Abstract

In this paper we study CEO contract design employing a unique dataset on privately-held and public firm CEO annual compensation over the period 1999-2011. Compared to public firms, privately-held firms have less diffuse ownership and stronger shareholder monitoring. We first show that both private and public firm CEO pay is positively and significantly related to firm accounting performance, and that the pay-performance link is much stronger in public firms. Reconciling prior mixed evidence, we further show that there is an overall negative relation between ownership concentration and CEO performance-based pay, while at the low end of ownership concentration, there is a positive relation between the two. Our main findings are robust to accounting for firms’ self-selection into different ownership structures and to different measures of firm accounting performance. We conclude that concentrated ownership structure substitutes for CEO performance-based compensation contracts.

Keywords: CEO pay; ownership concentration; pay-performance sensitivity; privately-held firms; public firms; shareholder monitoring

JEL Classification: G34

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Large Shareholders and CEO Performance-Based Pay: 
New Evidence from Privately-Held Firms

Abstract

In this paper we study CEO contract design employing a unique dataset on privately-held and public firm CEO annual compensation over the period 1999-2011. Compared to public firms, privately-held firms have less diffuse ownership and stronger shareholder monitoring. We first show that both private and public firm CEO pay is positively and significantly related to firm accounting performance, and that the pay-performance link is much stronger in public firms. Reconciling prior mixed evidence, we further show that there is an overall negative relation between ownership concentration and CEO performance-based pay, while at the low end of ownership concentration, there is a positive relation between the two. Our main findings are robust to accounting for firms’ self-selection into different ownership structures and to different measures of firm accounting performance. We conclude that concentrated ownership structure substitutes for CEO performance-based compensation contracts.

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1. Introduction

Chief Executive Officer (CEO) contract design plays a number of important roles, including acting as a sorting mechanism, and providing incentives for effort and the retention of human capital. Despite a large literature examining CEO pay in U.S. public firms starting with the seminal works by Ross (1973), Harris and Raviv (1979), Holmström (1979), Murphy (1985), and Jensen and Murphy (1990), there is mixed evidence and on-going debate on the important relation between corporate ownership and CEO performance-based pay. A number of papers argue and show that firms with concentrated ownership rely more on direct monitoring by shareholders and less on performance-based executive compensation contracts, suggesting that strong shareholder monitoring is associated with weak CEO pay-performance sensitivity (see, for example, Mehran (1995) and Ke, Petroni, and Safieddine (1999)). On the other hand, Hartzell and Starks (2003) and Cronqvist and Fahlenbrach (2013) show that shareholder monitoring enforces executive performance-based pay, so that firms with strong shareholders exhibit greater CEO pay-performance sensitivity; while Frydman and Saks (2010) find no relation between outside blockholder ownership and CEO pay-performance sensitivity.

In this study we take advantage of a unique dataset on CEO pay in privately-held and public firms to help understand the role of ownership structure in setting CEO performance-based pay.1 We expect that the private-versus-public dichotomy allows for a more powerful test of whether shareholder monitoring serves as a substitute for or a complement to CEO performance-based pay, given that the variation in the level of ownership concentration across these two groups of firms is likely to be at least as substantial as the variation within public firms. Further, the contrast between privately-held and public firms serves as a cross-validation of prior research on CEO contract design using only public firms. Finally, CEO compensation in privately-held firms is in itself of great interest to financial economists due

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1 This paper subsumes Gao, Lemmon, and Li (2012) titled “Are CEOs in U.S. public firms overpaid? New evidence from private firms.”
to a lack of data prior to our study.

Our new data, which provides detailed information on CEO annual compensation in a large number of privately-held firms in the U.S., is based on the following (relatively unknown) mandatory disclosure requirements by the Securities and Exchange Commission (SEC). First, if a company decides on a registered public offering, the Securities Act requires it to file a registration statement (Form S-1) with the SEC that contains information on executive compensation. Second, and more applicable to our sample of privately-held firms, even if a company has not registered a securities offering, it must file an Exchange Act registration statement if it has more than $10 million in total assets and a class of equity securities, like common stock, with 500 or more shareholders. After that, the company is required to continue reporting via annual and quarterly reports (Form 10-K, which contains information on executive compensation, and Form 10-Q, respectively), and proxy statements (which may also contain information on executive compensation).

Data for a vast majority (about 90%) of the private firm-year observations in our sample comes from Form 10-K; the remainder comes from Form S-1 due to public debt issuance.

Using a comprehensive sample of privately-held and public firms over the period 1999-2011, we first show that both private and public firm CEO pay is positively and significantly related to firm accounting performance, and that the pay-performance link is much stronger in public firms. We further show that only within mostly dispersedly-held S&P 1500 firms is ownership concentration positively associated with CEO pay-performance sensitivity, while within non-S&P 1500 public firms and within privately-held firms, greater ownership concentration is associated with weaker CEO pay-performance sensitivity. In a cross-section of both privately-held and public firms, we find that, despite an overall

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2 Privately-held firms can be incorporated as either S corporations or C corporations. Given that S corporations are restricted to have no more than 100 shareholders (http://taxes.about.com/od/scorporations/qt/scorp_criteria.htm), almost all privately-held firms in our sample are C corporations.

