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Duration of Executive Compensation

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ABSTRACT

Extensive discussions on the inefficiencies of "short-termism" in executive compensation notwithstanding, little is known empirically about the extent of such short-termism. We develop a novel measure of executive pay duration that reflects the vesting periods of different pay components, thereby quantifying the extent to which compensation is short-term. We calculate pay duration in various industries and document its correlation with firm characteristics. Pay duration is longer in firms with more growth opportunities, more long-term assets, greater R&D intensity, lower risk, and better recent stock performance. Longer CEO pay duration is negatively related to the extent of earnings-increasing accruals.

IT IS WELL RECOGNIZED that executive compensation is an important tool of corporate governance in aligning the interests of shareholders and managers. Issues related to how executive compensation should be structured have therefore been front and center in corporate governance discussions ever since Jensen and Murphy (1990) argued famously that what matters in CEO pay is not how much you pay, but *how* you pay. To this end, an active debate has raged on about what should be the optimal duration of executive compensation. On the one side of the debate, critics of the executive pay process (e.g., Bebchuk and Fried (2010)) argue that compensation contracts put too much emphasis on short-term performance and should be modified. They caution that excessive compensation short-termism could lead to self-interested and often myopic managerial behavior. On the other side of the debate, Bolton, Scheinkman, and Xiong (2006) point out that, in a speculative market where stock prices may

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deviate from fundamentals, an emphasis on short-term stock performance may be optimal from the perspective of the firm's existing shareholders. Further, to the extent that compensation duration is designed to influence managerial behavior, we should expect differences across industries in the nature of their projects to influence compensation duration.

This debate leads to a number of important yet unanswered questions. In practice, how do firms determine the duration of their executive compensation contracts, and how is compensation duration related to various firm and industry characteristics? How do observed compensation contracts relate to existing theories? How does past stock performance influence compensation duration? Does the duration of the compensation contract affect the executive's incentives to boost short-term performance? Addressing these questions is hampered by an obvious gap in our knowledge—we have no existing measure that helps to *quantify* the extent to which executive compensation is short- or long-term.

As a first step in filling this void and addressing these questions, we develop a novel measure, *pay duration*, to quantify the mix of short-term and long-term executive pay. This measure is a close cousin of the duration measure developed for bonds. We compute it as the weighted average of the vesting periods of the different components of executive pay (including salary, bonus, restricted stocks, and stock options), with the weight for each component being the fraction of that component in the executive's total compensation package. With this measure in hand, and motivated by earlier research on executive compensation, we examine how pay duration is related to numerous firm characteristics including project duration, firm risk, recent stock performance, and corporate governance. Finally, we also examine how pay duration is related to the executive's incentives to manage short-term performance.

To construct the pay duration measure, we obtain data on the levels and vesting schedules of restricted stock and stock option grants from Equilar Consultants (Equilar). Similar to Standard and Poor's (S&P) ExecuComp, Equilar collects its compensation data from firms' proxy statements. We obtain details of all stock and option grants to all named executives of firms covered by Equilar for the period 2006 to 2009. We obtain data on other components of executive pay, such as salary and bonus, from ExecuComp, and we ensure comparability of Equilar and ExecuComp by making sure that the total number of options granted during the year for each executive in our sample is the same across the two data sets. We believe that this is the *first* time in the literature that such comprehensive data on the vesting schedules of restricted stock and stock options have been brought to bear on the questions we address.

We find that the vesting periods of both stock and option grants cluster around three to five years, with a large proportion of the grants vesting in a fractional (graded) manner. There is, however, significant cross-sectional variation in the pay duration across the Fama-French 48 industries. For example, executive pay duration tends to be correlated with project and asset duration—industries with longer-duration projects, such as Defense and Utilities, offer longer-duration pay to their executives. We also find that firms in the Finance-Trading industry have above-median CEO pay duration (they rank 11th among

the 48 industries).[1] Moreover, the average pay duration increased during our sample period, especially for executives in the manufacturing and utilities industries. The average pay duration for *all* executives (including those below the CEO) in our sample is around 1.22 years, while CEO pay has a slightly longer duration at about 1.44 years. Executives with longer-duration contracts receive higher total compensation, but lower bonus, on average.

We next examine additional aspects of the relation between executive pay duration and various firm characteristics. Motivated by existing theories, we hypothesize that firms with more valuable long-term projects and less risky firms offer their executives longer-duration pay contracts. We test this hypothesized relationship by using market-to-book ratio, the fraction of long-term assets, and R&D intensity to measure the duration of the firm's projects. We find that executive pay duration is longer in firms with higher market-to-book ratio, for firms with more long-term assets, and in more R&D-intensive firms. Consistent with our hypothesis, we also find that riskier firms offer shorter-duration pay contracts.

We also find that firms with better recent stock performance offer longer-duration pay contracts to their executives. This may be because realized stock returns are positively correlated with inferences about executive ability, so boards find it optimal to lengthen vesting schedules to increase the cost of voluntary departure for executives with higher perceived ability. Furthermore, a commitment to increase pay duration following high stock returns may be an effective way for boards to battle stock price manipulation by the manager.

Our analysis reveals an ambiguous relationship between corporate governance and executive pay duration. Some governance proxies suggest that better-governed firms use shorter pay duration, whereas other proxies suggest the opposite. Pay duration is shorter for executives in firms with a higher proportion of non–executive director shareholdings, for executives with higher ownership in their own firms, and in firms with a lower entrenchment index value (Bebchuck, Cohen, and Ferrel (2009)). However, it is actually longer in firms with a larger fraction of independent directors on the board.

Next, we explore how pay duration is related to the incentives of the manager to manipulate short-term performance. Following prior literature (e.g., Bergstresser and Philipon (2006) and Sloan (1996)), we use the level of abnormal accruals as our main proxy for managerial manipulation of short-term performance. The use of accruals, which is part of earnings not reflected in current cash flows, accommodates a temporary shift of the firm's reported earnings between the future and the present. Firms with high (low) abnormal accruals will have high (low) current-period earnings and low (high) future earnings (e.g., Dichev et al. (2012) and Graham, Harvey, and Rajgopal (2005)). We expect managers with shorter-duration pay contracts to have a stronger tendency to boost short-term earnings, and hence such firms should be associated with higher abnormal accruals. We calculate abnormal accruals using the procedure

[1] One caveat is that we only have data on pay contracts for 14 CEO-years for the Finance-Trading industry.

outlined in Jones (1991), and relate CEO pay duration to the level of abnormal accruals.

In our baseline empirical specification, apart from the control variables suggested by the prior accounting literature (see Hribar and Nichols (2007)), we also include industry and time fixed effects. We find a strong negative association between CEO pay duration and abnormal accruals: firms that offer shorter-duration pay contracts to their CEOs have higher abnormal accruals in the current period. This negative association is stronger for earnings-enhancing positive accruals, and is robust to controlling for known determinants of abnormal accruals.

We also perform cross-sectional tests to see if the negative association between CEO pay duration and abnormal accruals is stronger among firms with less liquid stocks. The idea is that it will be easier for the managers of such firms to mislead the market by strategically manipulating current-period earnings. We use firm size, firm age, and the bid-ask spread of the firm's stock price as measures of stock liquidity. Consistent with our conjecture, we find that the negative association between CEO pay duration and the level of abnormal accruals is stronger for small firms, young firms, and firms with less liquid stock.

To examine the sensitivity of our results to the way we define pay duration, we develop an alternative measure of pay duration and show that our results are robust to this alternative measure. This measure differs from our baseline measure along two dimensions. First, it uses the pay-for-performance sensitivity (PPS) of stock and option grants, instead of the dollar values in our baseline measure, as the weights to calculate pay duration. We estimate PPS as the change in the grant value corresponding to a 1% change in the firm's stock price (Core and Guay (2002)). Second, the alternative measure of duration uses the executive's *entire* compensation portfolio, including all prior-year grants. We estimate the vesting schedules of unvested prior-year grants by looking at their year-on-year changes (see Section I.C for details).

Our paper is related to the vast literature on executive compensation. The broader literature covers a wide-ranging set of issues. These include whether CEOs are offered sufficient stock-based incentives and how these vary cross-sectionally,[2] whether CEOs are judged using relative performance evaluation (RPE),[3] and ultimately whether executive contracts in practice are set by the firm's board of directors or the executives themselves.[4]

With respect to the duration of executive pay, there have been numerous theoretical contributions, going back as far as Holmstrom and Ricart i Costa (1986), who examine the pros and cons of long-term compensation contracts

[2] See Aggarwal and Samwick (1999a), Garen (1994), Hall and Liebman (1998), Haubrich (1994), and Milbourn (2003).

[3] See Aggarwal and Samwick (1999b), Garvey and Milbourn (2003), Janakiraman, Lambert, and Larcker (1992), and Oyer (2004).

[4] See Bebchuk and Fried (2003), Bertrand and Mullainathan (2001), Garvey and Milbourn (2006), and Gopalan, Milbourn, and Song (2010).

in a managerial career-concerns setting. Examples of other optimal contracting models that examine executive pay duration include Bizjak, Brickley, and Coles (1993), Bolton, Scheinkman, and Xiong (2006), and Dutta and Reichelstein (2003). Empirically, numerous papers document various features of CEO compensation. Walker (2011) describes the evolution of stock and option compensation and the aggregate shift away from options and toward restricted stock. Core, Holthausen, and Larcker (1999), among others, examine the determinants of the cross-sectional variation in CEO compensation.

Our marginal contribution to this literature is threefold. First, we develop a novel measure of pay duration that directly captures the mix of short-term and long-term pay. This measure is materially different from the measures used in prior literature to characterize executive pay, which include the proportion of noncash pay in total pay (Bushman and Smith (2001)), the delta and vega of executive stock and option grants and holdings (Coles, Daniel, and Naveen (2006)), and the correlation of pay to stock returns and earnings (Bushman et al. (1998)).[5] The key difference is that our pay duration measure explicitly takes into account the *length* of the vesting schedule for each component of the executive's pay, of which there are often many during a given compensation year. This is important because, for example, a large stock grant itself is unlikely to contribute to short-term incentives, and this is particularly true if there is a long vesting schedule. Second, we use this measure to explain how pay duration varies in the cross-section based on executive and firm characteristics. And third, we examine the relationship between pay duration and an important corporate decision. Our empirical analysis confirms that our pay duration measure is more strongly correlated with executive behavior than the coarser measures used in the previous literature.

In addition to the intended contribution to the literature, our paper may also further stir up the policy-oriented executive compensation debate, which has been active. Bebchuk and Fried (2010, p. 1917) cite various popular press releases that allude to "... widespread recognition that pay arrangements that reward executives for short-term results can produce incentives to take excessive risks." However, none of these criticisms are specific to the *quantification* of the short-termism in compensation (perhaps not surprising, given the absence of a pay duration measure), which makes it difficult to say whether the critics would view the average CEO pay duration of 1.44 years that we document as "appropriate." This duration does appear short when compared to the average tenure of a CEO in a firm (six years) or to the average duration of a firm's projects. One would suspect that, for the large public firms in our sample, the average project lasts more than two years, although payback periods may well be two years or less. The main reason for the seemingly short average pay duration is that 30% of CEO pay consists of salary and bonus, which vest immediately, while the noncash components typically vest within five years. Cash

[5] Much of this work has appeared in the accounting literature, where researchers are also interested in how incentive-based pay loads on both corporate earnings measures and the firm's stock price. See also Banker and Datar (1989), Lambert and Larcker (1987), and Sloan (1993).

compensation may have to be unavoidably large to satisfy liquidity needs. To conduct a careful analysis of whether pay duration is appropriate, given all of these considerations, one would have to estimate a structural model of CEO pay.

The rest of the paper is organized as follows. Section I describes our data and constructs pay duration measures. Section II discusses summary statistics and the preliminary analysis of the data. Section II.B examines the relation between pay duration and firm characteristics. Section II.C analyzes how pay duration is related to managerial incentive to manipulate short-term performance. Section III concludes. Definitions of empirical variables are in Appendix A.

I. Data

In this section, we describe our data and construct the measures of pay duration.

A. Data Sources

Our data come from four sources: Equilar Consultants, Execucomp, the Center for Research in Security Prices (CRSP), and Compustat.

