Duisenberg school of finance - Tinbergen Institute Discussion Paper

TI 12-021/2/DSF30

The Executive Turnover Risk Premium

Florian S. Peters[1]
Alexander F. Wagner[2]

[1] Duisenberg school of finance, University of Amsterdam; [2] Swiss Finance Institute, University of Zürich, CEPR, Harvard.

This paper investigates the idea that turnover risk is priced in executive compensation. In light of the current discussion about pay practices in U.S. corporations, understanding this relationship is of particular interest. A positive association between dismissal risk and pay in the cross section of CEOs is a central prediction of a competitive labor market model: In such a model, pay in "constrained" sectors (where job risk exists and results in costs for dismissed employees) needs to be higher than in "unconstrained" sectors to compensate for job risk (Abowd and Ashenfelter, 1981). Consistent with this hypothesis, our results provide considerable evidence that CEOs who are exposed to higher job risk are paid more than CEOs enjoying more secure jobs.[1]

By focusing on the cross-sectional relationship between dismissal risk and compensation, our study complements that of Kaplan and Minton (2011) who document a secular downward trend in CEO tenures and argue that the shorter expected tenure of CEOs "likely offsets some of the benefits of the increase in CEO pay" (p. 27) over the past 15 years, suggesting a link between dismissal risk and compensation in the time series (see also Kaplan (2008)).

Previous work has shown that CEOs bear significant costs when getting fired, and so the existence of a turnover risk premium in CEO pay is not surprising per se. Empirical studies show that CEOs may remain unemployed for extended periods of time, and when they find a new job, they typically work for much smaller firms and earn significantly less than in their prior job (Fee and Hadlock, 2004).[2]

But is cross-sectional variation in turnover risk causally related to compensation? To answer this question, the natural empirical approach is to estimate job risk of CEOs in a first stage and to then relate this predicted job risk to their compensation levels in a second stage. We employ this approach, but we are mindful of the fact that several firm and CEO characteristics that are associated with turnover are arguably also directly related to compensation. Our task, therefore, is to identify factors providing exogenous variation in turnover risk that do not affect pay through other channels.

[1] We use the terms "dismissal risk," "job risk," and "turnover risk" interchangeably.

[2] Besides career concerns, CEOs may lose the unvested portion of previously granted equity-based pay. We discuss the role of severance agreements in more detail in Section 3.4 and merely note here that CEOs can in general expect only relatively small amounts of severance to be contractually guaranteed.

Our identification strategy relies on the idea that, in practice, firing does not only occur because the CEO demonstrated poor idiosyncratic performance and thus was revealed to possess low skill. Rather, a board may fire a CEO when industry conditions change. For example, after a technology shock the set of characteristics a CEO offers may no longer fit the new industry characteristics (Eisfeldt and Kuhnen, 2011). Therefore, we hypothesize that CEOs in industries (and firms) characterized by more uncertain business conditions are more likely to be dismissed. In short, firm and industry risk should predict forced turnover. However, we argue that the extent of changing business conditions is unlikely to directly affect compensation, conditional on other covariates such as firm and CEO characteristics.

As proxies for the degree of changeability of conditions we use firm and industry-level equity volatility, semi-volatility, and the credit rating. The idea is that all these variables signal different, but related types of potential changes of needs at the firm or in the industry, making it more likely that a board will find it optimal to replace a CEO.

In our empirical analysis, we first document that CEOs are in fact exposed to more job risk when firm and industry conditions are more changeable. To the best of our knowledge, this is a novel empirical result. (We also confirm earlier findings that realized industry performance predicts CEO dismissals (Jenter and Kanaan, 2011; Kaplan and Minton, 2011).)

Our central finding is that there is a robust and significantly positive association between predicted turnover risk and CEO compensation. On average, across various regression specifications, a one percentage point increase in turnover risk is associated with about 10% greater total compensation, in line with calibrated theoretical predictions.

In our analysis, we address a number of potentially relevant confounding factors. First, our results hold controlling for a range of other factors considered to influence pay, such as firm size, corporate governance, and pay-performance incentives. We also control for several proxies of CEO skill such as idiosyncratic returns, CEO age and tenure, and outsider status. This attenuates the concern that more difficult jobs may entail higher turnover risk, and, at the same time, require greater CEO skills, which need to be compensated as a skill premium rather than, or in addition to, a dismissal risk premium.

Second, we adjust the dependent variable - total compensation - by recomputing the value of the option package in total compensation, setting equity volatility to the same, constant value for all firms and all years. This avoids a mechanical relation that would otherwise exist between volatility and Black-Scholes option values.

Third, the results hold both when using the standard press-based classification and a purely age-based classification of forced turnover. The latter classification categorizes a turnover as forced if the CEO was below a certain age at the time of departure. It avoids biases in the press-based classification that may arise from varying degrees of media coverage of CEO turnover.

Finally, the results are quantitatively very similar in a smaller sample in which we can explicitly control for the severance amount that a firm has agreed to pay in case of an involuntary turnover. This suggests that our main results - on the large sample - are not significantly biased by the fact that we cannot generally control for severance agreements.

Overall, our results provide evidence in support of the hypothesis that job risk is compensated in the cross section of CEO pay. This is in line with the view that pay in CEO labor markets is set competitively.

Notably, our findings are opposite to a prediction of a simple model where pay is determined by CEO entrenchment or power. Specifically, if more powerful CEOs are able to set their own pay and job security while others are not, that would imply a negative correlation between turnover risk and compensation in the cross section. The reason is that entrenched CEOs would aim for higher compensation *and* lower turnover risk while the less powerful CEOs would be more moderately paid and, at the same time, exposed to higher turnover risk. This is not what the data show. We discuss these implications in more detail in the conclusion.

Three guideposts can be used to put our findings into the context of the literature. First, we note a difference to the mechanism proposed by Hermalin (2005). He argues that better governance forces CEOs to work harder. Consequently, pay must rise to compensate for the additional disutility of effort. However, in his model, the equilibrium dismissal risk does not increase with better governance as CEOs provide more effort in response. Hence, while relating board characteristics to pay levels, his model does not generate a positive relation between dismissal risk and pay. In contrast, our empirical identification works through the fact that some CEOs are exposed to an ex ante riskier environment than others. Knowing that boards fire more in changing industry conditions, these CEOs need to receive higher compensation in equilibrium than their counterparts.

Second, our finding of a cross-sectional link between CEO dismissal risk and pay is related to and complements the idea of a time-series connection between these two quantities, as proposed by Kaplan and Minton (2011).[3] While establishing causality in the time series is difficult, our data show that aggregate fluctuations in industry risk over the past decades are consistent with the parallel evolution of CEO pay levels and turnover over the same time period.[4]

Finally, our findings add to the literature on executive compensation and corporate governance more broadly. While several recent theories have aimed at explaining the development of CEO pay levels over time, their insights also apply to the cross section. Gabaix and Landier (2008) show that the secular rise in executive pay can be explained by the similar increase in firm size within a framework of competitive markets and rare skills. Bebchuk and Fried (2004) advocate the managerial entrenchment view in explaining excessive executive pay. Hall and Murphy (2003) argue that total compensation may to a large extent be driven by stock market valuations, as a significant share of CEO pay is equity-based. We control for all of these factors in our regressions and include time dummies to capture general developments such as trends in the composition of skills (Murphy and Zaboinik, 2004; Frydman, 2005). Thus, our contribution is to show that a significant fraction of the cross-sectional variation in CEO pay can be explained by dismissal risk even after controlling for other important determinants of CEO pay.

The paper is organized as follows. In Section 1 we present the data. Section 2 discusses our

[3]Eisfeldt and Rampini (2008) document a correlation of aggregate, realized levels of M&A related turnover and compensation with the business cycle to motivate a theoretical model of optimal incentives. Using a cross section of firms, Agrawal and Knoeber (1998) find that managers under a higher threat of takeover earn more, arguably because they need to be compensated for the risk of losing deferred compensation and firm-specific human capital. Our results contrast with those of Hayes, Hillegeist, and Keating (2005) who find a negative association between financial distress risk and compensation.

[4]Besides the econometric difficulties of proving evidence of causality in the time series, there are also theoretical concerns. Outside options, which determine CEOs' reservation utilities, decline when turnover risk increases over time across *all* firms. Thus, from a theoretical perspective, turnover risk and pay need not be correlated over time even if CEOs' participation constraints are always binding. See also Edmans and Gabaix (2011).

empirical strategy. Section 3 presents the results. Section 4 concludes.

1 Data

The core of our dataset contains a detailed, hand-collected classification of CEO turnovers in the Execucomp database. From 1993 on, Execucomp covers nearly all S&P1500 companies.[5] Identifying the true nature of a CEO turnover is not straightforward as firms almost never announce a turnover as being involuntary. The most widely used procedure to classify turnovers as "forced" follows Parrino (1997) and uses press reports along with an age criterion and further refinements. We assemble a dataset that relies on this algorithm for the period 1993 to 2009, based on our own efforts and those of several other authors.[6] Our dataset includes 3,207 CEO turnovers of which 740 are classified as forced using the press-based procedure.

We also construct an alternative indicator of forced turnover, which entails no interpretation of press reports. This indicator classifies a turnover as forced if the CEO is below a particular age at the time of departure. An important advantage of the age-based turnover classification is its robustness to biases resulting from the extent of press coverage. According to Core, Guay, and Larcker (2011), the number of press articles discussing *CEO pay* increased substantially in the 1990s. If there has been a similar rise in press coverage of *CEO turnover*, then the rise in press-reported CEO dismissals may be the result of the breadth of press coverage rather than of a rise in actual dismissals. The age-based algorithm produces false negatives among the turnovers above the respective age threshold and false positives among the turnovers below the age threshold. By comparison, the press-based classification likely produces some false negatives (not all forced turnovers are identified as such in the available press sources) but is unlikely to yield

[5] S&P1500 companies are constituents of the S&P500 (500 firms), the S&P Midcap (400 firms), or the S&P SmallCap (600 firms) indices. In 1993, Execucomp covers 1157 of the S&P1500 firms. In all later years, coverage of S&P1500 firms is virtually complete.

