older
Intercept	1,789 (2,656)	-1,721 (2,693)	177 (311)	-694** (259)
Dollar returns, firm	44.8* (8.33)	48.8* (5.10)	23.9* (3.61)	23.3* (2.57)
Dollar expected returns, CAPM	-5.03** (2.51)	1.20 (1.61)	-0.481* (0.172)	0.257** 0.127
\$ Returns \times cdf of firm-specific dollar variance	-25.8* (11.5)	-52.5* (7.71)	0.199 (7.55)	-22.8* (5.01)
\$ Returns \times cdf of systematic dollar variance	-17.3* (8.67)	5.61 (19.3)	-20.0** (9.55)	0.831 (3.33)
cdf of firm-specific dollar variance	6,888 (6,501)	5,991 (6,493)	1,708* (833)	208 (1,077)
cdf of systematic dollar variance	3,089 (5,500)	-2,290 (6,340)	1,199 (1,057)	2,644* (1,103)
R^2	0.242	0.262	0.077	0.119
Sample Size	2,768	2,742	2,768	2,742