- Data on the vesting schedules of restricted stock and stock options are drawn from Equilar Consultants (hereafter, Equilar). Similar to S&P (provider of ExecuComp), Equilar collects compensation data from firms' proxy statements. We obtain details of all stock and option grants to all named executives covered by Equilar for the years 2006 to 2009.[6] Equilar also provides the grant date and the present value of the grants. The present value of a stock grant is the product of the stock price on the grant date and the number of stocks granted, while the value of an option grant is estimated by Equilar using the Black-Scholes formula. Equilar also identifies whether the size or the vesting schedule of the grant is linked to firm performance.
- We obtain data on other components of executive pay, such as salary and bonus, from ExecuComp. We carefully hand-match Equilar and ExecuComp using firm tickers and executive names. Since prior studies on executive compensation predominantly use ExecuComp, we ensure comparability of Equilar and ExecuComp by making sure the total number of options granted during the year for each executive in our sample is the same across the two data sets.[7]

[6] The sample of executives covered by Equilar is larger than that covered by S&P's ExecuComp. Since we use data from both sources, our final sample consists of executives covered by both data sets.

[7] We drop 2,470 executive-year observations for which we cannot match the number of option grants across Equilar and ExecuComp. This amounts to 6.6% of the total executive-year observations in our sample.

Table I
Distributions of Stock and Option Grants

This table presents distributions of restricted stock and option grants in our sample covered by Equilar for the period 2006 to 2009. The fraction of a particular category is provided within brackets.

Year	2006	2007	2008	2009	Total
			Stock Grants		
Total number	9,867	9,969	9,330	8,138	37,304
Grants with time-based vesting	5,797 (58.75%)	5,769 (57.87%)	5,517 (59.13%)	4,916 (60.41%)	21,999 (58.97%)
Grants with performance-based vesting	478 (4.84%)	707 (7.09%)	557 (5.97%)	394 (4.84%)	2,136 (5.73%)
Performance-contingent grants with time-based vesting	3,580 (36.28%)	3,488 (34.99%)	3,255 (34.89%)	2,828 (34.75%)	13,151 (35.25%)
Other grants	12	5	1	0	18
			Option Grants		
Total number	6,072	7,383	6,447	5,836	25,738
Grants with time-based vesting	5,810 (95.69%)	7,102 (96.19%)	6,104 (94.68%)	5,515 (94.50%)	24,531 (95.31%)
Grants with performance-based vesting	135 (2.22%)	171 (2.32%)	238 (3.69%)	175 (3.00%)	719 (2.79%)
Performance-contingent grants with time-based vesting	127 (2.09%)	105 (1.42%)	105 (1.63%)	146 (2.50%)	483 (1.88%)
Other grants	0	5	0	0	5

- We complement the compensation data with stock returns from CRSP and firm financial data from Compustat.

B. Various Categories of Grants

In practice, the specific terms of stock and option grants are quite complex. Both the number of securities granted and the vesting schedule can depend on future firm performance. For our analysis, we classify the grants into three categories; see Table I for the distribution of our sample grants across the three categories. The first category is the simplest. It includes grants where the number of securities offered is fixed as of the grant date, and the grant has a time-based vesting schedule. Of the total 37,304 (25,738) stock (option) grants in our sample, 21,999 (24,531) or 58.97% (95.31%) belong to this category. For each grant in this category, we have information on the size of the grant, the length of the vesting period, that is, the length of time before the grant is completely vested, and the nature of the vesting, that is, whether the grant vests in equal installments over the vesting period (graded vesting) or entirely at the end of the vesting period (cliff vesting).

The next category includes grants for which the number of securities offered is fixed as of the grant date but the vesting schedule is contingent on future

firm performance. Of all the grants in our sample, 5.73% (2.79%) of the stock (option) grants belong to this category. For such grants, Equilar records the grant size, the period over which performance is measured, and the performance metrics used. We assume that these grants vest all at once at the end of the performance measurement period. Also, for grants with a performance-linked accelerated vesting schedule, we assume that they vest according to the initially specified vesting schedule. We rely on this approximation because the acceleration provisions in these grants are usually very complex and depend on multiple performance measures. Thus, it is difficult to determine if and when these grants will vest on an accelerated basis.

The third group of grants are part of long-term incentive plans in which the number of securities awarded is contingent on future performance. Some of these grants are also associated with a time-based vesting schedule for tax purposes (see Gerakos, Ittner, and Larcker (2007)). For such grants, Equilar records the target number of securities expected to be granted, the period over which performance is measured, and any time-based vesting schedule associated with the grant. Of all the stock (option) grants in our sample, 35.25% (1.88%) belong to this category. We include all these grants in calculating our duration measure, with the number of securities used in the calculation being the target number of securities to be granted. To estimate the vesting schedules of these grants, we assume that the vesting starts right after the performance measurement period.

We are not able to identify either the performance-measurement period or the vesting period for 23 grants in our sample. They are categorized as other grants and excluded from our analysis. In our analysis, we do not specifically differentiate between time- and performance-based vestings;[8] see Bettis et al. (2010) for a detailed discussion of grants with performance-based vesting.

C. Vesting Schedules of Pre-2006 Grants

Although our analysis focuses on the years 2006 to 2009, obtaining a comprehensive measure of pay duration for this period requires that we estimate the vesting schedules of unvested pre-2006 (excluding 2006) stock and option grants in the executive's compensation portfolio. We use ExecuComp to estimate the vesting schedules of these grants. For every executive, ExecuComp provides details on the total outstanding unvested stock and option grants at the end of each year, and then aggregates the option grants into groups with the same exercise price and expiration date. For option grants, our estimation procedure involves the following steps:

(1) We first aggregate the outstanding unvested post-2006 option grants (2006 included) from Equilar into unique exercise price-expiration date

[8] In unreported tests, we exclude performance-contingent grants and/or vesting and find all our results to be robust.

pairs, and merge Equilar and ExecuComp using executive identity, year, exercise price, and expiration date.

(2) We then subtract the unvested post-2006 grants from the total outstanding grants (which we get from ExecuComp) to isolate the unvested pre-2006 grants.

(3) We use the year-on-year change in the outstanding unvested pre-2006 grants to estimate their vesting schedule. We can do this for all grants except those that remain unvested at the end of 2010: there are 2,177 such grants for 1,272 executive-years (3.6% of our sample) in our sample. We assume that these grants vest at the end of 2011. We check the robustness of our conclusions by repeating our tests after excluding these executive-years.

We follow the same procedure to approximate vesting schedules of unvested pre-2006 stock grants, except that we match Equilar and ExecuComp using just executive identity and year (since a restricted stock has no expiration date or exercise price).

D. Baseline Measure of Pay Duration

Our baseline measure of pay duration is constructed using only the data on post-2006 awards provided by Equilar. We follow the fixed income literature and calculate pay duration as the weighted average duration of the four components of pay (i.e., salary, bonus, restricted stock, and stock options). In cases in which the stock and option awards have a cliff vesting schedule, we estimate pay duration as[9]

$$Duration = \frac{(Salary + Bonus) \times 0 + \sum_{i=1}^{n_s} Restricted\,stock_i \times t_i + \sum_{j=1}^{n_o} Option_j \times t_j}{Salary + Bonus + \sum_{i=1}^{n_s} Restricted\,stock_i + \sum_{j=1}^{n_o} Option_j}, \quad (1)$$

where i denotes a restricted stock grant, j denotes an option grant, *Salary* and *Bonus* are, respectively, the dollar values of annual salary and bonus. We calculate duration relative to the year-end, so *Salary* and *Bonus* have a vesting period of zero. Next, Restricted stock$_i$ is the dollar value of restricted stock grant i with corresponding vesting period t_i (in years). During the year, the firm may have other stock grants with different vesting periods (different t_i), and n_s is the total number of such stock grants. Finally, $Option_j$ is the Black-Scholes

[9] Cadman, Rusticus, and Sunder (2010) also introduce a similar measure of pay duration, but use only the vesting schedule of stock options. Thus, their measure only estimates the duration for the option component of pay. Since we include both stock options and restricted stock, and estimate the duration for the entire compensation package, our measure is more comprehensive. Chi and Johnson (2009) examine the effect of CEO incentive horizon on firm value, but they only look at the amount of vested stock and option grants relative to unvested ones without estimating a measure of pay duration.

value of option grant j with corresponding vesting period t_j (in years), and n_o has a similar interpretation as n_s. In cases where the restricted stock grant (option grant) has a graded vesting schedule, we modify the above formula by replacing t_i (t_j) with $(t_i + 1)/2$ ($(t_j + 1)/2$).[10]

E. Alternative Measure of Pay Duration

Our baseline measure of pay duration does not include grants from prior years. To account for such grants, we construct an alternative measure by expanding the estimation in (1) to include all stock and option holdings and grants from prior years. For each year during 2006 to 2009, we include: (i) all vested stock and option holdings awarded from all prior years (for which we assign a vesting period of zero), (ii) unvested pre-2006 grants (for which we follow the procedures outlined in Section I.C to estimate the vesting schedules), and (iii) unvested post-2006 grants (for which we have detailed information on vesting schedules from Equilar).

The second change we make in constructing the alternative measure is to use the PPS of the stock and option grants, instead of their dollar value, as the weight to calculate the pay duration.[11] We follow Core and Guay (2002) and calculate PPS as the change in the grant's value corresponding to a 1% change in the firm's stock price. We then combine the PPS and the vesting schedules to calculate the alternative pay duration as

$$Duration^{PPS,total} = \frac{\sum_{i=1}^{n_s}\sum_{t=0}^{t_{si}} PPS_{i,t}^{S} \times t + \sum_{j=1}^{n_o}\sum_{t=1}^{t_{oj}} PPS_{j,t}^{O} \times t}{\sum_{i=1}^{n_s} PPS_i^S + \sum_{j=1}^{n_o} PPS_j^O}. \quad (2)$$

In (2), i denotes a restricted stock grant, j denotes an option grant, $PPS_{i,t}^{S}$ is the PPS of the portion of stock grant i that vests in t years, t_{si} is the final vesting period of stock grant i, n_s denotes the total number of stock grants, which equals two plus the number of stock grants from Equilar,[12] PPS_i^S denotes the aggregate PPS of restricted stock grant i, $PPS_{j,t}^{O}$ is the PPS of the portion of option grant j that vests in t years, t_{oj} is the final vesting period of option grant j, n_o denotes the total number of option grants, including (i) post-2006 option grants from Equilar, (ii) the aggregate vested pre-2006 option grants,

[10] To see this, consider a stock grant i' that vests equally over $t_{i'}$ years. Since a fraction $1/t_{i'}$ of the grant is vested each year, the term $Restricted\ stock_{i'} \times t_{i'}$ in (1) should be replaced by $Restricted\ stock_{i'} \times (\frac{1}{t_{i'}} + \frac{2}{t_{i'}} + \cdots + \frac{t_{i'}}{t_{i'}}) = \frac{Restricted\ stock_{i'}}{t_{i'}} \times \frac{t_{i'}(t_{i'}+1)}{2} = Restricted\ stock_{i'} \times (\frac{t_{i'}+1}{2})$; $Option_j \times t_j$ can be modified in the same way.

[11] We thank an anonymous Associate Editor for suggesting that we use PPS in constructing an alternative duration measure.

[12] This is because, apart from the post-2006 stock grants from Equilar, we also include: (i) all the vested stock grants (as the first additional count), for which we assign a vesting period of zero, and (ii) the aggregate unvested pre-2006 stock grants (as the second additional count), whose vesting schedules are approximated using the procedures outlined in Section I.C.

and (iii) the unvested pre-2006 option grants aggregated into groups with the same exercise price and expiration date, and PPS_j^O denotes the aggregate PPS of option grant j.

We also construct another alternative measure, denoted by $Duration^{PPS,award}$, which is similar to $Duration^{PPS,total}$, but includes only annual grants for each year during the period 2006 to 2009, that is, it does not include grants from prior years. We use this as a control variable in some of our tests.