[6] The classification requires significant data collection efforts, and we are thus grateful to Cristian Dezsö, Dirk Jenter, Greg Nini, Bob Parrino, and Luke Taylor for providing us with their data. The methodology is as follows. Departures for which the press reports state that the CEO was fired, forced out, or retires or resigns due to policy differences or pressure, are classified as forced. Turnovers of CEOs below the age of 60 which have not been classified as forced by the press criterion, are classified as forced if the articles do not report the reason to be death, poor health, or acceptance of another position or the articles report that the CEO is retiring but the company does not announce the retirement date at least 6 months before departure. For further details, see Parrino (1997).

false positives (turnovers described as involuntary by the media typically are indeed involuntary). The press-based measure thus probably understates the true incidence of forced CEO turnover. For the age-based classification, we use an age threshold of 56 years to closely match the average dismissal rate resulting from the press-based classification.

We assign a one to the *Forced* or *Forced56* dummy in the last fiscal year in which a dismissed CEO is in office for the greater part of the fiscal year. We use this timing convention, because, in the case of a transition within a fiscal year, Execucomp records the compensation of the CEO who was in office for the greater part of that fiscal year. Thus, by using this convention, we ensure that forced turnover and compensation pertain to the same CEO. (In contrast, if we assigned a one to the first year a dismissed CEO is no longer in office for the greater part of the fiscal year, the compensation recorded in Execucomp would correspond to that of the successor CEO.)

We merge our turnover data with Execucomp, from which we obtain compensation data and CEO characteristics. From Execucomp's compensation data we extract total compensation (item *tdc1*) and convert it to 2000 dollars using the Consumer Price Index provided by the Bureau of Labor Statistics. We also compute a second measure of total compensation by recomputing the Black-Scholes values of the option packages in total pay using the same, constant volatility parameter for all CEOs and years.[7] We call this measure *volatility-adjusted total compensation*. The motivation for constructing this variable is explained in more detail in Section 2. We calculate the fraction of equity-based pay in total compensation, and we construct a dummy variable indicating whether the CEO received stock or stock options in a given year. For the time period 2006-2009, data on estimated payments in the event of involuntary termination (severance agreements) are available in Execucomp (item *term_pymt*). We winsorize this variable at the 0.5% level to reduce the influence of a few extreme observations.

Using Execucomp item *datebecameceo* (the date the executive became CEO of the firm), we compute CEO tenure at each fiscal year end, and round it to full integers. We also construct a dummy variable indicating whether a CEO is above the age of 60. This accounts for the likely non-linearity of the relation between CEO age on the one hand and dismissal risk and pay on the

[7] We use the mean volatility of the sample.

other. We then construct a dummy variable indicating whether the CEO was hired from inside or outside the firm using Execucomp items *joined_co* (the date when the executive joined the company) and *datebecameceo*. Following Weisbach (1988), we classify a CEO as an outside hire if he joined the firm no earlier than one year before his appointment as CEO.

We add to this dataset accounting and stock return data. As our measure of firm size we use the total market value of the firm computed as total assets minus book equity and deferred taxes plus market equity.[8] As measures of short-term stock performance, we use the one-year stock return which we decompose into its market, industry, and idiosyncratic component. The market component is the CRSP value-weighted market return. The industry component is the value-weighted industry return minus the market return. The idiosyncratic return is the individual return minus the industry return. We classify industries into 48 groups using the Fama-French classification (Fama and French, 1997) and use the respective industry returns provided by Ken French.

We pay particular attention to the time period over which stock returns are measured. Studies of CEO turnover typically use stock returns measured over fiscal years - either current or lagged years - as a determinant of CEO turnover. A potential concern with this timing convention is that, when using lagged-year performance, there may be a significant gap between the CEO's departure date and the performance measurement period. For instance, for a CEO that is fired at the end of the fiscal year, the lagged-year performance would neglect the most recent 12 months of performance realized under the departing CEO. On the other hand, when using current fiscal year performance, the measurement period often overlaps with the firing date and thus includes performance that should be attributed to the successor CEO. To address these issues, we measure performance over a period that covers the 12 months prior to the announcement date of a fired CEO, and the current fiscal year performance in case the CEO was not fired. (We use alternative timing choices in the robustness analysis.)

[8] Total assets is Compustat item *at*; book equity is book value of shareholdersâ equity (item *seq*), plus balance sheet deferred taxes and investment tax credit (item *txditc*), minus book value of preferred stock. Depending on availability, we use redemption (item *pstkrv*), liquidation (item *pstkl*), or par value (item *upstk*) (in that order) to estimate the book value of preferred stock.

We also add several measures of corporate governance from RiskMetrics: The percentage of independent directors, a dummy indicating whether the CEO is chairman of the board, and (the log of) board size. We also include the governance index constructed by Gompers, Ishii, and Metrick (2003). These governance variables are available only for the period 1996 to 2005.

Finally, we add several variables measuring the extent of variability in firm and industry conditions. First, we compute stock return volatility from monthly return data over the past 48 months. Second, we compute the semi-volatility over the same horizon. This risk measure only takes into account return realizations that are below the mean. High values therefore reflect left-skewness of the return distribution. Third, we add the S&P long-term issuer credit ratings from Compustat. Compustat maps the official rating categories into integer values from 2 (AAA) to 23 (CC). Thus, higher numbers correspond to worse ratings and thus higher distress risk. In the regressions, we scale these numbers such that a unit increase in our rating variable corresponds to the difference between a AAA and a BBB rating, or to the difference between a BBB and a CCC rating (the scaling factor is 1/9). Finally, we compute industry-level measures of all three risk proxies: We compute industry volatility and semi-volatility using the value-weighted returns of the Fama-French 48 industries, and we compute the industry rating as the average S&P rating of all firms in the industry.

All variable definitions are summarized in Table I.

[Table I approximately here]

The final sample used in the main regressions has between 15,135 and 5,006 CEO-year observations, depending on which variables are included. Regressions using individual firm ratings contain substantially fewer observations as several firms does not carry a S&P long-term issuer credit rating. In the regressions that include corporate governance variables the sample size drops even further since the relevant RiskMetrics data are available only between 1996 and 2005.

Table II reports descriptive statistics. Panel A contains basic turnover statistics. Panel B reports firm characteristics. Firm size is large and highly skewed with mean (median) firm value of around 16.3 (2.5) billion dollars. Individual stock return volatility is 40% on average. Semi-volatility is slightly higher, indicating some degree of left-skewness. The numerical analogues of ratings are on average 11, which corresponds to a triple-B rating. Panel C contains CEO compensation characteristics. Similar to firm size, total compensation is highly skewed with a mean (median) of about 4.4 (2.2) million dollars. The mean and median of volatility-adjusted compensation are somewhat lower because firms with higher volatility tend to grant more options. By construction, the standard deviation is also lower, but still sizable relative to the mean. The average percentage of equity-based pay is 40% over the entire period, but varies significantly over time (not shown in the table). 22% of CEOs do not receive any stock or options. Corporate governance variables, given in Panel D, are representative of the smaller sample between 1996 and 2005. Finally, Panel E presents statistics on basic CEO characteristics.

[Table II approximately here]

2 Empirical Strategy

The theoretical argument for why CEOs facing higher dismissal risk may get paid more is simple: A job loss comes with costs for the CEO, such as a deterioration of future earnings opportunities and uncertainty about the duration of the unemployment spell. Thus, in competitive labor markets job risk needs to be compensated with higher pay (Abowd and Ashenfelter, 1981).[9] However, the fundamental challenge this paper must address is that turnover risk is endogenous. To estimate the causal effect of turnover risk on compensation, we need to compare the compensation of a CEO who faces a given turnover risk with the counterfactual compensation that would have been observed had turnover risk been different for exogenous reasons. Ideally, we would like to randomly assign varying degrees of turnover risk to a sample of CEOs and relate these to the resulting levels of compensation. In observational data, the causal effect can instead be identified using instrumental variables, i.e., variables that significantly affect turnover risk, but are unrelated to CEO pay except through their effect on turnover.

[9]Studies in labor economics that investigate wage differentials that compensate for the risk of unemployment include Li (1986), Heywood (1989), and Moretti (2000).

2.1 Instrumental Variables

We argue that the extent of uncertainty regarding firm or industry conditions – that is, in short, firm and industry risk – provides a valid instrumental variable for forced turnover in our analysis.

The motivation for this instrument is as follows. It is clear that boards fire CEOs for poor firm (idiosyncratic) performance. More surprisingly, Jenter and Kanaan (2011) and Kaplan and Minton (2011) document that boards are also more likely to fire a CEO when industry performance is poor. While this empirical fact is puzzling from the perspective of standard models of relative performance evaluation, Eisfeldt and Kuhnen (2011) provide a competitive assignment model in which industry shocks change the outside options of firms and managers, making it optimal for boards to include industry conditions in their decision to terminate the current CEO. Intuitively, shocks to an industry's technology or productivity may not reveal poor skill of a CEO, but may mean that a different skill set is required.

These existing results concern realized firm or industry performance as a determinant of turnover. We build on these ideas and conjecture that, ex ante, more uncertain industry conditions lead to higher CEO dismissal risk because the board will be more likely to perceive a lack of match between the CEO's skill set and the current requirements in his industry. In a volatile environment, boards may also be more frequently pressured to replace CEOs due to uncertainty about the match between the CEO and the firm or industry. Thus, we hypothesize that boards fire CEOs not only because of poor realized firm or industry performance, but in addition are more likely to fire CEOs when uncertainty regarding the business environment is particularly pronounced.

We use three proxies for changing business conditions, and we compute these measures on both the firm and industry levels, with the latter offering an arguably more exogenous source of variation.

Our first measure is stock return volatility. More volatile equity prices signal a more changeable environment. On the industry level, equity volatility arguably reflects largely exogenous technology, productivity, or demand shocks.