F. Discussion

Our measure of executive pay duration has several advantages over measures used in prior literature. A principal objective of all these measures is to understand the mix of short-term and long-term pay and hence the extent to which overall pay provides short-term incentives to executives. These existing measures include the proportion of stock and option grants (noncash pay) in total pay, the delta and vega of the executive's stock and option holdings, and the correlation of executive pay with stock returns and accounting earnings. The important difference between our measure of pay duration and these measures is that our measure explicitly accounts for the length of the stock and option grants' vesting schedules. Clearly, a large stock grant itself is unlikely to contribute to short-term managerial incentives if it has a long vesting schedule. While the delta and vega of an executive's compensation portfolio capture its sensitivities to movements in stock price and its volatility, respectively, they do not capture the mix of short-term and long-term incentives in the pay contract, which our duration measure does. Further, unlike the correlation measure, we directly measure the mix of short-term and long-term pay in computing pay duration. Finally, our empirical analysis below confirms that our duration measure is more strongly correlated with executive behavior than the existing measures.

Our measure does have some limitations. First, we do not include severance and postretirement benefits that may be important for providing long-term incentives. The main reason for this exclusion is the difficulty in obtaining the vesting schedules of these benefits. Despite this, in our subsequent empirical analysis, we find that pay duration is significantly associated with measures of earnings management such as the level of abnormal accruals. This association survives controls for the extent of deferred compensation. A second limitation of our measure (as we explain in Section I.B) is that we ignore the optionality introduced by linking both the size and the vesting schedule of the grant to future firm performance.

In employing our definition of duration to capture the extent of short-term and long-term pay, we implicitly assume that, other than the vesting schedule, there are no other restrictions, either explicit or implicit, on the executive's ability to exercise and sell the stock and option grants as soon as they vest. To the extent that such restrictions exist, and to the extent that they are uncorrelated with the calculated pay duration, our measure is a noisy proxy

for the executive's incentive horizon. We further discuss the potential bias due to this omission in Section IV.C.

II. Preliminary Analysis

In this section, we present the distribution of vesting schedules, the distribution of executive pay duration across industries and over time, and summary statistics for the key variables used in our analysis.

A. Distribution of Vesting Schedules

In Panel A of Table II, we provide the distributions of the vesting periods for restricted stock and option grants for all executives in our sample. The distributions are somewhat similar for stocks and options, although a chi-squared test rejects the null that the two are identical. The vesting periods cluster around the three- to five-year horizon for both stocks and options and a large fraction of the vesting schedules are graded. In Panel B, we provide the distributions of the vesting periods just for CEOs. The distributions are similar to those in Panel A for all executives. For both stocks and options, we find that the distributions of vesting periods for CEOs first-order stochastically dominate (FOSD) those for all other executives. This suggests a longer pay duration for CEOs than for other executives, which we confirm below with our univariate evidence. Note that, while in Tables I and II we include all the stock and option grants for which we have vesting schedules from Equilar, our sample in subsequent tables is confined to executive-years for which we are able to exactly match the number of annual option grants across Equilar and Execucomp.

B. Industry and Time-Series Distributions of Pay Duration

Panel A of Table III provides the industry distributions of *Duration* and $Duration^{PPS,total}$ for CEOs and all executives in our sample. We use the Fama-French 48 industry classification and report the average pay duration of all executives and CEOs in separate columns within each industry. We include all industries with pay duration information for at least five executives. For ease of reference, we sort the data in terms of decreasing *Duration* for CEOs. We find that some industries that one would suspect to have assets with longer duration (e.g., Defense, Electrical Equipment, and Coal) also have longer executive pay duration (for CEOs and for all executives). We also find that $Duration^{PPS,total}$ is consistently lower than *Duration*. This is because $Duration^{PPS,total}$ includes both vested and unvested grants from prior years that have shorter remaining vesting periods.

It is interesting to note that executives in the Finance-Trading industry (e.g., securities broker-dealers) have *relatively* long pay durations on average; they rank 11th among the 48 industries. It is also interesting to note that Banking

Table II

Distribution of Vesting Schedules

This table presents distributions of vesting schedules for restricted stock and option grants in our sample covered by Equilar for the period 2006 to 2009. Panel A includes data for all executives, and Panel B only includes the subsample of CEOs. For all the grants with a given vesting period, the percentage of grants that vest in a fractional (i.e., graded) manner is given by the column Fraction Graded.

Panel A: All Executives						
	Restricted Stock			Options		
Vesting Period (years)	Frequency	Percent (%)	Fraction Graded	Frequency	Percent (%)	Fraction Graded
0	486	1.31	0.00	674	2.62	0.00
1	1,610	4.34	0.12	1,066	4.14	0.07
2	2,529	6.81	0.59	724	2.81	0.69
3	20,030	53.94	0.31	9,682	37.59	0.86
4	7,524	20.26	0.77	9,774	37.95	0.98
5	4,212	11.34	0.69	3,278	12.73	0.93
6	266	0.72	0.51	289	1.12	0.41
7	174	0.47	0.48	59	0.23	0.85
8	67	0.18	0.58	84	0.33	0.18
9	24	0.06	0.79	9	0.03	0.89
10	189	0.51	0.66	97	0.38	0.42
11	3	0.01	0.33	0	0.00	0.00
12	1	0.00	1.00	4	0.02	0.00
13	6	0.02	1.00	0	0	0.00
14	1	0.00	1.00	15	0.06	0.00
15	4	0.01	0.00	0	0	0.00
20	9	0.02	0.89	1	0.00	0.00
Total	37,135	100		25,756	100	
Panel B: CEOs						
0	113	1.62	0.01	170	3.46	0
1	371	5.33	0.12	226	4.60	0.07
2	506	7.27	0.59	158	3.22	0.66
3	3,696	53.09	0.32	1,848	37.61	0.86
4	1,347	19.35	0.75	1,776	36.14	0.97
5	790	11.35	0.66	619	12.60	0.94
6	49	0.70	0.49	63	1.28	0.33
7	39	0.56	0.41	9	0.18	0.89
8	10	0.14	0.60	24	0.49	0.04
9	4	0.06	0.50	2	0.04	1.00
10	32	0.46	0.53	17	0.35	0.35
13	2	0.03	1.00	0	0.00	0.00
14	0	0.00	0.00	2	0.04	0.00
20	3	0.04	0.67	0	0.00	0.00
Total	6,962	100		4,914	100	

Table III

Industry and Time-Series Distributions of Pay Duration

This table presents distributions of executive pay duration (in years), measured by *Duration* and $Duration^{PPS,total}$, in our sample across industries (Panel A) and over time (Panel B) based on the Fama-French 48 industry classification. Definitions of *Duration* and $Duration^{PPS,total}$ are provided in Appendix A.

Panel A: Distribution of Pay Duration across Fama-French Industries

	CEOs			All Executives		
Industry	*N*	*Duration*	$Duration^{PPS,total}$	*N*	*Duration*	$Duration^{PPS,total}$
Candy & soda	20	2.094	0.740	110	1.421	0.908
Beer & liquor	28	2.036	0.438	105	2.074	0.439
Defense	17	1.908	0.864	85	1.491	0.810
Electrical equipment	52	1.796	0.365	278	1.457	0.573
Coal	33	1.756	0.787	184	1.351	0.700
Rubber and plastic products	32	1.748	0.283	175	1.327	0.437
Medical equipment	142	1.730	0.368	783	1.453	0.517
Communication	348	1.726	0.703	1968	1.366	0.797
Machinery	201	1.723	0.557	1,117	1.375	0.647
Utilities	269	1.684	0.444	1,506	1.444	0.613
Finance-Trading	14	1.660	0.717	61	1.342	0.960
Ship building and railroad equipment	34	1.638	0.431	182	1.506	0.604
Transportation	36	1.627	0.422	191	1.365	0.597
Pharmaceutical products	229	1.595	0.402	1,240	1.434	0.525
Construction materials	107	1.539	0.669	589	1.216	0.686
Measuring and control equipment	355	1.534	0.518	1,982	1.262	0.633
Healthcare	130	1.514	0.441	685	1.306	0.618
Chemicals	143	1.513	0.516	819	1.266	0.627
Real estate	348	1.512	0.380	1,937	1.229	0.543
Personal services	148	1.491	0.436	863	1.327	0.662
Wholesale	171	1.490	0.452	960	1.328	0.636
Petroleum and natural gas	15	1.481	0.408	82	1.290	0.639
Business supplies	134	1.471	0.423	686	1.342	0.554
Shipping containers	101	1.465	0.639	591	1.158	0.785
Business services	68	1.460	0.422	393	1.085	0.452

(*Continued*)

Table III—*Continued*

Panel A: Distribution of Pay Duration across Fama-French Industries

	CEOs			All Executives		
Industry	*N*	*Duration*	$Duration^{PPS,total}$	*N*	*Duration*	$Duration^{PPS,total}$
Construction	82	1.454	0.441	449	1.164	0.558
Other	422	1.452	0.388	2,152	1.284	0.580
Banking	111	1.409	0.384	608	1.108	0.570
Retail	187	1.408	0.463	1,009	1.154	0.596
Food and food products	114	1.393	0.575	597	1.280	0.643
Computers	633	1.361	0.444	3,454	1.169	0.662
Steel works, etc.	95	1.300	0.392	511	1.097	0.635
Printing and publishing	32	1.250	0.605	193	1.044	0.861
Electronic equipment	231	1.231	0.450	1,166	1.161	0.622
Aircraft	98	1.225	0.569	542	0.949	0.706
Restaurants, hotels, and motels	320	1.220	0.442	1,662	1.078	0.637
Insurance	465	1.184	0.268	2,565	0.992	0.403
Recreation	34	1.182	0.415	172	0.983	0.532
Apparel	99	1.169	0.452	510	1.019	0.661
Consumer goods	69	1.123	0.426	369	1.012	0.721
Textiles	19	1.106	0.774	124	0.683	0.727
Agriculture	17	1.036	0.290	96	0.891	0.476
Automobiles and trucks	49	0.927	0.396	219	0.909	0.480
Precious metals	17	0.919	0.217	104	0.659	0.341
Entertainment	72	0.707	0.428	360	0.708	0.614

Panel B: Distribution of Pay Duration over Time

Year	All Firms	Finance	Utilities	Manufacturing
	Annual Average *Duration* for All Executives			
2006	1.185	1.214	1.534	1.246
2007	1.262	1.190	1.626	1.356
2008	1.107	1.043	1.566	1.271
2009	1.324	1.186	1.763	1.550
	Annual Average *Duration* for CEOs			
2006	1.421	1.434	1.534	1.430
2007	1.492	1.427	1.626	1.569
2008	1.340	1.258	1.566	1.451
2009	1.508	1.374	1.763	1.611

(*Continued*)

Table III—*Continued*

Panel B: Distribution of Pay Duration over Time				
Year	All Firms	Finance	Utilities	Manufacturing
Annual Average $Duration^{PPS,total}$ for All Executives				
2006	0.663	0.519	0.726	0.689
2007	0.586	0.462	0.668	0.592
2008	0.581	0.499	0.678	0.603
2009	0.623	0.547	0.829	0.643
Annual Average $Duration^{PPS,total}$ for CEOs				
2006	0.552	0.384	0.641	0.612
2007	0.416	0.287	0.536	0.444
2008	0.438	0.356	0.530	0.473
2009	0.433	0.362	0.613	0.463

firms (e.g., depository institutions) have shorter average executive pay duration than firms in the Finance-Trading industry.

In Panel B, we provide the yearwise average *Duration* and $Duration^{PPS,total}$ in our sample. In the full sample, the average *Duration* increases from 1.185 years in 2006 to 1.324 years in 2009. When we look within broad industry groups, we find that the increase in *Duration* is confined to firms in the utilities and manufacturing industries. Interestingly, there is no significant increase in the average *Duration* for firms in the finance industry. We find a similar time-series pattern of the average *Duration* for CEOs, where, again, the increase in the average *Duration* for CEOs is confined to firms in the utilities and manufacturing industries during our sample period.[13]

Unlike *Duration*, we find no systematic pattern in the yearwise average $Duration^{PPS,total}$ in our sample. This could be due to two opposing forces. The first is the increase in average *Duration* during the sample period that contributes to an increase in $Duration^{PPS,total}$. The second is depressed stock prices that prevailed during the sample period. This may have prompted executives not to sell their vested stock and option grants. An increase in vested stock and option grants in the executive's portfolio is likely to depress $Duration^{PPS,total}$.