In practice, boards may be particularly attentive to uncertainty when it comes to downside risks. Our second measure, semi-volatility, accounts for below-mean returns only and therefore increases with the left-skew of the distribution. Third, we use firms' long-term credit ratings. Ratings also focus explicitly on the probability of bad realizations (default). But they take into account additional and more complex criteria than volatility or semi-volatility alone and could, therefore, measure additional aspects of uncertainty regarding future conditions not reflected in stock prices.

All three variables are highly but not perfectly correlated – the correlations are 92.0% between volatility and semi-volatility, 62.7% between volatility and rating, and 62.1% between semi-volatility and rating – indicating that they measure the same underlying factor.

In the main analysis, we lag the instruments by one fiscal year to reduce potential simultaneity concerns. (The results are similar if we use the contemporaneous variables.) The industry-level versions of volatility, semi-volatility and ratings mitigate a concern with firm-level instruments, namely, that firm risk itself may be driven by CEO skill. Stock returns may be more volatile (rather than just low), and ratings may be worse under a poorly skilled CEO. Without perfect controls for CEO skill, such a channel would bias against finding a positive turnover risk premium. Industry-level measures are arguably unrelated to the skill of the individual CEO while still affecting firm-level risk and thus turnover risk.

We note that risk – whether measured on the firm level or on the industry level – exhibits a mechanical relation to pay levels for those CEOs who receive compensation in part by way of stock options. This is because Black-Scholes values are increasing in the volatility of the underlying stock. We address this concern by constructing a compensation measure, *volatility-adjusted total compensation*, that replaces the Black-Scholes values of option packages reported in Execucomp by our own calculations of Black-Scholes values using the same constant volatility parameter for all CEOs and all years (and keeping all the other parameters as in Execucomp). This way, we essentially justify the exclusion restriction for volatility by construction. The value of option packages computed in this way still varies along many other dimensions, in particular the number of options granted.

Finally, we are careful to include a range of control variables that may be correlated with the instrumental variables and compensation. First, we aim to control for CEO skill by including idiosyncratic stock returns (see above for the timing convention we adopt in the main analysis). We also include (lagged) firm size which has been argued to correlate with CEO skill (Gabaix and Landier, 2008). We further include the following CEO characteristics: tenure, an indicator for whether the CEO is above the age of 59, and a dummy indicating whether the CEO is an outside hire. These firm and CEO variables constitute our principal set of controls.

Moreover, we control for the industry return in excess of the market return (with the same timing as the idiosyncratic return). Because we use year fixed effects throughout in our regressions, we omit the market return as a control variable.

In additional regressions we also control for whether a company uses equity-based pay for its CEO (and, in additional analysis, the extent of use of this form of pay), and we include various governance variables.

Overall, we cannot completely exclude the possibility that unobserved variables bias the estimated effect of turnover on pay upwards or downwards, depending on the nature of the omitted variables. However, we believe that the use of industry-level instrumental variables and the inclusion of many key control variables allows us to obtain a very high degree of exogeneity.

2.2 Empirical Model

We conduct a standard two-stage least squares approach. The first stage estimates the following linear probability model:

$$\text{Forced}_{it} = \alpha_1 + X'_{it}\beta_1 + \gamma_1 Z_{it} + \theta_{1t} + \epsilon_{1it} \tag{1}$$

where Forced_{it} is a dummy variable indicating whether the CEO was fired in a given year, X_{it} is a vector of controls described earlier which include some lagged variables, θ_{1t} is a full set of year dummies, and ϵ_{1it} is a stochastic error term. Z_{it} is our instrumental variable, which measures risk either at the firm level or at the industry level. The index 1 references the first stage. Naturally, we omit industry dummies in the regressions, as we have a specific theory as to which industry features affect turnover risk.

Note that even though Forced_{it} is an indicator variable, the linear probability model yields consistent second stage estimates (Angrist and Krueger, 2001). Using a Probit or Logit model instead can harm consistency of the second stage estimates and complicates the computation of standard errors (see Bennedsen, Nielsen, Perez-Gonzalez, and Wolfenzon (2007) for an application).

The second stage estimates the effect of forced turnover risk on compensation:

$$\text{Ln(1+Comp)}_{it} = \alpha_2 + X'_{it}\beta_2 + \gamma_2 \widehat{\text{Forced}}_{it} + \theta_{2t} + \epsilon_{2it} \tag{2}$$

where Ln(1+Comp)_{it} is the log of (1 plus) total CEO compensation and $\widehat{\text{Forced}}_{it}$ is the predicted value from regression (1). Similar to equation (1), θ_{2t} is a set of year fixed effects, and ϵ_{2it} is the error term. As discussed above, we use two alternative approaches to measure compensation.

By including year dummies in both stages, our identification strategy emphasizes cross-sectional variation in the changeability of firm and industry conditions and as such mainly speaks to cross-sectional variation in pay. Indeed, from a theoretical perspective, turnover risk premia are more natural to affect the cross section of pay levels rather than the time series. In particular, some theoretical models predict no relation between turnover risk and compensation levels in the time series if increasing turnover risk adversely affects the outside options of all CEOs equally (Edmans and Gabaix, 2011).

The coefficient of interest is γ_2 which measures the elasticity of CEO compensation with respect to forced turnover risk. Because Forced_{it} is a dichotomous variable, predicted values from regression (1) are interpreted as probabilities, so that γ_2 measures the percentage change in CEO pay that is associated with a one percentage point increase in the forced turnover probability.

3 Two-stage least squares results

3.1 Determinants of Forced Turnover

Table III presents the results of the first stage regressions estimating the probability of forced turnover. For our main regressions, we use as controls idiosyncratic returns, market-adjusted industry returns, firm size, an indicator for CEO age, tenure, outsider status, and year dummies (which also capture general market returns). As the analysis proceeds, we add further controls.

[Insert Table III approximately here]

Concerning the control variables, we find that, unsurprisingly, CEOs delivering poor idiosyncratic performance are more likely to be fired. Firm size does not appear to consistently affect turnover risk. Older CEOs and those with longer tenure are fired less often. We also find, as do Jenter and Kanaan (2011) and Kaplan and Minton (2011), that CEOs in poorly performing industries are more likely to be terminated.[10]

Our main interest is in the candidate instrumental variables, shown at the top of the table. All six variables are highly statistically significant and correlated with forced turnover in the predicted direction: More volatile firms and industries, those with more downside volatility, and those that receive worse ratings fire their CEOs more.

Most of the existing work on determinants of dismissals does not control for firm or industry risk, and we believe our finding of a relationship between CEO turnover and the changeability of firm and industry conditions is novel and in itself interesting.[11] It is also noteworthy that the impact of the instrumental variables is economically significant. For example, comparing CEOs of two otherwise equal firms, the CEO of the firm with a BBB rating has a turnover risk that is

[10]In untabulated results, we confirm that in logit regressions the statistical significance of industry performance is much higher than in the linear probability model (which is used to ensure consistency of estimates in the two-stage procedure; see above). When we use lagged fiscal year returns as our performance measure, stock returns are much less significant determinants of forced turnover. But our main results remain unchanged.

[11]An exception is Bushman, Dai, and Wang (2010) who show that CEOs are more likely to be replaced when volatility of the idiosyncratic component of firm performance is high. When exposure to systematic risk is high, by contrast, boards may infer less about the talent of the CEO, reducing the turnover rate. Our focus instead is on the idea that higher changeability of industry conditions makes it more likely that a CEO's skill set does not fit new industry conditions anymore.

two percentage points higher than that of his colleague at a AAA rated firm. (Recall that ratings are scaled such that a unit increase in the rating variable corresponds to the difference between a AAA and a BBB rating.) Importantly, the industry-level measures of risk are even more strongly associated with firing risk for CEOs than the firm-level variables. For instance, a difference in industry ratings of one unit implies a difference in turnover risk of four percentage points. When using the industry-level instruments, we also include excess firm-level volatility, semi-volatility and rating because this allows us to only use the industry component of total risk as an instrument while retaining the firm-specific component as a potential determinant of compensation in the second stage. (The results do not depend on including the firm-specific excess risk variables.)

Closer inspection reveals that Business Equipment and Telecoms industries show the highest industry volatilities and highest turnover, and they also exhibit the highest and third highest pay, respectively. The Energy, Chemicals, and Utilities industries have low turnover and relatively low pay. An exception is the Finance sector in which turnover is lowest, industry volatility is low, industry ratings are strong, but pay is the second highest.[12]

In sum we find that indeed CEOs in firms and industries that present the CEO with higher ex ante risk in firm and industry conditions are more likely to be dismissed. The strong correlation between risk and CEO turnover establishes the relevance of the instruments and alleviates weak instrument concerns.

3.2 Turnover Risk and CEO Pay: Main Results

A first set of second-stage regressions is shown in Table IV. These regressions are an important baseline for understanding the main results, while the following Table V addresses several potential concerns with these baseline regressions.

The six columns of Table IV use the predicted turnover probabilities from Table III as the key explanatory variable for log total compensation. Each column uses the instrument shown at

[12] The latter is likely to be due to the fact that the Finance sector has experienced unprecedented growth over much of the sample period and was much less affected by the burst of the dot-com bubble than most other industries. From the present perspective, this appears to have been a somewhat unusual period for the Finance sector. The flip side of high pay, namely a higher risk of getting fired, has become more visible recently. If we exclude the Finance sector, our findings are even stronger.

the bottom of the table. As can be seen from the F-statistics, shown in the last row of the table, all five first stages are strong. The F-statistics are well above the threshold level of 10 suggested by Stock, Wright, and Yogo (2002).

Consistent with the central hypothesis, dismissal risk is strongly and positively associated with compensation in all six regressions.

The second-stage coefficient estimates using volatility and semi-volatility as instruments are similar, which is as expected given that these are highly correlated sources of variation in turnover risk. The estimate for the turnover risk premium in the regression that uses firm-level rating as an instrument appears smaller and the second-stage estimate is only borderline significant (see column (3)). This result becomes clear when considering the regressions with industry-level variables as instruments and firm-level excess volatility or rating as control variables. Specifically, columns (4) to (6) show that there are two countervailing effects of a high total exposure of a firm to changing conditions: First, the industry component of total firm risk drives up compensation through increasing dismissal risk. Second, higher firm-specific volatility (and semi-volatility) and worse firm-specific ratings, relative to the industry, imply lower compensation (perhaps because these firms cannot afford to pay high compensation, or because this indicates low CEO skill). Separating out this second effect, regression (6) in fact tends to suggest that in the sample for which rating data is available, the turnover risk premium explained by variation in industry ratings is somewhat higher than that implied by variation in industry volatility or semi-volatility. We return to this issue when we discuss the quantitative interpretation of the effects in Section 3.3.

[Table IV approximately here]

As discussed in Section 2, including CEO characteristics likely goes a long way in reducing an important endogeneity concern, a correlation of our instruments with skill and selection on skill. The former concern is alleviated also through the use of industry-level instruments. For the concern regarding selection, it could be argued that industries with high CEO turnover (due to an “up-or-out-culture”, say) weed out the less-skilled CEOs. Over time, the remaining CEOs will be more highly-skilled than average, thus deserving higher pay. Similarly, it is possible that only highly-skilled CEOs choose to work in such competitive environments. This would induce a spurious correlation between turnover and pay, driven in part by unobserved skill. We believe that the included variables age, tenure, and a dummy variable indicating whether the CEO has been appointed from outside, in addition to past idiosyncratic performance, capture unobserved skill to a significant extent.[13]

Next, we proceed by addressing several concerns one might have with the findings in Table IV. First, we use volatility-adjusted compensation as the dependent variable. This way, there is no direct, mechanical effect of volatility (or variables correlated with volatility, such as rating) on compensation. We concentrate on the industry-level instruments–industry volatility (by year), industry semi-volatility (by year), and industry-average rating (by year)–because these are most likely to be exogenous from the perspective of the CEO.

The results corresponding to the baseline specification are shown in columns (1) to (3) of Table V. (We do not report the standard control variables, which are the same as in Table IV, to conserve space. As before, CEOs of larger firms earn more, as do executives who have recently performed better, older executives, and outsiders. Also in line with previous results, firms with excess firm-specific risk pay their CEOs less. Again, the first stages are confirmed to be strong, as seen in the F-statistics.

The main result for our purposes is that in this 2SLS specification, dismissal risk remains a statistically and economically significant determinant of CEO compensation. Reduced form regressions (not shown) also confirm that our instruments are strongly associated with compensation.

[Table V approximately here]

[13]We also do not observe risk aversion of CEOs. If more risk-averse CEOs select into safe industries while risk-loving CEOs select into risky industries (which is conceivable given the evidence in Graham, Harvey, and Puri (2010) regarding matching of CEO and firm characteristics), this implies that risk premia would be decreasing in risk. To the extent that age and tenure capture risk-aversion, this selection concern is alleviated. Moreover, the regression coefficients can also be interpreted as weighted average derivatives of compensation with respect to turnover risk (Angrist and Krueger, 1999). More weight is placed on values near the median of the turnover risk distribution, and less on *both* tails. Thus, there is no obvious bias introduced by selection on unobserved risk aversion.

Next, we include a control for whether the CEO receives equity-based compensation (columns (4) to (6) of Table V). Some firms may generally establish stronger incentives. Thus, boards would grant pay packages with higher proportions of equity-based pay, and would, at the same time, be more willing to fire CEOs.[14] More incentive compensation would, for risk-averse CEOs, be associated with higher expected values of pay. Thus, this mechanism may cause turnover risk and levels of compensation to be spuriously correlated.

Consistent with these ideas, the quantitative size of the effect of dismissal risk on CEO pay tends to decrease somewhat when we include this proxy for pay structure, but remains highly statistically significant. (In the robustness analysis, we also control for the actual percentage of equity-based pay in total compensation.)

Finally, we add governance characteristics to the set of regressors (columns (7) to (9)). In the first stage (not shown), corporate governance variables tend to have the expected signs (for example, turnover risk for chairman-CEOs is significantly lower than for their non-chairman counterparts, and smaller boards fire more), though not all of them are always significant. Interestingly, the coefficients in the second stage remain highly significant. In fact, they somewhat increase compared to the previous regressions. (Some of this change is due to the change in sample composition.)

3.3 Quantitative interpretation

Is the size of the coefficients we obtain in these regressions reasonable? To answer this question, we begin by observing that the coefficients vary somewhat across the instruments we use. They are around 10% when volatility and semi-volatility are used as instruments; they are sometimes substantially higher when the rating is the instrument. To understand these differences, first note that rating data are available only for a smaller subset of firms, so that the turnover risk premiums derived from using industry rating as an instrument cannot be directly compared with those obtained when using industry volatility as an instrument. Second, the first-stage F-statistic

[14] Note that the fact that monetary incentives and turnover as an incentive device can be substitutes is perfectly compatible with the notion that as boards wish to implement stronger incentives overall, they make more use of both tools.

tends to be lower for ratings than for the other instruments, putting ratings potentially into weak-instrument territory in some regressions. This calls for caution in the interpretation even if the second-stage coefficient is significant. For example, in regression (9) of Table V, the coefficient on the predicted turnover probability is a very large 27.45, but this is precisely where the F-stat drops below the conventional threshold of 10.[15]

Overall, we believe that while, economically, ratings are a powerful and intuitive predictor of dismissal risk, the statistical results argue for relying more on the regressions using volatility and semi-volatility as instruments to capture the average turnover risk premium. Therefore, a plausible estimate of the dismissal risk premium is 10%. The cross-industry interquartile range of turnover risk is about one and a half percentage points. For compensation, this spread is about 42%. Therefore, in this range, turnover risk explains about a third ($= 1.5 \times 10/42$) of the cross-industry variation in CEO pay. In a wider range, the explanatory power of dismissal risk is smaller as other factors drive the extreme ends of the compensation spectrum. Translating the elasticities into dollar values implies that in the cross section, a one percentage point increase in turnover risk is compensated with about \$220,000 (\$2.2m $\times$ 10%) for the median CEO, and with around \$440,000 (\$4.4m $\times$ 10%) for the CEO receiving mean pay.

We can compare these quantities with theoretical predictions from a simple life-cycle model reflecting career concerns that we develop in Appendix A. There, we find that for realistic parameter values, the cash equivalent of CEO pay needs to rise by 3.5% to 10% to compensate the CEO for one percentage point of dismissal risk. For a standard compensation package consisting of base pay, bonus, stock, and options, a plausible approximation is that the cash equivalent value to the CEO is about two thirds of the market value of the pay package.[16] Thus, for a typical CEO, a one percentage point variation in forced turnover risk would explain variation in reported

[15] A separate analysis reveals that the variation in ratings induces variation in turnover risk mostly in a particular region of ratings, namely in the region of relatively poor ratings; in the region of good ratings, turnover risk does not vary much with ratings. By contrast, the degree of variation in turnover risk that industry volatility explains is similar across the range of this instrument. (The same holds for semi-volatility.) In other words, the treatment intensity of the two instruments is different: that of ratings is more variable than that of volatility, leading to different implied average treatment effects (Angrist and Pischke, 2009).

[16] See, for example, the calculations in Lambert, Larcker, and Verrecchia (1991), Hall and Murphy (2002), and Ingersoll (2006).

market values of total compensation between 5% and 15%.

We therefore conclude that our estimates of the size of the turnover risk premium are in line with theoretical calibrations.

While it is tempting to use these results to infer how much of the increase of CEO pay over time can explained by the rise in turnover risk, we caution that our identification strategy is restricted to the cross section. We simply note that aggregate developments in industry risk over the past decades are consistent with the pattern in CEO pay levels and turnover over time. This is reassuring.

3.4 Severance Agreements

A natural question to ask about the results presented so far concerns the role of severance agreements in mitigating the need for a turnover risk premium in flow compensation. It is possible that our estimates are biased by the fact that we cannot generally control for termination agreements.

In this section, we investigate this possibility using newly available data on contractually agreed severance amounts for the time period 2006-2009. In this time period, the median contracted amount of severance is about one half of total yearly compensation. Thus, CEOs can in general expect only relatively small amounts of severance to be contractually guaranteed.[17] In light of this fact, Kaplan and Minton (2011) note that severance agreements are unlikely to play a major role in diminishing the role of turnover risk for compensation (in particular, see p. 27).[18]

In Table VI, we include the contractually agreed severance amounts as a control variable in the regression. Although the sample size is reduced, we find similar results as before for two of the three instruments, namely volatility and semi-volatility. Only for ratings, which are available on an even smaller subset of the data, do we not obtain significant second-stage results. Indeed, in these regressions, the first stage is weak, with correspondingly poor F-statistics. (It is possible

[17] This is consistent with earlier studies (Dahiya and Yermack, 2008; Lys, Rusticus, and Sletten, 2010). See Hartzell, Ofek, and Yermack (2004) for the special case of "golden parachutes" in case of acquisitions.

[18] Actual severance payments often have a significant discretionary component, going beyond contractually agreed amounts, though even these additional payments generally appear modest (Yermack, 2006). Arguably, CEOs cannot, ex ante, count on these deviations from contractual agreements, especially in times when they face stronger and more assertive boards and active shareholders.

that in the financial crisis period ratings were not helpful in signaling differential extents of changing conditions across industries.) Notably, where the first stage is strong, the size of the coefficients for turnover risk is essentially identical to that in unreported regressions on the same sample, in which we do not control for severance agreements. This suggests that the omission of severance agreements in the main regressions does not bias the results.

[Table VI approximately here]

3.5 Robustness

This section presents results using an alternative method of classifying turnovers, mentions findings regarding the turnover risk premium in specific components of pay, and discusses other robustness checks.

First, it is possible that the standard press-based measure of forced turnover (Parrino, 1997) introduces measurement error. More importantly, it is conceivable that the increasing incidence of forced CEO turnovers identified through press reports is due to an increase of CEO turnover coverage, and it is also conceivable that the press follows particular types of firms more. In either case, our results may be biased. Therefore, we repeat our analysis using the age-based turnover classification system.