C. Summary Statistics of Key Variables

Panels A and B of Table IV provide summary statistics of the key variables used in our analysis for all executives and for CEOs, respectively, in our sample. Focusing on Panel A, we find that the average annual total compensation for our sample executive is $2,214,425, which comprises $447,365 of salary, $143,252

[13] In unreported multivariate tests later, we estimate regression (3) after including year dummies for the full sample and for the industry subsamples, and again find that the coefficient on the year dummies is higher in 2009 as compared to 2006 for executives from the utilities and manufacturing industries.

Table IV
Summary Statistics

This table presents descriptive statistics for our sample executives and firms. The data are collected for all executives that we are able to match across ExecuComp and Equilar for the period 2006 to 2009. Panel A summarizes the full sample for all executives, and Panel B summarizes the subsample of CEOs. Definitions of the variables reported in this table are provided in Appendix A.

Variable	*N*	Mean	Median	Std. Dev.
Panel A: Full Sample				
Pay Characteristics				
Total compensation ($ thousand)	35,084	2,214.425	962.429	4,832.741
Salary ($ thousand)	35,084	447.365	372.83	311.281
Bonus ($ thousand)	35,084	143.252	0	953.572
Options ($ thousand)	35,084	908.969	26.553	3,567.12
Restricted stock ($ thousand)	35,084	711.228	148.747	1,889.774
Duration (years)	35,084	1.218	1.33	0.967
$Duration^{PPS,award}$ (years)	32,798	2.224	2.5	1.342
$Duration^{PPS,total}$ (years)	32,233	0.61	0.365	0.745
Firm Characteristics				
Total assets ($ million)	35,002	17,618.78	2,195.21	97,745.87
Debt/Total assets	34,893	0.231	0.201	0.2
Sales growth	34,906	0.069	0.059	0.231
Market to book	34,636	1.721	1.379	1.009
Long-term assets	31,308	0.416	0.428	0.245
R&D/Total assets	35,002	0.024	0	0.047
Capital expenditure	34,863	0.049	0.029	0.062
EBIT/Sales	34,961	0.124	0.111	0.168
Volatility	32,639	0.323	0.185	0.405
Spread (%)	32,639	0.213	0.133	0.309
Director shareholding (%)	25,694	2.334	0	7.733
Entrenchment index	19,701	3.235	3	1.364
Fraction independent	25,694	0.763	0.778	0.129
Accruals	27,848	0.002	0.003	0.064
Executive Characteristics				
Shareholding (%)	35,084	0.642	0	3.796
Age (years)	30,013	51.943	52	7.621
Panel B: Subsample of CEOs				
Pay Characteristics				
Total compensation ($ thousand)	6,461	4,841.917	2,410.1	8,530.523
Salary ($ thousand)	6,461	735.249	691.667	407.826
Bonus ($ thousand)	6,461	287.582	0	1,839.468
Options ($ thousand)	6,461	2,165.038	194.5	6,557.308
Restricted stock ($ thousand)	6,461	1,644.266	542.92	3,298.175
Duration (years)	6,461	1.44	1.631	1.045
$Duration^{PPS,award}$ (years)	6,348	2.209	2.5	1.381
$Duration^{PPS,total}$ (years)	6,264	0.456	0.23	0.641

(*Continued*)

Table IV—*Continued*

Panel B: Subsample of CEOs				
Executive Characteristics				
Shareholding (%)	6,461	2.239	0	6.28
Age (years)	6,320	54.92	55	7.449

of bonus, $908,969 of stock options, and $711,228 of restricted stock. These numbers are comparable to those reported in previous studies. The average executive pay duration in our sample, measured by *Duration*, is 1.218 years. Thus, executive pay vests, on average, about one year after it is granted. In comparison, the average value of $Duration^{PPS,total}$ in our sample is 0.61 years. Our sample tilts toward larger firms in Compustat, as shown by the median value of total assets of $2,195 million.

Our next set of variables measures the corporate governance characteristics of our sample firms. With respect to the shareholding of nonexecutive directors (*Director shareholding*), the average is 2.334%, whereas the median is less than 1%; note that ExecuComp records director shareholding of less than 1% as zero. The average Bebchuk, Cohen, and Ferrell (2009) entrenchment index of our sample firms is about three (out of six), and the average fraction of independent directors on our sample firms' boards (*Fraction independent*) is 76.3%. The average executive in our sample holds about 0.642% of the firm's shares (*Shareholding*), and is 52 years old. The average level of *Accruals* in our sample is 0.002.

In Panel B, we present summary statistics for the subsample of CEOs. Comparing with Panel A, we find that, as expected, the CEOs in our sample have higher annual total compensation than the average executive ($4,841,917 versus $2,214,425). This higher compensation is reflected in four pay components (salary, bonus, options, and restricted stock). The pay duration, measured by *Duration*, is also longer for the CEO than for the average executive (1.44 years versus 1.218 years). Interestingly, we find that the average CEO has lower $Duration^{PPS,total}$ as compared to the average executive (0.456 years versus 0.61 years). This is because of a large amount of vested stock and option grants in the average CEO's compensation portfolio. The average CEO is 55 years old, and holds more shares in the firm than the average executive (2.239% versus 0.642%).[14] To reduce the effects of outliers, our variables of empirical interest are all winsorized at the 1% level and we estimate standard errors that are robust to heteroskedasticity throughout our analysis.

[14] We find that all the corresponding statistics across the two subsamples (CEO versus average executive), except those for $Duration^{PPS,award}$, are significantly different from each other when we explicitly test for such differences.

III. Pay Duration and Firm Characteristics

In this section, we examine how pay duration is related to firm characteristics, including project duration, firm risk, past stock performance, and corporate governance.

A. Hypotheses

We begin by developing hypotheses that relate executive pay duration to firm characteristics. These hypotheses are tested in the rest of Section III.

(1) *Project Duration and Pay Duration*: For a variety of reasons (e.g., to exploit stock mispricing as in Bolton, Scheinkman, and Xiong (2006), or to minimize the dissipative costs of external financing as in Thakor (1990)), firms may wish to provide their managers with short-term incentives. These incentives will make it attractive for managers to choose projects that boost short-term performance. However, the cost of creating such incentives will be higher for firms with valuable long-term projects. This suggests that firms that have longer-duration projects (e.g., due to the nature of their industry) will prefer longer-duration executive compensation. To test this prediction, we use market-to-book ratio, the proportion of long-term assets, and R&D intensity as proxies for a firm's project duration, with higher values indicating firms with longer-duration projects.

(2) *Cash Flow Volatility and Pay Duration*: To the extent that distant cash flows are more volatile than near term cash flows, a longer-duration pay contract is, ceteris paribus, likely to impose greater risk on the executive. This is especially likely for firms with more volatile cash flows. From standard principal-agent theory (e.g., Holmstrom (1979)), we know that firms with higher output risk choose less performance-sensitive contracts. Using similar logic, we expect firms with greater cash flow volatility to choose shorter-duration pay contracts. We use stock return volatility, cash flow volatility, and sales volatility as proxies for firm risk to test this prediction.

(3) *Past Stock Performance and Pay Duration*: If the firm has high past stock returns, it may induce an upward revision in beliefs about CEO ability. This may result in a stronger desire on the part of the board to retain such a CEO, and one way to increase the likelihood of retention may be to extend the vesting schedules of stock and option grants. Since executives typically lose unvested stock and option grants if they leave the firm, a longer vesting schedule elevates the cost of voluntary departure.[15] An alternative possibility is that vesting schedules are determined by

[15] Boards may also (commit to) lengthen pay duration following good past stock performance as a deterrent against managerial manipulation. This follows because long-term grants following a stock price run-up will have reduced value to the extent that the run-up is indicative of manipulation and overvaluation. Our tests are unable to distinguish this theory from the CEO-retention theory.

powerful CEOs interacting in a self-serving manner with "captured" boards. In this case, higher stock returns may indicate a higher likelihood of an overvalued stock, something that the CEO may wish to exploit by shortening pay duration. We relate past stock returns to pay duration to test these competing predictions.

(4) *Corporate Governance and Pay Duration*: Pay duration and alternate forms of corporate governance, such as board monitoring, can be substitutes or complements. If they are substitutes, optimizing shareholders may design a longer-duration pay contract for executives in situations where board oversight is costly and hence weak. Alternatively, according to the complements view, a strong board is more likely to design a long-duration pay contract linking CEO pay to long-term value maximization, whereas a weak board is likely to be captured by the CEO and will design a short-duration pay contract.[16] In our empirical tests, we attempt to distinguish between these alternative predictions.

B. Univariate Tests

To gain some basic insights, we first present the findings of our univariate analysis of the relationship between pay duration and firm characteristics. In Panel A of Table V, we split our sample into executives with above- and below-median pay duration as measured by *Duration* (the difference in *Duration* across the subsamples is 1.595 years), and compare the characteristics across the two subsamples. Executives with above-median pay duration have higher annual total compensation, which is reflected in three components of pay, but most noticeably in the values of option and restricted stock grants. Interestingly, executives with longer-duration pay contracts receive about \$62,523 less bonus on average. Pay duration is longer among larger firms (as shown by the difference in *Total assets*). Firms awarding longer-duration pay contracts have higher sales growth (7.5% versus 6.2%), higher market-to-book ratio (1.838 versus 1.601), a higher proportion of long-term assets (0.443 versus 0.39), and higher R&D expenditures as a proportion of total assets (2.5% versus 2.2%). These results indicate that firms experiencing faster growth and facing greater growth opportunities offer longer-duration pay contracts, which is consistent with the conjectured positive association between pay duration and project duration. Executives with longer pay duration are from firms that are more profitable (measured by $\frac{EBIT}{Sales}$), have greater stock liquidity as reflected in a lower bid-ask spread, and have lower stock volatility (which is consistent with the hypothesized negative relation between pay duration and firm risk).

Focusing on the governance characteristics, we find that firms that offer longer-duration pay contracts have a higher entrenchment index value and lower shareholdings by both nonexecutive directors and executives. If larger shareholdings of nonexecutive directors and executives and a lower

[16] Note that, in making this argument, we implicitly assume that, ceteris paribus, longer pay duration is preferable for shareholders.

Table V
Univariate Comparison

This table compares the mean values of the key variables across the subsamples of executives with pay duration below (*Short Duration*) and above (*Long Duration*) the sample median, where pay duration is measured by *Duration*. Panel A includes data for all executives, and Panel B only includes the subsample of CEOs. Definitions of the variables reported in this table are provided in Appendix III.A. Asterisks denote statistical significance at the 1%(***) level.

Panel A: Univariate Comparison for the Full Sample Based on *Duration*

Variable	Short Duration	Long Duration	Difference
Pay Characteristics			
Total compensation ($ thousand)	840.142	3,588.708	−2,748.57***
Salary ($ thousand)	383.672	511.058	−127.386***
Bonus ($ thousand)	174.514	111.991	62.523***
Options ($ thousand)	123.862	1,694.076	−1,570.21***
Restricted stock ($ thousand)	151.894	1,270.562	−1,118.67***
Duration (years)	0.421	2.016	−1.595***
$Duration^{PPS,award}$ (years)	1.407	2.934	−1.527***
$Duration^{PPS,total}$ (years)	0.436	0.756	−0.32***
Firm Characteristics			
Total assets ($ million)	12,950.55	22,269.44	−9,318.89***
Debt/Total assets	0.231	0.23	0.001
Sales growth	0.062	0.075	−0.013***
Market to book	1.601	1.838	−0.237***
Long-term assets	0.39	0.443	−0.053***
R&D/Total assets	0.022	0.025	−0.003***
Capital expenditure	0.047	0.051	−0.004***
EBIT/Sales	0.102	0.145	−0.043***
Volatility	0.404	0.245	0.159***
Spread (%)	0.285	0.143	0.142***
Director shareholding (%)	2.795	1.968	0.827***
Entrenchment index	3.164	3.296	−0.132***
Fraction independent	0.743	0.779	−0.036***
Accruals	0	0.003	−0.003***
Executive Characteristics			
Shareholding (%)	0.812	0.471	0.341***
Age (years)	52.207	51.686	0.521***

Panel B: Univariate Comparison for CEOs Based on *Duration*

Pay Characteristics			
Total compensation ($ thousand)	2,101.848	7,582.835	−5,480.99***
Salary ($ thousand)	651.923	818.601	−166.678***
Bonus ($ thousand)	410.347	164.779	245.568***
Options ($ thousand)	511.492	3,819.096	−3,307.6***
Restricted stock ($ thousand)	509.49	2,779.394	−2,269.9***
Duration (years)	0.615	2.265	−1.65***
$Duration^{PPS,award}$ (years)	1.398	2.992	−1.594***
$Duration^{PPS,total}$ (years)	0.318	0.587	−0.269***
Executive Characteristics			
Shareholding (%)	3.041	1.436	1.605***
Age (years)	55.581	54.269	1.312***

entrenchment index value signify firms with better governance, then these results suggest that better-governed firms offer shorter-duration pay contracts. However, firms that offer longer-duration pay contracts also have a higher proportion of independent directors. Since higher representation of independent directors is typically viewed as representing a more independent board, this finding conflicts with the idea that better-governed firms offer shorter-duration pay contracts. Thus, the relation between pay duration and corporate governance seems sensitive to the choice of governance proxy, and hence is ambiguous. We also find that executives with longer pay duration are younger on average.

In Panel B, we confine our comparisons to the subsample of CEOs. We only examine pay and executive characteristics as the comparisons of firm characteristics are similar to those in Panel A. We find that CEOs with longer pay durations have significantly higher annual total compensation as well as higher pay along three subcategories: salary, restricted stock, and options. CEOs with longer-duration pay contracts have a significantly lower bonus and lower shareholdings on average, and are younger.

C. Multivariate Tests

We now perform multivariate tests by estimating variants of the following OLS regression:

$$Duration_{ket} = \alpha + \beta_1 \mathrm{X}_{kt} + \beta_2 \mathrm{X}_{et} + \mu_{it}(\mathrm{I} \times \mathrm{T}) + \epsilon_{ket}, \tag{3}$$

where k indicates the firm, e the executive, t time in years, and i the firm's three-digit SIC industry. The term T refers to a set of year dummies, I to a set of three-digit SIC industry dummies, X_{kt} to firm characteristics, and X_{et} to executive characteristics. The main firm characteristics that we include are firm size (Log(*Total assets*)), leverage ($\frac{Debt}{Total\ assets}$), asset structure (*Long-term assets*), growth opportunities (*Market to book*), and R&D intensity ($\frac{R\&D}{Total\ assets}$). We use *Long-term assets*, *Market to book*, and $\frac{R\&D}{Total\ assets}$ to measure the "duration" of the firm's assets, with higher values indicating firms with longer-duration assets. We use the volatility of the firm's stock, cash flows, and sales (*Volatility*, *S.D. Cashflow*, and *S.D. Sales*, respectively) to measure the risk in the firm's operations. We include the firm's stock return over the previous year (Return − 1 year) to control for prior stock performance. We also include the liquidity of the firm's stock (*Spread*) to examine the potential effect of stock liquidity on pay duration. To show the pay difference between CEOs and non-CEO executives, we include a dummy variable that identifies CEOs (*CEO*). Since there is likely to be substantial similarity in the pay contracts for executives of firms in the same industry, in all our tests, we include within-industry time fixed effects. Thus, our identification comes only from cross-sectional within-industry-year differences in firm characteristics.

C.1. Project Duration, Firm Risk, and Pay Duration

In Panel A of Table VI, we relate pay duration to project duration and firm risk. To understand the extent to which pay duration is similar for firms within the same industry, we begin our empirical analysis in column (1) by estimating equation (3) with only the within-industry time fixed effects. We find that within-industry clustering is able to explain about 14% ($R^2 = 13.7\%$ to be exact) of the variation in pay duration in our sample. In column (2), we include a number of firm characteristics along with the fixed effects and find that the R^2 increases to 24.3%. Thus, firm characteristics are also important determinants of pay duration across firms. The positive and significant coefficient on *Market to Book* in column (2) indicates that pay duration is longer for firms with more growth opportunities. To the extent that such firms have longer-duration projects, this is consistent with firms matching pay duration to project duration. From the coefficients on the control variables, we find that longer-duration pay contracts are offered by larger firms, firms with lower leverage, firms with higher stock returns in the recent past, and firms with a more liquid stock, and such contracts are more likely to be offered to the CEO than to other executives.

Our coefficient estimates are also economically significant. The coefficient on *Market to book* in column (2) indicates that pay duration for an executive in a firm with *Market to book* equal to 1.97 (75^{th} percentile in our sample) is about 0.102 years longer than the pay duration for an executive in a firm with *Market to book* equal to 1.09 (25^{th} percentile in our sample). In comparison, the average pay duration of our sample executives is 1.218. We also find that, on average, CEO compensation has a duration that exceeds the compensation duration of other executives by about 0.28 years.

In columns (3) and (4), we use *Long-term assets* and $\frac{R\&D}{Total assets}$, respectively, to measure the duration of the firm's projects and find that firms with a higher proportion of long-term assets and larger R&D expenditures over total assets offer longer-duration pay contracts.

In columns (5) to (7), we relate pay duration to firm risk. In column (5), we use the lagged volatility of stock prices, *Volatility*, as a measure of firm risk and find that firms with more volatile stock prices have shorter-duration pay contracts. This is consistent with the agency-theoretic argument that extending pay duration is costlier for riskier firms. The negative association between volatility and pay duration may also reflect the greater risk taken by executives with shorter-duration pay. The use of lagged volatility in our analysis partly controls for this latter effect. From columns (6) and (7), we find that, consistent with our hypothesis, firms with more volatile cash flows and more volatile sales offer shorter-duration pay contracts.

Overall, our evidence from Panel A indicates that firms with longer-duration projects and lower risk offer longer-duration pay contracts. In unreported tests, we find that our results are robust to excluding non-CEOs, and to explicitly controlling for the proportion of noncash pay.[17]

[17] In unreported tests, we also collapse the data set to one observation per industry-year and replace the variables by their industry median values. We then repeat our tests on this smaller

Table VI
Pay Duration and Firm Characteristics

This table reports results of the regression relating executive pay duration to firm characteristics. Specifically, we estimate the OLS regression: $Duration_{ket} = \alpha + \beta_1 X_{kt} + \beta_2 X_{et} + \mu_{it}(I \times T) + \epsilon_{ket}$. Definitions of the variables in this table are provided in Appendix III.A. The sample includes all firm-year data that we are able to obtain by matching Equilar and ExecuComp. Standard errors reported in parentheses are robust to heteroskedasticity and are clustered at the three-digit SIC industry level. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

Panel A: Project Duration, Firm Risk, and Pay Duration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(Total assets)		0.182	0.176	0.190	0.178	0.177	0.177
		(0.011)***	(0.012)***	(0.012)***	(0.013)***	(0.013)***	(0.013)***
Market to book		0.116	0.126	0.116	0.127	0.132	0.132
		(0.029)***	(0.027)***	(0.030)***	(0.027)***	(0.028)***	(0.028)***
Long-term assets			0.260	0.199	0.222	0.237	0.242
			(0.097)***	(0.101)**	(0.096)**	(0.101)**	(0.100)**
R&D/Total assets				0.574			
				(0.277)**			
Volatility					−0.282		
					(0.039)***		
S.D. Cashflow						−0.450	
						(0.253)*	
S.D. Sales							−0.209
							(0.095)**
Debt/Total assets		−0.208		−0.148	−0.110	−0.186	−0.200
		(0.095)**		(0.096)	(0.087)	(0.088)**	(0.087)**
CEO		0.288	0.279	0.277	0.277	0.278	0.278
		(0.019)***	(0.019)***	(0.019)***	(0.019)***	(0.019)***	(0.019)***
Return-1 year		0.153	0.140	0.136	0.126	0.132	0.133
		(0.030)***	(0.031)***	(0.033)***	(0.028)***	(0.032)***	(0.031)***
Spread		−0.344	−0.335	−0.324	−0.196	−0.308	−0.314
		(0.034)***	(0.036)***	(0.034)***	(0.038)***	(0.035)***	(0.034)***
Const.	1.221	−0.310	−0.422	−0.457	−0.333	−0.369	−0.354
	(1.49e-17)***	(0.119)***	(0.120)***	(0.119)***	(0.126)***	(0.126)***	(0.130)***
Obs.	35,002	31,471	28,123	25,672	28,014	28,008	28,014
R^2	0.137	0.251	0.266	0.285	0.272	0.267	0.268

Panel B: Stock Returns and Pay Duration

	(1)	(2)	(3)	(4)
Return-1 year	0.126			
	(0.028)***			
Return-3 years		0.059		
		(0.020)***		
Abnormal return − 1 year			0.118	
			(0.027)***	
Abnormal return − 3 years				0.039
				(0.021)*

(*Continued*)

Table VI—*Continued*

Panel B: Stock Returns and Pay Duration

	(1)	(2)	(3)	(4)
Const.	−0.333	−0.401	−0.338	−0.412
	(0.126)***	(0.109)***	(0.125)***	(0.110)***
Obs.	28,014	26,902	28,014	26,902
R^2	0.272	0.280	0.271	0.279

Panel C: Governance Characteristics and Pay Duration

	(1)	(2)	(3)
High director share holding	−0.133		
	(0.040)***		
Entrenchment index		0.047	
		(0.012)***	
Fraction independent			0.600
			(0.115)***
Log(Total assets)	0.176	0.184	0.177
	(0.015)***	(0.017)***	(0.017)***
Market to book	0.133	0.145	0.118
	(0.028)***	(0.027)***	(0.030)***
Long-term assets	0.160	0.188	0.126
	(0.126)	(0.132)	(0.118)
Debt/Total assets	−0.058	0.004	−0.008
	(0.105)	(0.106)	(0.102)
Volatility	−0.319	−0.287	−0.279
	(0.048)***	(0.073)***	(0.049)***
Return-1 year	0.134	0.142	0.152
	(0.036)***	(0.049)***	(0.037)***
CEO	0.275	0.293	0.274
	(0.019)***	(0.021)***	(0.019)***
Spread	−0.259	−0.286	−0.297
	(0.081)***	(0.116)**	(0.075)***
Const.	−0.238	−0.574	−0.728
	(0.167)	(0.195)***	(0.176)***
Obs.	21,532	16,661	19,740
R^2	0.284	0.276	0.303

C.2. Pay Duration and Past Stock Performance

In Panel B of Table VI, we examine the relation between pay duration and past stock returns. In column (1), we repeat the estimates from column (5) of Panel A. We include the same set of control variables as in column (5) of Panel A, but for brevity, we do not present their coefficients. Firms with higher past stock return offer longer-duration pay contracts. In column (2), we repeat the estimates with three-year stock returns instead of a one-year return and

data set and find that pay duration is longer in industries with more long-lived assets and less volatile performance.

again find that firms with high past stock returns offer longer-duration pay contracts. In the next two columns, we repeat our estimates with abnormal returns instead of raw returns, where we adjust for expected returns using the Fama-French four-factor model. Here, again, we find that firms with high past abnormal returns offer longer-duration pay contracts. Our results are also economically significant. The coefficient on Return − 1 year in column (1) indicates that pay duration for an executive in a firm with Return − 1 year equal to −0.248 (75^{th} percentile in our sample) is about 0.08 years longer than the pay duration for an executive in a firm with Return − 1 year equal to 0.269 (25^{th} percentile in our sample).

C.3. Pay Duration and Governance Characteristics

In Panel C of Table VI, we examine the relationship between a firm's governance characteristics and executive pay duration. In column (1), we use the extent of nonexecutive directors' shareholding as a measure of firm governance and repeat our tests after including a dummy variable, *High director shareholding*, which identifies firms with more than 1% shareholding by nonexecutive directors. Our results indicate that pay duration of all executives is shorter in firms with higher stock ownership by nonexecutive directors. One theoretical interpretation of this result is as follows. Because lengthening pay duration imposes more compensation risk on executives, the firm will seek a cheaper way to generate the same executive incentives that a long pay duration provides, if such an alternative is available. In firms in which directors hold more company stock, agency-dissipating monitoring incentives are stronger (e.g., Ryan and Wiggins (2004)) and governance is better. So, such firms may provide shorter-duration pay contracts.

In column (2), we employ the Bebchuk, Cohen, and Ferrell (2009) entrenchment index as a governance measure and find similar results—firms with a lower entrenchment index value (better governance) offer shorter-duration pay contracts for all executives.