Table VII shows the second-stage regression results. As can be seen, the first stage is again highly significant and the second-stage coefficients are somewhat smaller but overall similar to those obtained with the primary classification.

[Table VII approximately here]

Second, we examine whether particular forms of flow compensation are used to compensate for job risk. Base salaries do not exhibit much variation across CEOs in this sample; nonetheless, in untabulated results, we find that the regressions equivalent to those shown in Tables IV and V mostly yield a statistically significant (though economically small) relationship between turnover risk and salaries. We also find the same for salaries and bonuses together.

Finally, the results are also robust to a large variety of alternative specifications and subsamples. Among other things, the results continue to hold (1) if we exclude CEOs with ownership in excess of 10% of common shares, (2) if we exclude CEOs in the highest and lowest 0.5% of the pay distribution (or winsorize compensation at that level), (3) if we separately exclude the High Tech sector (which exhibits the highest turnover rate), the Finance sector, or Utilities from the regressions, (4) if we exclude firms in default or selective default, (5) if we also control for the actual percentage of equity-based pay (in which case we retain significance when using semi-volatility and ratings as instruments), and (6) if we use two-way clustered standard errors, thus allowing for cross-sectional interdependencies.

4 Conclusion and Interpretation

The paper makes the simple point that forced turnover risk explains an important part of the cross-sectional variation of compensation for the CEOs of public US corporations. The empirical magnitude of the turnover risk premium – about 10% greater market value of compensation for a one percentage point increase of turnover risk – is in line with calibrated theoretical predictions.

The relevance of these findings is two-fold. First, by documenting that higher job risk is compensated with higher CEO pay in the cross section, this paper complements the argument brought forward by Kaplan and Minton (2011) that part of the aggregate time series development of executive pay can be explained by decreasing CEO tenures.

Second, the cross-sectional evidence is important because it speaks to a central issue in the debate on executive compensation. Some argue that CEO pay is largely determined by market forces; see, for example Kaplan (2008). Others argue that CEOs may be entrenched and may be able to set their own pay and job security; this argument has been most forcefully made by Bebchuk and Fried (2004). To understand how our findings contribute to this debate, consider the setting of partially entrenched CEOs. First note that, for each individual CEO, there will be a positive association between turnover risk and compensation. To see this, assume that the CEO would like high compensation and low turnover risk. Arguably, the relation between these two "goods" is such that a pay increase is more valuable if it can be sustained with a higher probability. Conversely, the marginal value of job security is higher when the pay associated with it is also higher.[19] However, the CEO is unlikely to be free in choosing any combination of turnover risk and compensation; instead, he needs to expend his political capital in the firm to achieve his goals. It is quite natural to assume, therefore, that he faces an entrenchment constraint: Increasing compensation requires him to also accept a higher probability of getting fired, perhaps because he is now held more accountable. That is, the CEO chooses from a menu of turnover risk - compensation pairs which reflect the tradeoff between the two as well as his level of entrenchment. From this perspective, therefore, our results are not able to distinguish between the two extreme positions on how the pay-setting process for CEOs works.

Importantly, however, as we move from the individual CEO to the cross section of CEOs with varying degrees of entrenchment, we obtain clearer predictions. To see this, note that each CEO will aim to choose his optimal combination of compensation and job security, but the more entrenched CEOs will obtain more of both. This follows from a standard microeconomic argument by which an agent with greater income will consume more of all (normal) goods. Therefore, under partial entrenchment, we would expect to observe a negative correlation between turnover probabilities and compensation in the cross section of CEOs. The evidence we have presented – in particular the regressions in which we do not control for corporate governance variables that arguably proxy for entrenchment – would appear to be largely inconsistent with this notion.[20]

It is clear that some CEOs do achieve spectacular compensation packages while at the same

[19] That is, the marginal benefit of compensation is proportional to the level of job security, and vice versa. For example, such multiplicative preferences with respect to job security and pay arise naturally in a simple model where the CEO's utility is given by the expected value of compensation, and turnover negatively affects future compensation. For an application of multiplicative preferences in the context of executive compensation see Edmans, Gabaix, and Landier (2009), though they focus on effort choice.

[20] There are ways in which modified efficient contracting and entrenchment stories yield different results from those just described. It is possible, for example, that those who are more entrenched will also have lower or higher relative costs of attaining higher compensation rather than greater job security. That is, the entrenchment constraint not only shifts, but also tilts as we vary entrenchment. While it is not clear why this should be the case, it is at least conceivable that there are cases where even the cross section of differentially entrenched CEOs could yield a positive correlation between turnover risk and compensation. Another possibility is that CEOs' reservation utilities vary. Then, a cross section of firms with different exogenous turnover risks need not necessarily result in a positive cross-sectional correlation of turnover risk and compensation, even if for each individual CEO higher turnover risk requires higher pay.

time being apparently immune against the risk of being fired. If these were the rule rather than the exception, government intervention would be called for. But precisely in light of these cases of egregious abuse of power and failing corporate governance, it is reassuring that, with respect to the relationship between pay and turnover risk, the available evidence suggests that, on average, the market for CEOs works in a way that is consistent with a model of competitive pay.

A. Turnover Risk Premia due to Career Concerns

In this Appendix we present a simple model of lifetime utility which we then use to calibrate risk premia that can be attributed to uncertainty about future labor income, i.e., to career concerns.[21]

A.1. Model

Assume that the CEO derives utility from income, $\widetilde{w_t}$, in each period over the course of his professional life according to the time-invariant CRRA utility function $u(\widetilde{w_t}) = \widetilde{w_t}^{1-\rho}/(1-\rho)$.

Importantly, for the purposes of this Appendix, it is useful to think of this income as the certainty-equivalent cash amount that the CEO would be willing to accept for a pay package that may contain non-cash components. As is well-known, equity risk, forfeiture risk, vesting restrictions, and limited tradability all combine into implying a potentially sizable difference between the market value of compensation packages and the value to the executive. We assume that these risks have been taken into account and that there is only one type of uncertainty remaining in this model: that due to the risk of losing the job and losing future income.

Denoting by β the time-discount factor, the CEO's expected lifetime utility is given by

$$E[\sum_{t=1}^{T_R} \beta^t u(\widetilde{w_t})]. \tag{A-1}$$

where T_R are the years until the CEO reaches retirement. Note that, to keep the model simple, we assume that the CEO receives utility from income rather than consumption, and that the utility is realized when the CEO receives that income, so that there is no scope for maximizing lifetime utility through saving and consumption smoothing.

[21] The literature on career concerns (e.g., Gibbons and Murphy (1992)) has long considered the interaction between explicit incentives (pay-performance sensitivities) and implicit incentives (career concerns). Here, we are concerned with the relationship between turnover risk and the *level* of pay.

Current income of the CEO is given by w. To reflect the adverse consequences of forced turnover we assume that income declines by a percentage d when the CEO is dismissed and remains at the new level until retirement. Thus, uncertain income can be written as

$$\tilde{w}_t = w(1 - d \cdot \mathbf{1}(T_f < t)) \tag{A-2}$$

where w is current income, $\mathbf{1}(.)$ is an indicator function equal to one if the condition in parentheses is true, and T_f is the year of forced turnover. Substituting (A-2) into (A-1) and noting that with power utility, utility of current income can be factored and placed outside the expectations operator, expected utility can be written as

$$E[\sum_{t=1}^{T_R} \beta^t u(\widetilde{w_t})] = u(w) \cdot \sum_{t=1}^{T_R} \beta^t E[(1 - d \cdot \mathbf{1}(T_f < t))^{1-\rho}]. \tag{A-3}$$

Lifetime utility of a certain income stream w^* is given by

$$\sum_{t=1}^{T_R} \beta^t u(w^*). \tag{A-4}$$

The certainty equivalent income is given by the safe income w^* that solves

$$E[\sum_{t=1}^{T_R} \beta^t u(\widetilde{w_t})] = \sum_{t=1}^{T_R} \beta^t u(w^*) \tag{A-5}$$

This equation can be solved in closed form for the ratio of certainty equivalent to risky income:

$$\frac{w^*}{w} = \left[\frac{\sum_{t=1}^{T_R} \beta^t}{\sum_{t=1}^{T_R} \beta^t E[(1 - d \cdot \mathbf{1}(T_f < t))^{1-\rho}]}\right]^{-1/(1-\rho)} \tag{A-6}$$

Two aspects of equation (A-6) are noteworthy: First, due to the power utility specification and the assumption that income shocks due to forced turnover are proportional to income before dismissal, the percentage risk premium, $1-w/w^*$, does not depend on the level of wealth. Second, the risk premium is positive even for a risk-neutral CEO. This is due to the fact that the income shock distribution has negative mean.[22]

Writing out the expectation in the denominator of equation (A-6) and assuming, again for simplicity, that the one year hazard rate, $P(T_f < t+1 | T_f > t) \equiv p$, is constant, we obtain

$$\begin{aligned} \frac{w^*}{w} &= \left[\frac{\sum_{t=1}^{T_R} \beta^t}{\sum_{t=1}^{T_R} \beta^t [P[T_f \leq t] \cdot (1-d)^{1-\rho} + P[T_f > t] \cdot 1^{1-\rho}]} \right]^{-1/(1-\rho)} \\ &= \left[\frac{\sum_{t=1}^{T_R} \beta^t}{\sum_{t=1}^{T_R} \beta^t [(1-(1-p)^t) \cdot (1-d)^{1-\rho} + (1-p)^t]} \right]^{-1/(1-\rho)} \end{aligned} \quad \text{(A-7)}$$

Equation (A-7) shows that the risk premium, $1 - w^*/w$, is a function of the five parameters T_R, β, ρ, d, and p.