In column (3), we use a third measure of governance—the fraction of independent directors on the firm's board. We find that firms with a larger fraction of independent directors (better governance) have longer pay durations for all executives. This result is inconsistent with our previous findings in columns (1) and (2). In unreported tests, we find that the number of directors on the firm's board is not significantly related to pay duration.

Overall, our results in Panel B do *not* show a consistent relationship between firm governance and pay duration.[18]

In unreported tests, we also estimate how pay duration is related to executive age and tenure, and find that pay duration is shorter for older executives

[18] Our failure to find a deterministic relationship between pay duration and firm governance quality suggests that the interaction between pay duration and corporate governance is more complex than simply being substitutes or complements with each other. Exploring the interplay between the two variables, however, is beyond the scope of the paper and awaits further research.

and executives with longer tenure. There are several plausible interpretations of this finding. Older executives are likely to have more reputational capital at stake and better-established legacies to compromise if caught diverting capital to boost short-term results at the expense of long-term value. Consequently, there is greater self-policing and a diminished need for long-duration pay contracts to prevent abuse. Alternatively, in the inefficient contracting framework of Bebchuk and Fried (2003), one can argue that older executives and those with longer tenure are more likely to be entrenched, and thus they award themselves more short-term pay to avoid the higher risk of long-term pay. We are not able to differentiate between these competing explanations. But our results do indicate that pay contracts are *not* longer for older executives and those with longer tenure.

IV. Pay Duration and Earnings Management

In this section, we explore the relation between a CEO's pay duration and her incentives to manage the firm's short-term performance, examine how the relationship varies in the cross section, and perform a robustness check using an alternative measure of pay duration.

A. *Baseline Regressions*

In our baseline analysis, we estimate variants of the following OLS model:

$$y_{kt} = \alpha + \beta_1 \times Duration_{ket} + \beta_2 \mathrm{X}_{kt} + \mu_t \mathrm{T} + \mu_i \mathrm{I} + \epsilon_{kt}, \tag{4}$$

where k indicates the firm, e the CEO, t time in years, and i the firm's three-digit SIC industry. The terms T, I, and X_{kt} refer to, respectively, a set of year dummies, three-digit SIC industry dummies, and firm characteristics. Note that, unlike in regression (3), we do not include within-industry time effects because we only have one observation per firm-year in these tests. Inclusion of within-industry time effects is equivalent to including 1,200 dummy variables, which significantly reduces the power of our estimates given a sample size of 4,745 observations. The variable y is a measure of earnings management, and, in our analysis, y represents signed abnormal accruals, *Accruals*. A larger value of *Accruals* implies higher earnings in this period relative to cash flows. Since signed accruals must sum up to zero in the long run, larger (smaller) accruals in the current period imply a lower (higher) level of accruals and consequently lower (higher) earnings in future periods. Thus, managers can use "discretionary accruals" to shift reported income across time periods. We calculate *Accruals* following the procedure outlined in Jones (1991), which is described in greater detail in Appendix B. In some of our tests, we split *Accruals* into positive and negative accruals to shed further light on the mechanism at work. The standard errors in our regressions are robust to heteroskedasticity and are clustered at the three-digit SIC code industry level.

Our sample for these regressions includes one observation per firm-year. Our choice of control variables is guided by the prior accounting literature (see, for example, Hribar and Nichols (2007)). To control for differences in firm size, we include *Log*(*Total assets*) and *Log*(*Market cap*), the natural logarithm of the firm's book value of total assets and market capitalization, respectively. We control for growth opportunities using market-to-book ratio (*Market to book*) and annual sales growth (*Sales growth*), for profitability using *Cashflows*, for operating volatility using the standard deviations of cash flows and sales (*S.D. Cashflow* and *S.D. Sales*, respectively), and for leverage using $\frac{Debt}{Totalassets}$ (the ratio of total debt over total assets). We also include industry and time fixed effects, and only rely on within-industry differences in the level of accruals for our identification.

It is possible that riskier firms—those with more volatile operating performance—may have higher abnormal accruals as they have greater need to smooth reported earnings over time. Such firms may also have shorter pay durations, for example, because uncertainty increases the cost of long-term compensation. We employ two methods in our baseline model to control for such risk differences. First, in calculating *Accruals*, we isolate the discretionary portion of accruals. We calculate *Accruals* as the residuals from regressing total accruals on firm size, firm growth, and asset structure. We run this regression individually for every industry-year. This ensures that *Accruals* measures only deviations from the industry average. Second, we explicitly control for operating risk using the standard deviations of both sales and cash flows in our baseline model.

In Panel A of Table VII, we relate CEO pay duration to the level of signed abnormal accruals, *Accruals*. Our specification in these tests follows Hribar and Nicholas (2007). The results in column (1) show that firms that offer longer-duration pay contracts to their CEOs are associated with lower abnormal accruals. The coefficients on the control variables indicate that firms with higher market-to-book ratio (positive coefficient on *Market to book*), less volatile cash flows (negative coefficient on *S.D. Cashflow*), more volatile sales (positive coefficient on *S.D. Sales*), lower cash flows (negative coefficient on *Cashflows*), higher sales growth (positive coefficient on *Sales growth*), and higher market capitalization (positive coefficient on *Log*(*Market cap*)) have higher abnormal accruals. In column (2), we repeat our estimates after controlling for the fraction of the CEO's shareholding and find our results to be robust.

In columns (3) and (4), we split *Accruals* into positive and negative accruals and repeat our estimation. Specifically, our dependent variable in column (3) is *Accruals* $\times$ *Positive accruals* (where *Positive accruals* is a dummy variable that identifies firm-years with positive abnormal accruals), while the dependent variable in column (4) is *Accruals* $\times$ (1 $-$ *Positive accruals*). Bergstresser and Philippon (2006) show that the sensitivity of CEO pay to stock price movements affects the executive's incentive to manage earnings. We control for that by including the natural logarithm of the delta of the CEO's stock and option portfolio, *Log*(*Delta*). We measure *Delta* using the procedure in Coles, Daniel, and Naveen (2006). Our results indicate that pay duration is negatively related

Table VII

Accruals and CEO Pay Duration

This table reports results of the regression relating signed accruals to CEO pay duration. Specifically, we estimate the OLS regression: $y_{kt} = \alpha + \beta_1 \times Duration_{ket} + \beta_2 X_{kt} + \mu_t T + \mu_i I + \epsilon_{kt}$, where y is *Accruals* in all columns in both panels except columns (3) and (4) in Panel A, where y is *Accruals* × *Positiveaccruals* (*Accruals* × (1 − *Positiveaccruals*)) in column (3) (column (4)). Panel B provides the results of cross-sectional tests. The specification is similar to that in column (1) of Panel A. For Panel B, in column (1) (column (2)), we report results for the subsample of firms with below- (above-) sample median market capitalization; in column (3) (column (4)), we report results for the subsample of firms with above- (below-) sample median bid-ask spread; in column (5) (column (6)), we report results for the subsample of firms with below- (above-) sample median firm age; and in column (7) (column (8)), we report results for the subsample of firms with nonexecutive directors holding less (more) than 1% shares of the firm. Definitions of the variables in this table are provided in Appendix III.A. The sample includes one observation per firm-year and includes all firm-year data that we are able to obtain by matching Equilar and ExecuComp. Standard errors reported in parentheses are robust to heteroskedasticity and are clustered at the three-digit SIC industry level. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

Panel A: Signed Accruals and *Duration*

	Signed Accruals		Positive Accruals	Negative Accruals
	(1)	(2)	(3)	(4)
Duration	−0.002	−0.002	−0.002	0.0001
	(0.0009)**	(0.0009)**	(0.0007)**	(0.0006)
Log(Total assets)	−0.004	−0.004	−0.003	0.002
	(0.003)	(0.003)	(0.002)	(0.002)
Market to book	0.008	0.008	0.005	−0.004
	(0.003)***	(0.003)***	(0.002)***	(0.002)**
Debt/Total assets	0.005	0.005	0.002	−0.004
	(0.008)	(0.008)	(0.005)	(0.005)
S.D. Cashflow	−0.167	−0.167	0.017	0.182
	(0.041)***	(0.041)***	(0.026)	(0.026)***
S.D. Sales	0.021	0.021	0.024	0.003
	(0.010)**	(0.010)**	(0.006)***	(0.007)
Cashflows	−0.282	−0.282	−0.151	0.140
	(0.039)***	(0.039)***	(0.020)***	(0.023)***
Sales growth	0.041	0.041	0.038	−0.005
	(0.011)***	(0.011)***	(0.007)***	(0.006)

(*Continued*)

Table VII—*Continued*

Panel A: Signed Accruals and *Duration*

	Signed Accruals		Positive Accruals	Negative Accruals
	(1)	(2)	(3)	(4)
Log(Market cap)	0.008	0.008	0.004	−0.005
	(0.003)***	(0.003)***	(0.002)**	(0.002)***
Shareholding (%)		0.0001		
		(0.0002)		
Log(Delta)			−0.0004	0.0003
			(0.0004)	(0.0004)
Const.	0.002	0.002	0.025	0.024
	(0.008)	(0.008)	(0.005)***	(0.006)***
Obs.	4,745	4,745	4,745	4,745
R^2	0.286	0.286	0.252	0.301

Panel B: Signed Accruals and *Duration* (Cross-Sectional Tests)

	Small (1)	Large (2)	Illiquid (3)	Liquid (4)	Young (5)	Old (6)	Low Director (7)	High Director (8)
Duration	−0.004	−0.002	−0.003	−0.002	−0.003	0.0002	−0.003	−0.001
	(0.001)**	(0.001)*	(0.001)**	(0.001)	(0.002)*	(0.001)	(0.001)**	(0.002)
Log(Total assets)	0.001	−0.013	−0.011	−0.00004	−0.007	−0.0007	−0.011	−0.011
	(0.004)	(0.005)**	(0.005)**	(0.003)	(0.004)*	(0.004)	(0.005)**	(0.008)
Market to book	0.007	0.007	0.009	0.006	0.007	0.009	0.009	0.019
	(0.003)**	(0.003)**	(0.003)***	(0.004)	(0.003)**	(0.004)**	(0.004)**	(0.006)***
Debt/Total assets	−0.006	0.019	0.025	−0.010	0.018	−0.012	0.020	0.043
	(0.012)	(0.009)**	(0.010)***	(0.011)	(0.013)	(0.009)	(0.010)**	(0.019)**
S.D. Cashflow	−0.122	−0.233	−0.170	−0.134	−0.228	−0.123	−0.169	−0.202
	(0.045)***	(0.070)***	(0.066)**	(0.046)***	(0.066)***	(0.042)***	(0.075)**	(0.111)*

(*Continued*)

Table VII—*Continued*

Panel B: Signed Accruals and *Duration* (Cross-Sectional Tests)

	Small (1)	Large (2)	Illiquid (3)	Liquid (4)	Young (5)	Old (6)	Low Director (7)	High Director (8)
S.D. Sales	0.027	0.040	0.026	0.015	0.046	0.005	0.026	0.041
	(0.013)**	(0.017)**	(0.015)*	(0.013)	(0.018)**	(0.013)	(0.019)	(0.025)*
Cashflows	−0.318	−0.264	−0.307	−0.282	−0.277	−0.288	−0.303	−0.373
	(0.048)***	(0.044)***	(0.042)***	(0.046)***	(0.043)***	(0.050)***	(0.062)***	(0.046)***
Sales growth	0.049	0.030	0.050	0.037	0.027	0.052	0.040	0.051
	(0.016)***	(0.009)***	(0.012)***	(0.014)***	(0.015)*	(0.011)***	(0.011)***	(0.023)**
Log(Market cap)	0.013	0.014	0.011	0.007	0.011	0.006	0.014	0.015
	(0.004)***	(0.005)***	(0.005)**	(0.004)*	(0.003)***	(0.004)	(0.004)***	(0.008)*
Const.	−0.056	0.030	0.041	−0.017	0.007	−0.009	0.019	−0.019
	(0.017)***	(0.016)*	(0.015)***	(0.013)	(0.013)	(0.012)	(0.014)	(0.023)
Obs.	2,388	2,357	2,343	2,402	2,267	2,478	2,878	767
R^2	0.319	0.347	0.388	0.291	0.305	0.33	0.325	0.462

to positive accruals. We do *not* find a significant relationship between pay duration and negative accruals.[19] This indicates that a longer-duration pay contract reduces the CEO's incentive to engage in earnings-enhancing accruals.

Apart from a long vesting schedule, executives can also be given long-term incentives through deferred compensation. To see if the effect of *Duration* on *Accruals* is robust to controlling for the extent of long-term incentives provided by such deferred compensation, in unreported tests, we repeat our estimations after controlling for the extent of deferred pay using *High deferred pay*, a dummy that identifies executives with above-median deferred compensation as a fraction of total compensation. We obtain results similar to those reported here.

Summarizing, our results in Panel A of Table VII show that firms that offer their CEOs longer-duration pay contracts are associated with lower accruals and more specifically, less positive (earnings-enhancing) accruals, which is consistent with the intuition that short-duration pay provides incentives for managers to emphasize short-term earnings. Our results are economically significant as well. Comparing the coefficient in column (1) to the mean (standard deviation) of accruals in our sample, we find that a one-standard-deviation increase in *Duration* (1.045 years) is associated with a 100% (3.25%) reduction in accruals as compared to its sample mean (standard deviation). Similarly, the coefficient in column (3) implies that a one-standard-deviation increase in *Duration* (1.045 years) is associated with a 67% (8.3%) reduction in positive accruals as compared to its sample mean (standard deviation).

If higher *Accruals* among firms with short CEO pay duration reflect managerial effort to boost the short-term stock price by inflating short-term earnings, then this should be more prevalent among firms with less liquid stock. Such firms will have less scrutiny in the public equity market, making it easier for the manager to manipulate the stock price by reporting high short-term earnings. To test this conjecture, we conduct cross-sectional tests differentiating firms based on size, age, and bid-ask spread. Moreover, if the board of directors serves a monitoring role to limit managerial effort at manipulating short-term performance, then the correlation between pay duration and *Accruals* should be stronger for firms with weaker board oversight. We use the extent of nonexecutive director shareholding as a proxy for board oversight to test this conjecture.

In Panel B of Table VII, we test our cross-sectional predictions by repeating our tests in different subsamples. In columns (1) and (2), we divide our sample into small and large firms, where we identify firms as small if they have below-sample median market capitalization. In columns (3) and (4), we divide our sample based on bid-ask spread. In columns (5) and (6), we divide our sample

[19] Note that negative accruals reduce current earnings and increase future earnings, which will benefit managers with long-duration pay contracts and suggest a link between long-duration pay and negative accruals. However, low current earnings may cause a CEO to be fired before her grants vest, in which case the grants may be worthless. This may weaken the relation between pay duration and negative accruals.

into young and old firms. We classify firms as young if they have below-median firm age, where firm age is the number of years since the IPO year. Since older firms are likely to have greater institutional shareholding (Bennett, Sias, and Starks (2003)), we expect duration to have a greater effect on accruals for younger firms. Finally, in columns (7) and (8), we repeat our tests in subsamples of firms with high and low board oversight, where we classify firms in which nonexecutive directors own more than 1% of the shares as having high board oversight. Overall, our results in Panel B show that the negative association between *Duration* and *Accruals* is stronger for smaller firms, younger firms, firms with less liquid stock, and firms with low board oversight.[20]

B. Robustness Checks

In this section, we repeat our tests with $Duration^{PPS,total}$ as our independent variable. Note that, in calculating $Duration^{PPS,total}$, we include all prior-year grants and holdings. Apart from the standard controls, we also include $Duration^{PPS,award}$ as an additional control in these regressions. Recall that $Duration^{PPS,award}$ is the PPS-weighted duration calculated using annual grants alone. Thus, we control for the structure of the annual compensation contract, which allows us to interpret the coefficient on $Duration^{PPS,total}$ as predominantly measuring the effect of prior-year grants on *Accruals*. To the extent that prior-year grants are less affected by time-varying unobserved factors that may affect the current period's *Accruals*, this specification helps to control for unobserved private information.

In Table VIII, we repeat our tests from Panel A of Table VII after replacing *Duration* with $Duration^{PPS,total}$. The results in column (1) show that firms managed by CEOs with longer-duration compensation portfolios are associated with lower levels of abnormal accruals. The coefficients on the control variables are similar to those reported in Panel A of Table VII. In column (2), we repeat our estimates after controlling for the fraction of executives' shareholding and find our results to be unaffected. In columns (3) and (4), we split *Accruals* into positive and negative accruals and also control for the delta of the executive's compensation portfolio. We find that firms with higher $Duration^{PPS,total}$ have higher negative accruals.

Our analysis indicates that firms with shorter-duration CEO pay have higher abnormal accruals. To the extent that the stock market does not correctly price accruals, such behavior may lead to temporary mispricing of the firm's shares and prove costly for some shareholders. In some cases, this may even lead to inefficient corporate decisions. Thus, our analysis highlights a potentially important cost of short-duration pay.

[20] Although the coefficients are observationally different across the different subsamples, when we explicitly test for such differences, we find that the coefficients are not significantly different from each other. When we repeat our tests using *Short duration* instead of *Duration*, where *Short duration* identifies firms with below-median CEO pay durations, we obtain results similar to those reported here. In this alternative specification, we find the coefficients to be significantly different across young and old firms.

Table VIII

Robustness Checks

This table reports results of robustness checks relating signed accruals to CEO pay duration. It reports the OLS regression relating the level of signed accruals to CEO pay duration, measured by $Duration^{PPS,total}$. Definitions of the variables in this table are provided in Appendix III.A. The sample includes one observation per firm-year and includes all firm-year data that we are able to obtain by matching Equilar and ExecuComp. Standard errors reported in parentheses are robust to heteroskedasticity and are clustered at the three-digit SIC industry level. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

Signed Accruals and $Duration^{PPS,total}$

	Signed Accruals		PositiveAccruals	Negative Accruals
	(1)	(2)	(3)	(4)
$Duration^{PPS,total}$	−0.003	−0.003	−0.0007	0.002
	(0.002)*	(0.002)*	(0.001)	(0.001)*
$Duration^{PPS,award}$	0.00005	0.0001	−0.0006	−0.0007
	(0.0008)	(0.0008)	(0.0005)	(0.0005)
Log(Total assets)	−0.004	−0.004	−0.003	0.002
	(0.003)	(0.003)	(0.002)*	(0.002)
Market to book	0.008	0.008	0.005	−0.004
	(0.003)***	(0.003)***	(0.002)***	(0.002)**
Debt/Total assets	0.006	0.006	0.002	−0.004
	(0.008)	(0.008)	(0.005)	(0.006)
S.D. Cashflow	−0.168	−0.169	0.018	0.184
	(0.041)***	(0.041)***	(0.027)	(0.027)***
S.D. Sales	0.019	0.019	0.022	0.003
	(0.010)*	(0.010)*	(0.006)***	(0.007)
Cashflows	−0.280	−0.281	−0.149	0.140
	(0.039)***	(0.039)***	(0.020)***	(0.023)***
Sales growth	0.041	0.041	0.038	−0.006
	(0.011)***	(0.011)***	(0.007)***	(0.006)
Log(Market cap)	0.008	0.008	0.004	−0.005
	(0.003)***	(0.003)***	(0.002)**	(0.002)***
Shareholding (%)		0.0001		
		(0.0002)		
Log(Delta)			−0.0004	0.0006
			(0.0004)	(0.0005)
Const.	0.005	0.005	0.027	0.023
	(0.009)	(0.009)	(0.006)***	(0.006)***
Obs.	4,705	4,705	4,705	4,705
R^2	0.287	0.287	0.249	0.304

C. Caveats

We now discuss potential biases in our analysis. First, as mentioned earlier in Section I.F, our omission of restrictions (either explicit or implicit) on the executive's ability to exercise and sell stock and option grants as soon as they vest will lead our pay duration measure to underestimate the extent of long-term incentives provided to the executive by the pay contract. The effect of such omission on the estimated negative relationship between abnormal accruals and our pay duration measure is, however, unclear.

(1) If the restrictions are uncorrelated with pay duration, and to the extent that they affect executive behavior, then pay duration is likely to be a noisy proxy for the executive's incentives to boost short-term performance, which is likely to attenuate our estimates.
(2) If the restrictions are positively correlated with pay duration, that is, firms with longer explicit vesting schedules impose additional restrictions on executives' ability to sell their grants, then our duration measure, *Duration*, will underestimate the CEO's true horizon, especially for those with larger *Duration*. This will lead our estimated (negative) relationship between abnormal accruals and pay duration (see Table VII) to *overstate* the magnitude of the (negative) relationship between abnormal accruals and the executive's true incentive horizon.
(3) Finally, if the restrictions are negatively correlated with *Duration*, that is, less stringent restrictions are associated with larger *Duration*, then *Duration* will underestimate the CEO's true incentive horizon by a lesser extent for a larger *Duration*. This will lead our estimated (negative) relationship between abnormal accruals and *Duration* to *understate* the magnitude of the (negative) relationship between abnormal accruals and the true incentive horizon provided by the pay contract.

Further, our analysis does not establish a causal link between CEO pay duration and abnormal accruals, since both are endogenous choices. This endogeneity problem is challenging and its effect on our estimates is ambiguous. One possible omitted variable that could bias our estimates upward is firm risk. Riskier firms, with more volatile cash flows, could offer shorter-duration pay contracts to reduce their CEOs' compensation risk, and at the same time have higher abnormal accruals to smooth reported earnings relative to more volatile cash flows. An omitted variable that could bias our estimates downward is the extent of information and agency problems between the board and the CEO. In a firm with greater information and agency problems, where direct monitoring of the manager is more difficult, the board may optimally design a longer-duration pay contract because long-term earnings may be more informative about true performance than short-term earnings, and thus may represent a better conditioning variable for incentive contracting purposes. Managers of such firms may also engage in greater earnings management. Thus, overall, it is difficult to sign the bias in our estimates.

There are a number of avenues for future research to better understand the causes and consequences of pay duration. One promising avenue is to identify potential instruments for pay duration and estimate a causal link between pay duration and earnings management. Another possibility is to look for an exogenous shock, say a regulatory or tax change that differentially affects the costs of long-term and short-term pay, and then examine how pay duration reacts to the shock. If a convincing instrument can be found, another area for future research would be to explore the causal effect of pay duration on the firm's investment policy. Pay duration should affect the mix of projects a manager may choose with longer-duration pay contracts prompting long-duration projects. Another possible avenue for future research is careful scrutiny of the link between pay duration and managerial risk choices. We believe that advances in our understanding of these important questions would be of first-order interest.

V. Conclusion

There has been a long-standing intuition in the executive compensation literature that the extent to which a CEO's compensation is long-term or short-term will affect the investment and effort allocation decisions of the CEO. In fact, this is the main reason for the enormous attention devoted—both in research and in policy discussions—to the issue of possibly inefficient "short-termism" in executive compensation. However, lacking an empirical measure that quantifies the extent to which compensation is short-term or long-term, it has not been possible to give legs to this intuition. This paper seeks to fill such a gap in the literature.

We develop a new measure of the extent to which executive compensation is short-term versus long-term. This measure is called *Duration* and is conceptually similar to the duration of fixed-income securities. We obtain data on the vesting schedules of restricted stock and stock options, the use of which is novel, to calculate the pay duration for a large sample of executives. Our empirical analysis shows that shorter-duration executive compensation contracts are associated with greater managerial incentive to manipulate short-term performance. There is also evidence of a correlation between executive pay duration and industry and firm characteristics. Executive pay duration is longer in larger firms, firms with more growth opportunities, firms with a higher proportion of long-term assets, firms with higher R&D intensity, less risky firms, and firms with better past stock performance. Executives with longer-duration contracts receive higher compensation, but lower bonus, on average. We find our results to be robust to alternative ways of calculating duration.

Our focus is on developing a new measure of executive compensation duration and documenting what we believe are interesting stylized facts related to cross-sectional differences in the association between this duration measure and a host of firm characteristics. Due to formidable endogeneity challenges, we have not established causal links. We view this as a promising agenda for future research that goes beyond the modest first step taken in this paper. One interesting question to address is the nature of the causal relationship

between pay duration and the extent of short-termism in project choice. Another interesting question is whether observed pay durations are optimal, based on calibration relative to a theoretically optimal benchmark, or whether corporate governance weaknesses engender systematic deviations from optimal contracts. Developing and testing structural models may be the way to move this research agenda forward.