A.2. Numerical results

We now calibrate the model to a realistic range of these parameter values, and compute the corresponding risk premia. We set the years until retirement to $T_R = 10$, as the average CEO in our dataset is about 55 old, and fix the time preference rate β at 0.96. We vary the other parameters within the following ranges: The coefficient of relative risk aversion, ρ, takes the values 0, 2, or 3. While values for ρ of 2 to 3 correspond to standard estimates, the case $\rho = 0$ serves as a benchmark, and helps to disentangle the effect of risk aversion from the (negative) mean effect of forced turnover on future labor income. The percentage decline of future income due to forced turnover varies between 10% and 100%. Conditional on finding a subsequent job, a 20%-75% decrease in pay appears realistic in light of the empirical evidence in Fee and Hadlock (2004).[23]

[22]Note that our notion of risk premia is different from the more common notion where risk is defined as a mean-preserving spread. With the latter definition, risk premia can only occur in the presence of risk aversion.

[23]They find that (1) in three quarters of cases of turnovers (even voluntary ones), new salaries are lower than prior ones, (2) only a third of CEOs who were fired reappear at other employers in their sample, (3) those who do obtain new employment after having been fired do so at firms approximately one-tenth the size of their former employer, and (4) those for whom salary data is available (and who are, therefore, likely to have gotten the best new jobs), experience pay cuts on the order of 20%. While the 20% pay loss arguably understates the average earnings consequences of forced turnover, Fee and Hadlock's findings on the size of subsequent employers allows one to obtain a second approximate benchmark. We can translate the decrease in firm size by a factor of ten into the corresponding pay reduction using the coefficient of log firm size in a regression of log total compensation on firm size. Consistent with other studies on CEO compensation, we find this coefficient to be between 0.30 and 0.40 (see empirical section below). This implies that a decline in firm size by a factor of ten is associated with 66%-75% lower pay. Thus, dismissed CEOs are likely to earn about one quarter to one third of their pre-turnover pay. Note that both the 20% and 75% estimates are conditional on the CEO finding a new employer at all. In our sample of S&P 1500 firms only 11 out of the 639 fired CEOs subsequently regain a CEO post within the same universe

Of course, such a pay decrease may not necessarily imply an exactly equivalent proportional decrease of certainty-equivalent pay (which is the variable this model deals with). Finally, we vary the one-year forced turnover hazard rate, p, in a range of 1% to 10%.

Table A-1 presents the calibration results. As expected, risk premia are increasing in the coefficient of relative risk aversion, the assumed percentage decline in pay following forced turnover, and the yearly forced turnover probability. Risk premia for a 100% decline in future pay following turnover are not defined for a CRRA utility function with strictly positive ρ, because expected utility becomes infinitely negative if there is a chance of receiving zero income at any point in time.

When reading through the lines from left (low pay decline following turnover) to right (high pay decline), note that while the turnover risk premium increases linearly with the pay decline if CEOs are risk neutral, the risk premium is increasingly convex in the pay decline as risk aversion becomes larger. This is a reflection of the fact that agents with CRRA utility are approximately risk-neutral with respect to small risks, but become increasingly risk averse as the size of the risk increases Arrow (1971). When reading through the columns from top (low turnover risk) to bottom (high turnover risk), note that the risk premium is concave in turnover risk.

For purposes of obtaining an empirical prediction, we consider the historical average of the turnover rate as the baseline. To the extent that for an individual CEO, his individual turnover rate is lower (higher), the risk premium for an increase in turnover risk would be higher (lower). But since we cannot ascertain what the appropriate assumption for the pay loss following turnover is, it does not appear worthwhile to aim to obtain more precise calibration results. In this case then, for realistic degrees of risk aversion ($\rho \, \epsilon \, (2, 3)$) and pay losses following forced turnover of around 50%, the risk premium for a one percentage point increase in the forced turnover hazard rate is around 3.5%, but can reach close to 10% for pay losses of around 75%. If, for example, the certainty-equivalent pay amount is two thirds of the fair value of the compensation package that companies disclose in their proxy statements, this means that we expect to see coefficients

of firms. On average, these CEOs take on their subsequent job only four years after they have been dismissed by their former employer.

of between 5% and 15% in regressions estimating the impact of dismissal risk on (log) total compensation.

Table A-1
Risk Premia due to Career Concerns

The table presents calibrated risk premia that arise from the adverse consequences of forced turnover on future earning opportunities. Risk premia are defined as the percentage difference between current pay (in certainty-equivalent terms), which is subject to a permanent negative shock if forced turnover occurs, and the safe amount of pay that yields the same lifetime utility. Risk premia are computed using equation (A-7). The model parameters required for calibration are the years until retirement, T, the time preference, β, the coefficient of relative risk aversion, ρ, the expected proportional loss of future pay conditional on forced turnover, d, and the one-year turnover probability, p. T and β are fixed at 10 years and 0.96, respectively. Panel A assumes risk neutrality ($\rho = 0$) while Panels B and C use $\rho = 2$ and $\rho = 3$, respectively. The turnover probability, p, is varied between 1% and 10%. The expected pay loss following forced turnover, d, varies between 10% and 100%.

Panel A: $\rho = 0$

	Pay loss following turnover						
Turnover rate	10%	20%	30%	40%	50%	75%	100%
1%	0.50	1.00	1.51	2.01	2.51	3.76	5.02
2%	0.98	1.95	2.93	3.90	4.88	7.32	9.76
3%	1.42	2.85	4.27	5.69	7.12	10.67	14.23
4%	1.85	3.69	5.54	7.38	9.23	13.84	18.46
5%	2.24	4.49	6.73	8.98	11.22	16.84	22.45
10%	3.93	7.87	11.80	15.73	19.67	29.50	39.33

Panel B: $\rho = 2$

	Pay loss following turnover						
Turnover rate	10%	20%	30%	40%	50%	75%	100%
1%	0.55	1.24	2.11	3.24	4.78	13.09	-
2%	1.07	2.38	4.01	6.11	8.89	22.64	-
3%	1.56	3.44	5.75	8.67	12.46	29.92	-
4%	2.01	4.41	7.33	10.96	15.58	35.64	-
5%	2.43	5.31	8.78	13.02	18.33	40.24	-
10%	4.19	8.95	14.43	20.77	28.23	54.13	-

Panel C: $\rho = 3$

	Pay loss following turnover						
Turnover rate	10%	20%	30%	40%	50%	75%	100%
1%	0.58	1.38	2.51	4.18	6.77	24.47	-
2%	1.13	2.64	4.72	7.69	12.05	36.29	-
3%	1.63	3.78	6.67	10.67	16.29	43.52	-
4%	2.10	4.82	8.41	13.23	19.77	48.49	-
5%	2.53	5.77	9.97	15.46	22.70	52.15	-
10%	4.32	9.51	15.77	23.29	32.27	61.93	-

References

Abowd, John M., and Orley C. Ashenfelter, 1981, Anticipated unemployment, temporary layoffs, and compensating wage differentials, in Sherwin Rosen, ed.: *Studies in Labor Markets* . pp. 141–186 (University of Chicago Press: Chicago).

Agrawal, Anup, and Charles R. Knoeber, 1998, Managerial compensation and the threat of takeover, *Journal of Financial Economics* 47, 219–239.

Angrist, Joshua, and Alan B. Krueger, 1999, Empirical strategies in labor economics, in Orley C. Ashenfelter, and David Card, ed.: *Handbook of Labor Economics, vol. 3* (North Holland: Amsterdam).

Angrist, Joshua D., and Allan B. Krueger, 2001, Instrumental variables and the search for identification: From supply and demand to natural experiments, *Journal of Economic Perspectives* 15, 69–85.

Angrist, Joshua D., and Jörn-Steffen Pischke, 2009, *Mostly Harmless Econometrics* (Princeton University Press: Princeton).

Arrow, Kenneth, 1971, *Essays in the Theory of Risk-Bearing* (Markham Publishing Company).

Bebchuk, Lucien, and Jesse Fried, 2004, *Pay without performance* (Harvard University Press: Cambridge).

Bennedsen, M., K. Nielsen, F. Perez-Gonzalez, and D. Wolfenzon, 2007, Inside the family firm: The role of families in succession decisions and performance, *Quarterly Journal of Economics* 122, 647–691.

Bushman, Robert, Zhonglan Dai, and Xue Wang, 2010, Risk and CEO turnover, *Journal of Financial Economics* 96, 381–398.

Core, John, Wayne Guay, and David Larcker, 2011, The power of the pen and executive compensation, *Journal of Financial Economics* 88, 1–25.

Dahiya, Sandeep, and David Yermack, 2008, You can't take it with you: Sunset provisions for equity compensation when managers retire, resign or die, *Journal of Corporate Finance* 14, 499–511.

Edmans, Alex, and Xavier Gabaix, 2011, The Effect of Risk on the CEO Market, *Review of Financial Studies* 24, 2822–2863.

———, and Augustin Landier, 2009, A multiplicative model of optimal CEO incentives in market equilibrium, *Review of Financial Studies* 22, 4881–4917.

Eisfeldt, Andrea L., and Camelia M. Kuhnen, 2011, CEO turnover in a competitive assignment framework, *Mimeo.*

Eisfeldt, Andrea L., and Adriano A. Rampini, 2008, Managerial incentives, capital reallocation, and the business cycle, *Journal of Financial Economics* 87, 177–199.

Fama, Eugene, and Kenneth French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153–193.

Fee, C. Edward, and Charles J. Hadlock, 2004, Management turnover across the corporate hierarchy, *Journal of Accounting and Economics* 37, 3–38.

Frydman, Carola, 2005, Rising through the ranks: The evolution of the market for corporate executives, *Mimeo.*

Gabaix, Xavier, and Augustin Landier, 2008, Why has CEO pay increased so much?, *Quarterly Journal of Economics* 123, 49–100.

Gibbons, Robert, and Kevin Murphy, 1992, Optimal incentives in the presence of career concerns, *Journal of Political Economy* 100, 468–505.

Gompers, Paul A., Joy L. Ishii, and Andrew Metrick, 2003, Corporate governance and equity prices, *Quarterly Journal of Economics* 118, 107–155.

Graham, John, Campbell Harvey, and Manju Puri, 2010, Managerial attitudes and corporate actions, *Mimeo.*

Hall, Brian J., and Kevin J. Murphy, 2002, Stock options for undiversified executives, *Journal of Accounting and Economics* 33, 3–42.

——— , 2003, The trouble with stock options, *Journal of Economic Perspectives* 17.