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Appendix A: Empirical Variable Definitions

The variables used in the empirical analysis are defined as follows:

- ***Abnormal return - 1 year*** is the abnormal return on the firm's stock over the previous fiscal year. We calculate abnormal return as the difference between realized return and expected return and employ the Fama-French four-factor model to estimate expected returns.
- ***Abnormal return - 3 years*** is the abnormal return on the firm's stock over the previous three years. We calculate abnormal return as the difference between realized return and expected return and employ the Fama-French four-factor model to estimate expected returns.
- ***Accruals*** is signed abnormal accruals. We calculate this measure following the procedure outlined in Jones (1991).
- ***Age*** is the executive's age in the data year.
- ***Bonus*** is the executive's yearly bonus value.
- ***Capital expenditure*** is the ratio of capital expenditure to lagged book value of total assets.
- ***Cashflows*** is the ratio of cash flows from operations to lagged total assets. We calculate cash flows from operations as the difference between operating income after depreciation and accruals for the year. Accruals is the change in net working capital less depreciation expense.
- ***CEO*** is a dummy variable that takes the value one if the executive is a CEO and zero otherwise.
- **Debt/Total assets** is the ratio of the sum of long-term and short-term debt (Compustat items: dltt and dlc) to the book value of total assets.
- ***Delta*** is the sensitivity of the executive's stock and options portfolio to a 1% change in the level of stock price; *Log*(*Delta*) is the natural logarithm of *Delta*.
- ***Director shareholding*** is nonexecutive directors' share ownership. *High director shareholding* is a dummy variable that takes the value one if *Director shareholding* is greater than 1%, and zero otherwise.
- ***Duration*** is the baseline measure of executive pay duration calculated in (1); $Duration^{PPS,total}$ is our alternate measure of pay duration calculated in (2); $Duration^{PPS,award}$ is constructed similar to $Duration^{PPS,total}$ but only includes annual grants for each year during the period 2006 to 2009.

- **EBIT/Sales** is the ratio of earnings before interest and taxes over sales.
- ***Entrenchment index*** is the Bebchuk, Cohen, and Ferrell (2009) entrenchment index.
- ***Fraction independent*** is the fraction of independent directors on the firm's board.
- ***High deferred pay*** is a dummy variable that takes the value one for executives with above-median deferred pay as a proportion of total pay. We calculate deferred pay as the sum of unvested stock and option grants and deferred compensation.
- ***Log(Market cap)*** is the natural logarithm of the firm's market capitalization.
- ***Long-term assets*** is the ratio of book value of property, plant, and equity plus goodwill over noncash total assets.
- ***Market to book*** is the ratio of market value of total assets to book value of total assets.
- ***Options*** is the Black-Scholes value of the options granted to the executive during the year.
- **R&D/Total assets** is the ratio of research and development expenditure over book value of total assets. We code missing values of research and development expenditure as zero.
- ***Restricted stock*** is the value of the restricted stock granted to the executive during the year.
- ***Return − 1 year*** is the one-year percentage return for the firm's stock over the previous fiscal year.
- ***Return − 3 years*** is the cumulative buy-and-hold return on the firm's stock over the previous three years.
- ***Salary*** is the executive's yearly salary value.
- ***Sales growth*** is the firm's annual sales growth rate.
- ***S.D. Sales*** is the standard deviation of the firm's annual sales growth during the prior five years.
- ***S.D. Cashflow*** is the standard deviation of the ratio of cash flows over lagged total assets over the previous five years.
- ***Shareholding*** is the executive's share ownership in the firm.
- ***Spread*** is the average daily stock bid-ask spread during the previous year.
- ***Total assets*** is the book value of total assets; *Log*(*Total assets*) is the natural logarithm of *Total assets*.
- ***Total compensation*** is the sum of salary, bonus, other annual compensation, long-term incentive payouts, other cash payouts, and the value of restricted stock and stock option awards.
- ***Volatility*** is the stock return volatility calculated as the annualized volatility of daily stock returns during the previous year.

Appendix B: Estimating Accruals

To estimate *Accruals*, we start by estimating the following regression for each industry-year pair combination in our sample, where we define industries

using the Fama-French 48 industry classification:

$$\left(\frac{\text{Total accruals}}{\text{Lag asset}}\right)_{kt} = \alpha + \beta_1 \times \left(\frac{1}{\text{Lag asset}}\right)_{kt} + \beta_2 \times \left(\frac{\Delta\text{Sales}}{\text{Lag asset}}\right)_{kt} + \beta_3 \times \left(\frac{\text{PPE}}{\text{Lag asset}}\right)_{kt} + \epsilon_{kt}, \tag{B1}$$

where

$$\begin{aligned} \textit{Total accruals} \equiv\ & \Delta\textit{Current assets} - \Delta\textit{Current liabilities} - \Delta\textit{Cash} \\ & - \Delta\textit{Short-term debt} - \textit{Depreciation expense}. \end{aligned}$$

The residual from this regression represents *Accruals* for each firm-year.

REFERENCES

Aggarwal, Rajesh K., and Andrew A. Samwick, 1999a, The other side of the trade-off: The impact of risk on executive compensation, *Journal of Political Economy* 107, 65–105.

Aggarwal, Rajesh K., and Andrew A. Samwick, 1999b, Executive compensation, strategic competition, and relative performance evaluation: Theory and evidence, *Journal of Finance* 54, 1999–2043.

Banker, Rajiv D., and Srikant M. Datar, 1989, Sensitivity, precision, and linear aggregation of signals for performance evaluation, *Journal of Accounting Research* 27, 21–39.

Bebchuk, Lucian A., Alma Cohen, and Allen Ferrell, 2009, What matters in corporate governance? *Review of Financial Studies* 22, 783–827.

Bebchuk, Lucian A., and Jesse M. Fried, 2003, Executive compensation as an agency problem, *Journal of Economic Perspectives* 17, 71–92.

Bebchuk, Lucian A., and Jesse M. Fried, 2010, Paying for long-term performance, *University of Pennsylvania Law Review* 158, 1915–1960.

Bennett, James A., Richard W. Sias, and Laura T. Starks, 2003, Greener pastures and the impact of dynamic institutional preferences, *Review of Financial Studies* 16, 1203–1238.

Bergstresser, Daniel, and Thomas Philippon, 2006, CEO incentives and earnings management, *Journal of Financial Economics* 80, 511–529.

Bertrand, Marianne, and Sendhil Mullainathan, 2001, Are CEOs rewarded for luck? The ones without principals are, *Quarterly Journal of Economics* 116, 901–932.

Bettis, Carr, John M. Bizjak, Jeffrey L. Coles, and Swaminathan Kalpathy, 2010, Stock and option grants with performance-based vesting provisions, *Review of Financial Studies* 23, 3849–3888.

Bizjak, John M., James A. Brickley, and Jeffrey L. Coles, 1993, Stock-based incentive compensation and investment behavior, *Journal of Accounting and Economics* 16, 349–372.

Bolton, Patrick, Jose Scheinkman, and Wei Xiong, 2006, Executive compensation and short-termist behaviour in speculative markets, *Review of Economic Studies* 73, 577–610.

Bushman, Robert M., Ellen Engel, Jennifer C. Milliron, and Abbie J. Smith, 1998, An empirical investigation of trends in the absolute and relative use of earnings in determining cash compensation of CEOs, Working paper, UNC-Chapel Hill.

Bushman, Robert M., and Abbie J. Smith, 2001, Financial accounting information and corporate governance, *Journal of Accounting and Economics* 32, 237–333.

Cadman, Brian D., Tjomme O. Rusticus, and Jayanthi Sunder, 2010, Stock option grant vesting terms: Economic and financial reporting determinants, Working paper, Northwestern University.

Chi, Jianxin, and Shane A. Johnson, 2009, The value of vesting restrictions on managerial stock and option holdings, Working paper, Texas A&M University.

Coles, Jeffrey L., Naveen D. Daniel, and Lalitha Naveen, 2006, Managerial incentives and risk-taking, *Journal of Financial Economics* 79, 431–468.

Core, John E., and Wayne R. Guay, 2002, Estimating the value of employee stock option portfolios and their sensitivities to price and volatility, *Journal of Accounting Research* 40, 613–630.

Core, John E., Robert W. Holthausen, and David F. Larcker, 1999, Corporate governance, chief executive officer compensation, and firm performance, *Journal of Financial Economics* 51, 371–406.

Dichev, Ilia D., John R. Graham, Campbell R. Harvey, and Shiva Rajgopal, 2012, Earnings quality: Evidence from the field, Working paper, Duke University.

Dutta, Sunil, and Stefan Reichelstein, 2003, Leading indicator variables, performance measurement and long-term versus short–term contracts, *Journal of Accounting Research* 41, 837–866.

Garen, John E., 1994, Executive compensation and principal-agent theory, *Journal of Political Economy* 102, 1175–1199.

Garvey, Gerald, and Todd Milbourn, 2003, Incentive compensation when executives can hedge the market: Evidence of relative performance evaluation in the cross section, *Journal of Finance* 58, 1557–1581.

Garvey, Gerald, and Todd Milbourn, 2006, Asymmetric benchmarking in compensation: Executives are rewarded for good luck but not penalized for bad, *Journal of Financial Economics* 82, 197–225.

Gerakos, Joseph J., Christopher D. Ittner, and David F. Larcker, 2007, The structure of performance-vested stock option grants, in Rick Antle, Pierre J. Liang, and Froystein Gjesdahl, eds.: *Essays on Accounting Theory in Honor of Joel S. Demski* (Springer, New York).

Gopalan, Radhakrishnan, Todd Milbourn, and Fenghua Song, 2010, Strategic flexibility and the optimality of pay for sector performance, *Review of Financial Studies* 23, 2060–2098.

Graham, John R., Campbell R. Harvey, and Shiva Rajgopal, 2005, The economic implications of corporate financial reporting, *Journal of Accounting and Economics* 40, 3–73.

Hall, Brian J., and Jeffrey B. Liebman, 1998, Are CEOs really paid like bureaucrats? *Quarterly Journal of Economics* 113, 653–691.

Haubrich, Joseph G.,1994, Risk aversion, performance pay, and the principal-agent problem, *Journal of Political Economy* 102, 258–276.

Holmstrom, Bengt, 1979, Moral hazard and observability, *Bell Journal of Economics* 10, 74–91.

Holmstrom, Bengt, and Joan Ricart i Costa, 1986, Managerial incentives and capital management, *Quarterly Journal of Economics* 101, 835–860.

Hribar, Paul, and D. Craig Nichols, 2007, The use of unsigned earnings quality measures in tests of earnings management, *Journal of Accounting Research* 45, 1017–1053.

Janakiraman, Surya N., Richard A. Lambert, and David F. Larcker, 1992, An empirical investigation of the relative performance evaluation hypothesis, *Journal of Accounting Research* 30, 53–69.

Jensen, Michael C., and Kevin J. Murphy, 1990, CEO incentives: It's not how much you pay, but how, *Harvard Business Review* 68, 138–149.

Jones, Jennifer J., 1991, Earnings management during import relief investigations, *Journal of Accounting Research* 29, 193–228.

Lambert, Richard A., and David F. Larcker, 1987, An analysis of the use of accounting and market measures of performance in executive compensation contracts, *Journal of Accounting Research* 25, 85–125.

Milbourn, Todd, 2003, CEO reputation and stock-based compensation, *Journal of Financial Economics* 68, 233–263.

Oyer, Paul, 2004, Why do firms use incentives that have no incentive effects? *Journal of Finance* 59, 1619–1650.

Ryan, Harley E., and Roy A. Wiggins, 2004, Who is in whose pocket? Director compensation, board independence, and barriers to effective monitoring, *Journal of Financial Economics* 73, 497–524.

Sloan, Richard G., 1993, Accounting earnings and top executive compensation, *Journal of Accounting and Economics* 16, 55–100.

Sloan, Richard G., 1996, Do stock prices fully reflect information in accruals and cash flows about future earnings? *The Accounting Review* 71, 289–315.

Thakor, Anjan V., 1990, Investment "myopia" and the internal organization of capital allocation decisions, *Journal of Law, Economics, & Organization* 6, 129–154.

Walker, David I., 2011, Evolving executive equity compensation and the limits of optimal contracting, *Vanderbilt Law Review* 64, 611–674.