Hartzell, Jay, Eli Ofek, and David Yermack, 2004, What's in it for me? Personal benefits obtained by CEOs whose firms are acquired, *Review of Financial Studies* 17, 37–61.

Hayes, Rachel M., Stepehn A. Hillegeist, and Elizabeth K. Keating, 2005, Financial distress risk and initial CEO compensation contracts, *Mimeo.*

Hermalin, Benjamin E., 2005, Trends in corporate governance, *Journal of Finance* 60, 2351–2384.

Heywood, John S., 1989, Do union members receive compensating differentials? The case of employment security, *Journal of Labor Research* 10, 271–85.

Ingersoll, Jonathan E., 2006, The subjective and objective evaluation of incentive stock options, *Journal of Business* 79.

Jenter, Dirk, and Fadi Kanaan, 2011, CEO turnover and relative performance evaluation, *The Journal of Finance, forthcoming.*

Kaplan, Steven N., 2008, Are U.S. CEOs overpaid?, *Academy of Management Perspectives* 22, 5–20.

——— , and Bernadette A. Minton, 2011, How has CEO turnover changed?, *International Review of Finance* forthcoming.

Lambert, Richard, David F. Larcker, and Robert E. Verrecchia, 1991, Portfolio considerations in valuing executive compensation, *Journal of Accounting Research* 29, 129–149.

Li, Elizabeth H., 1986, Compensating differentials for cyclical and noncyclical unemployment: The interaction between investors' and employees' risk aversion, *Journal of Labor Economics* 4, 277–300.

Lys, Thomas, Tjomme Rusticus, and Eva Sletten, 2010, Executive severance agreements, *Mimeo*.

Moretti, Enrico, 2000, Do wages compensate for risk of unemployment? Parametric and semi-parametric evidence from seasonal jobs, *Journal of Risk and Uncertainty* 20, 45–66.

Murphy, Kevin J., and Jan Zaboinik, 2004, CEO pay and appointments: A market-based explanation for recent trends, *American Economic Review* 94, 192–196.

Parrino, Robert, 1997, CEO turnover and outside succession: A cross-sectional analysis, *Journal of Financial Economics* 46, 165–197.

Stock, James, J. Wright, and M. Yogo, 2002, A survey of weak instruments and weak identification in generalized method of moments, *Journal of the American Statistical Association* 20, 518529.

Weisbach, Michael S., 1988, Outside directors and CEO turnover, *Journal of Financial Economics* 20, 431–460.

Yermack, David, 2006, Golden handshakes: Separation pay for retired and dismissed CEOs, *Journal of Accounting and Economics* 41, 237–256.

Table I
Variable Descriptions

Variable name	Definition	Source
Ln(1+total compensation)	Natural logarithm of 1 plus total compensation. Total compensation is Execucomp item TDC1 which includes salary, bonus, the market value of restricted stock granted, the Black-Scholes value of stock options granted, long-term incentive payouts, and other compensation. Total compensation is converted to year 2000 dollars using the Consumer Price Index provided by the Bureau of Labor Statistics.	Execucomp Bureau of Labor Statistics
Ln(1+total comp.) - vol.-adjusted	Same as Ln(1+total compensation), except that the value of stock options in the compensation package is computed using the Black-Scholes formula with the same volatility parameter - the sample mean of volatility - for all CEO-/firm-years.	Execucomp CRSP Bureau of Labor Statistics
Equity-based pay> 0	Dummy variable indicating that the CEO received a positive amount of equity -based pay	Execucomp
Ln(1+severance amount)	Natural logarithm of 1 plus the dollar value of estimated payments in the event of involuntary termination.	Execucomp
Forced	Forced turnover indicator equal to one in year t and firm i if the incumbent CEO is in office for the larger part of fiscal year t but no longer in fiscal year t+1, and the departure was involuntary as identified from press reports (see Section 1 for a more detailed description).	Execucomp Press Reports (Factiva)
Forced56	Same as Forced, except that a turnover is classified as involuntary if the CEO is below the age of 56 at departure	Execucomp
Ln(1+firm value)	Natural logarithm of 1 plus firm value. Firm value is defined as: total assets (data6) - book equity (data60) - deferred taxes (data74) + market equity (data199*data25)	Compustat
Market return	CRSP value-weighted return	CRSP
Excess industry return	Value-weighted industry return (Fama-French 12-industry classification) minus market return	CRSP
Idiosyncratic return	Individual stock return minus value-weighted industry return	CRSP
Volatility	Stock return volatility computed from monthly returns over the past 48 months	CRSP
Semi-volatility	Semi-volatility of stock returns computed from monthly returns over the past 48 months	CRSP
Rating	S&P long-term issuer credit rating	Compustat
CEO age >=60	Indicator equal to one if the CEO is older than 59	Execucomp
Tenure	CEO tenure	Execucomp
Outsider	Indicator equal to one if the CEO joined the company less than one year prior to his appointment as CEO	Execucomp
Ln(board size)	Natural logarithm of the number of board members	RiskMetrics
Indept. directors [%]	Percentage of independent directors	RiskMetrics
Chairman	Indicator equal to one if the CEO serves as chairman of the board	RiskMetrics
GIM index	Governance index constructed by Gompers, Ishii and Metrick (2003)	RiskMetrics

Table II
Descriptive Statistics

Panel A: Frequency of forced and voluntary turnover				
	# firm years	#turnovers	#forced turnovers	#voluntary turnovers
Sample size and # of turnovers	28792	3207	740	2467

Panel B: Firm characteristics	Mean	Median	Std	N
Firm value [$m]	16292.41	2490.75	73438.85	28260
Total assets [$m]	10620.77	1352.05	50621.45	21233
Market-to-book	2.04	1.46	2.47	20985
ROA [%]	3.11	4.01	10.91	21226
Volatility	0.40	0.35	0.20	25591
Semi-volatility	0.42	0.37	0.22	25587
Rating	10.85	11.00	3.43	11284

Panel C: CEO compensation	Mean	Median	Std	N
Total compensation [$1000]	4393.88	2189.63	10109.41	28792
Volatility-adjusted total compensation [$1000]	3323.25	1795.99	6744.13	26633
Salary [$1000]	655.01	599.60	363.10	28792
Bonus [$1000]	604.54	223.41	1704.69	28792
Black-Scholes value of option grants [$1000]	2225.67	547.84	8954.32	21252
Value of restricted stock [$1000]	462.82	0.00	5054.03	21536
Other compensation [$1000]	409.26	49.80	1674.50	21252
Equity-based pay [% of total comp.]	39.52	41.25	29.34	28440
Equity-based pay> 0	0.78	1.00	0.41	28440
Severance amount [$1000]	5960.84	1383.80	14107.69	7253

Panel D: Corporate governance	Mean	Median	Std	N
Chairman	0.62	1.00	0.48	13355
Board size	9.60	9.00	2.94	13355
Percentage of independent directors	64.74	66.67	17.72	13355
GIM index	9.30	9.00	2.69	15976

Panel E: CEO characteristics	Mean	Median	Std	N
Age	55.50	56.00	7.55	28447
CEO age >= 60	0.29	0.00	0.45	28447
Tenure	7.58	5.00	7.16	26434
Outsider	0.37	0.00	0.48	17667

Table III
1st Stage Regressions of Forced CEO Turnover

This table presents first stage least squares regressions of a dummy variable indicating forced CEO turnover on controls. The sample contains the companies in the Execucomp database and covers the time period 1993-2009. All variables are defined in Table I. The timing convention for returns is explained in Section 1. T-statistics, reported in parentheses, are calculated based on robust standard errors clustered at the CEO level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dept. variable:	Forced turnover dummy					
	(1)	(2)	(3)	(4)	(5)	(6)
Volatility in t-1	0.04***					
	(5.33)					
Semivolatility in t-1		0.04***				
		(5.28)				
Rating in t-1			0.02***			
			(4.01)			
Industry Volatility in t-1				0.06***		
				(6.11)		
Industry Semivolatility in t-1					0.07***	
					(5.75)	
Industry rating in t-1						0.04***
						(4.03)
Idiosyncratic return in t	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***
	(-13.55)	(-13.58)	(-11.43)	(-13.49)	(-13.51)	(-11.41)
Market-adjusted industry return in t	-0.01**	-0.01**	-0.03***	-0.01*	-0.01**	-0.03***
	(-2.02)	(-2.07)	(-3.13)	(-1.93)	(-2.00)	(-3.07)
Ln(1+firm value) in t-1	-0.00*	-0.00**	0.00**	-0.00	-0.00*	0.00**
	(-1.83)	(-2.16)	(2.27)	(-1.64)	(-1.77)	(2.51)
CEO age >= 60	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
	(-5.60)	(-5.63)	(-4.73)	(-5.54)	(-5.56)	(-4.74)
Tenure	-0.00***	-0.00***	-0.00	-0.00***	-0.00***	-0.00
	(-2.59)	(-2.59)	(-0.09)	(-2.64)	(-2.65)	(-0.15)
Outsider	0.00	0.00	0.00	0.00	0.00	0.00
	(0.75)	(0.81)	(0.69)	(0.75)	(0.79)	(0.75)
Vol. - ind. vol. in t-1				0.03***		
				(3.36)		
Semivol. - ind. semivol. in t-1					0.03***	
					(3.41)	
Rating - ind. rating in t-1						0.02***
						(3.64)
Constant	0.02*	0.02**	-0.03*	0.01	0.01	-0.06***
	(1.95)	(2.29)	(-1.82)	(0.83)	(0.66)	(-2.88)
Year fixed effects	X	X	X	X	X	X
Observations	15135	15133	9103	15135	15133	9103

Table IV
Preliminary 2nd Stage Regressions of CEO Compensation

This table presents results of second stage least squares regressions of log total compensation on the forced turnover probability and control variables. The sample contains the companies in the Execucomp database and covers the time period 1993-2009. The forced turnover probability is the predicted value from the first stage least squares regressions shown in Table III. All other variable definitions are given in Table I. The timing convention for returns is explained in Section 1. T-values, reported in parentheses, are calculated with robust standard errors clustered at the CEO level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dept. variable:	Ln(1+total compensation)					
	(1)	(2)	(3)	(4)	(5)	(6)
Forced turnover probability [%]	14.66***	14.50***	6.67*	19.86***	22.57***	28.12***
	(4.36)	(4.33)	(1.85)	(5.47)	(5.36)	(4.01)
Ln(1+firm value) in t-1	0.46***	0.46***	0.38***	0.47***	0.48***	0.33***
	(24.89)	(24.95)	(25.88)	(21.35)	(19.69)	(8.66)
Idiosyncratic return in t	0.76***	0.75***	0.51***	0.96***	1.06***	1.45***
	(6.05)	(6.05)	(3.13)	(6.99)	(6.60)	(4.68)
Market-adjusted industry return in t	0.48***	0.48***	0.48***	0.56***	0.60***	1.08***
	(3.63)	(3.66)	(3.33)	(3.28)	(3.09)	(2.91)
CEO age >= 60	0.27***	0.26***	0.16**	0.36***	0.41***	0.53***
	(3.56)	(3.55)	(2.13)	(4.30)	(4.33)	(3.65)
Tenure	0.00	0.00	0.00	0.00	0.00	0.00
	(0.15)	(0.13)	(0.04)	(0.66)	(0.88)	(0.06)
Outsider	0.13**	0.13**	0.20***	0.11*	0.11	0.15
	(2.29)	(2.32)	(4.13)	(1.69)	(1.44)	(1.36)
Vol. - ind. vol. in t-1				-0.39**		
				(-2.11)		
Semivol. - ind. semivol. in t-1					-0.42*	
					(-1.91)	
Rating - ind. rating in t-1						-0.51***
						(-2.74)
Constant	3.40***	3.41***	4.19***	3.14***	3.07***	4.21***
	(15.32)	(15.46)	(28.32)	(12.17)	(10.66)	(12.30)
Year fixed effects	X	X	X	X	X	X
Observations	15135	15133	9103	15135	15133	9103
Endogenous variable	Forced	Forced	Forced	Forced	Forced	Forced
Instrument	Vol	Semivol	Rating	VolInd	SemivolInd	RatingInd
F-stat of excluded instrument	24.27	23.95	16.77	37.06	35.73	19.13

Table V
2nd Stage Regressions of CEO Compensation

This table presents the second stage least squares regressions of volatility-adjusted total compensation on the forced turnover probability and control variables. The sample contains the companies in the Execucomp database and covers the time period 1993-2009. Volatility-adjusted total compensation is calculated by replacing the standard Black-Scholes value of options packages with the value of options packages but using the same constant volatility parameter for options of all CEOs and all years. The forced turnover probability is the predicted value from the first stage least squares regressions shown in Table III. All other variable definitions are given in Table I. Firm-level controls and CEO controls are the variables used in Table IV. T-statistics, reported in parentheses, are calculated with robust standard errors clustered at the CEO level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dept. variable:	Ln(1+total compensation) - volatility-adjusted								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Forced turnover probability [%]	9.38***	13.02***	21.12***	8.73***	11.60***	21.55***	10.48***	13.95***	27.45***
	(4.35)	(4.69)	(4.06)	(4.53)	(4.88)	(4.16)	(3.19)	(3.34)	(2.68)
Equity-based pay> 0				0.98***	1.07***	1.48***	1.17***	1.32***	2.05***
				(12.47)	(11.19)	(6.46)	(6.80)	(5.96)	(3.42)
Ln(boardsize)							0.02	0.03	0.19
							(0.13)	(0.19)	(0.58)
Indept. directors [%]							-0.00	-0.00	0.00
							(-0.83)	(-0.88)	(0.31)
Chairman							0.24***	0.28***	0.35*
							(3.72)	(3.46)	(1.92)
GIM index							0.01	0.01	-0.02
							(0.81)	(0.59)	(-0.72)
Vol. - ind. vol. in t-1	-0.49***			-0.40***			-0.40***		
	(-4.31)			(-3.94)			(-2.60)		
Semivol. - ind. semivol. in t-1		-0.51***			-0.43***			-0.45**	
		(-3.50)			(-3.43)			(-2.22)	
Rating - ind. rating in t-1			-0.48***			-0.42***			-0.50**
			(-3.32)			(-3.10)			(-2.06)
Constant	3.56***	3.45***	4.22***	3.04***	2.90***	3.15***	3.12***	2.91***	2.74**
	(22.62)	(18.01)	(15.73)	(18.16)	(14.45)	(9.69)	(7.84)	(5.88)	(2.56)
Firm-level controls	X	X	X	X	X	X	X	X	X
CEO controls	X	X	X	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X	X	X	X
Observations	14655	14653	8853	14634	14632	8848	7817	7817	5006
Endogenous variable	Forced	Forced	Forced	Forced	Forced	Forced	Forced	Forced	Forced
Instrument	VolInd	SemivolInd	RatingInd	VolInd	SemivolInd	RatingInd	VolInd	SemivolInd	RatingInd
F-stat of excluded instrument	36.33	35.56	21.29	37.98	38.38	21.03	14.16	14.26	7.896

Table VI
Results Controlling for Contractually Agreed Severance Amounts

This table presents the second stage least squares regressions of volatility-adjusted total compensation on the forced turnover probability and control variables. The sample contains the companies in the Execucomp database over the time period 2006-2009. Volatility-adjusted total compensation is calculated by replacing the standard Black-Scholes value of options packages with the value of options packages but using the same constant volatility parameter for the options of all CEOs and all years. The forced turnover probability is the predicted value from the first stage least squares regressions. Severance Amount is the dollar value of estimated payments in event of involuntary termination. All other variable definitions are given in Table I. T-statistics, reported in parentheses, are calculated with robust standard errors clustered at the CEO level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dept. variable:	Ln(1+total compensation) - volatility-adjusted					
	(1)	(2)	(3)	(4)	(5)	(6)
Forced turnover probability [%]	6.56**	9.12**	40.47	6.06**	7.50**	40.08
	(2.28)	(2.54)	(0.60)	(2.40)	(2.50)	(0.61)
Ln(1+Severance Amount)	0.06***	0.07***	0.16	0.04***	0.05***	0.14
	(6.27)	(5.74)	(0.79)	(5.28)	(4.96)	(0.77)
Equity-based pay> 0				0.97***	1.00***	2.19
				(10.39)	(9.82)	(1.11)
Vol. - ind. vol. in t-1	-0.69***			-0.45**		
	(-3.28)			(-2.32)		
Semivol. - ind. semivol. in t-1		-0.73***			-0.52**	
		(-2.96)			(-2.51)	
Rating - ind. rating in t-1			-1.45			-1.32
			(-0.69)			(-0.68)
Firm-level controls	X	X	X	X	X	X
CEO controls	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Observations	2708	2706	1454	2702	2700	1454
Endogenous variable	Forced	Forced	Forced	Forced	Forced	Forced
Instrument	VolInd	SemivolInd	RatingInd	VolInd	SemivolInd	RatingInd
F-stat of excluded instrument	13.57	13.21	0.394	14.07	13.88	0.405

Table VII
Results with the Age-based Turnover Indicator

This table presents the second stage least squares regressions of volatility-adjusted total compensation on the forced turnover probability and control variables. The sample contains the companies in the Execucomp database and covers the time period 1993-2009. Volatility-adjusted total compensation is calculated by replacing the standard Black-Scholes value of options packages with the value of options packages but using the same constant volatility parameter for the options of all CEOs and all years. The forced turnover probability is the predicted value from the first stage least squares regressions. The endogenous variable is the age-based turnover indicator *Forced56*, taking the value of one if the incumbent CEO is under the age of 56 at the time of departure. All other variable definitions are given in Table I. Firm-level controls and CEO controls are the variables used in Table IV. T-statistics, reported in parentheses, are calculated with robust standard errors clustered at the CEO level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dept. variable:	Ln(1+total compensation) - volatility-adjusted								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Forced turnover probability [%]	7.44***	11.60***	19.91***	6.96***	10.37***	20.32***	8.38***	13.35***	33.71**
	(4.34)	(4.47)	(3.88)	(4.59)	(4.70)	(3.98)	(3.26)	(3.12)	(2.20)
Equity-based pay> 0				0.94***	1.06***	1.39***	1.07***	1.28***	2.00***
				(13.67)	(11.31)	(6.31)	(8.00)	(6.01)	(2.85)
Ln(boardsize)							0.05	0.11	0.18
							(0.46)	(0.67)	(0.48)
Indept. directors [%]							0.00	0.00	0.01
							(0.22)	(0.32)	(1.26)
Chairman							0.17***	0.19***	0.09
							(3.35)	(2.71)	(0.50)
GIM index							-0.00	-0.01	-0.06
							(-0.12)	(-0.61)	(-1.41)
Vol. - ind. vol. in t-1	-0.62***			-0.53***			-0.56***		
	(-5.29)			(-5.06)			(-3.78)		
Semivol. - ind. semivol. in t-1		-0.72***			-0.63***			-0.68***	
		(-4.19)			(-4.25)			(-2.90)	
Rating - ind. rating in t-1			-0.50***			-0.44***			-0.22
			(-3.28)			(-3.11)			(-0.86)
Constant	3.48***	3.27***	3.77***	2.99***	2.76***	2.75***	2.91***	2.38***	1.71
	(21.13)	(14.70)	(12.05)	(17.74)	(12.12)	(6.92)	(6.90)	(3.64)	(1.08)
Firm-level controls	X	X	X	X	X	X	X	X	X
CEO controls	X	X	X	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X	X	X	X
Observations	14655	14653	8853	14634	14632	8848	7817	7817	5006
Endogenous variable	Forced56	Forced56	Forced56	Forced56	Forced56	Forced56	Forced56	Forced56	Forced56
Instrument	VolInd	SemivolInd	RatingInd	VolInd	SemivolInd	RatingInd	VolInd	SemivolInd	RatingInd
F-stat of excluded instrument	40.17	31.88	18.56	42.33	34.75	18.50	16.28	12.36	5.142