3 Filing obligations are suspended when the following “thresholds” are satisfied: the company has fewer than 300 shareholders of the class of securities offered, or it has fewer than 500 shareholders of the class of securities offered and less than $10 million in total assets for each of its last three fiscal years.
negative relation between ownership concentration and pay-performance sensitivity, pay-performance sensitivity increases with the level of ownership concentration when the latter is at the low end. This non-linear relation between ownership concentration and CEO performance-based pay helps reconcile mixed evidence in prior studies. We interpret our findings to be consistent with the shareholder monitoring hypothesis, whereby direct monitoring by large shareholders reduces the need for performance-based pay.

We employ three different approaches to addressing self-selection concerns that companies may choose to go public or stay privately-held: a sample of transitioning firms going through initial public offerings (IPOs) to become publicly listed, the propensity score matching based on observable firm and CEO characteristics, and two-stage least squares regressions with instrumental variables. We still find that public firms (firms with diffuse ownership) exhibit greater CEO pay-performance sensitivity than do private firms (firms with concentrated ownership). Taking these findings together, we conclude that concentrated ownership structure substitutes for CEO performance-based compensation contracts.

Our paper contributes to the CEO compensation literature along the following dimensions. First, by taking advantage of greater variation in the level of ownership concentration between privately-held and public firms than that within public firms, we provide a cleaner test of the optimal contracting theory of Holmström (1979). Our findings of an inverted U-shaped relation between levels of ownership concentration and CEO pay-performance sensitivity provide fresh new evidence to the general debate on whether different governance mechanisms work as substitutes or complements, and have important implications for CEO contract design. Our ability to speak to big-picture questions of CEO contract design in relation to corporate ownership structure and to reconcile conflicting extant evidence is the real distinction of our paper from others.

Second, despite the fact that over 70% of U.S. firms with more than 500 employees are
privately-held, and that private firms account for over 60% of U.S. production (Farre-Mensa (2013)), little is known about how privately-held firms compensate their CEOs due to data limitations. Our paper is the first to provide some descriptive statistics on the level and structure of CEO pay in large U.S. privately-held firms.

Finally, in using privately-held firms, we join a recent surge of papers using data on these private firms to draw new insights into public firm behavior (see, for example, Brav (2009), Michaely and Roberts (2012), and Gao, Harford, and Li (2013a)).

The paper is organized as follows. We review the literature and develop our hypotheses in the next section. We describe the data and key variable construction in Section 3. We examine differences in CEO pay-performance sensitivity between privately-held and public firms and across firms with different levels of ownership concentration in Section 4. Self-selection concerns are addressed in Section 5. We conclude in Section 6 with a brief summary.

### 2. Prior literature and hypothesis development

Berle and Means (1932) are the first to point out that the separation of ownership and control in modern public corporations creates significant conflicts of interest between managers and shareholders—the quintessential agency problem. Jensen and Meckling (1976) formalize the agency theory of the firm and suggest that agency problems can be controlled through monitoring, bonding, and incentive contracts. Many papers thereafter have explored the incentive mechanisms that overcome those conflicts either from a theoretical perspective (see, for example, Ross (1973), Mirrlees (1975), Harris and Raviv (1979), Holmström (1979), Shavell (1979), and Grossman and Hart (1983)) or using CEO compensation data from public firms around the world (see, for example, Murphy (1985), Jensen and Murphy (1990),
2.1. Related research

Our paper is related to one strand of the CEO compensation literature focusing on interactions between different governance mechanisms, particularly ownership concentration and performance-based incentive contracts.

Using a sample of 153 manufacturing firms in 1979-1980, Mehran (1995) shows that equity-based compensation is positively associated with firm value, and that firms with outside blockholders use less equity-based compensation, suggesting that monitoring by outside blockholders is a substitute for incentive pay for CEOs. Using a sample of 45 privately-held and 18 publicly-held insurers, Ke, Petroni, and Safieddine (1999) show that there is a significant positive association between return on assets (ROA) and the level of compensation for publicly-held insurers with diffuse ownership, while there is no such pay-performance link for privately-held insurers with concentrated ownership. They conclude that their results are consistent with the optimal contracting theory view of CEO pay, where corporate ownership affects the relation between pay and performance. They also suggest that within privately-held insurers, CEO pay is based less on such objective measures as accounting information and more on subjective measures. Using a sample of 464 IPO firms in the internet, manufacturing, and technology industries between 1996-1999, Engel, Gordon, and Hayes (2002) show that option grants of IPO firms with little or no venture capital influence display significantly more association with performance measures than those with greater venture capital influence, consistent with direct monitoring by venture capitalists and the use of explicit performance measures in CEO contract design acting as substitute
governance mechanisms. Using a sample of S&P 1500 firms between 1993-2004, Fahlenbrach (2009) find that firms with weaker corporate governance (such as the CEO being the Chairman of the Board and little shareholder monitoring) exhibit greater CEO pay-performance sensitivity.

On the other hand, Hartzell and Starks (2003) show that institutional ownership concentration is positively related to CEO pay-performance sensitivity and negatively related to the level of CEO pay in S&P 1500 firms. They interpret these findings as supporting institutional investors’ monitoring role in reducing the agency conflicts between managers and shareholders. Using the Survey of Small Business Finances data (SSBF, i.e., businesses with less than 500 employees), Cole and Mehran (2011) find that over time, CEO pay in privately-held firms does not grow as fast as pay in public firms, and that privately-held firms have significantly higher pay-size elasticity compared to public firms. Based on a sample of 20 leveraged buyout-target firms, Cronqvist and Fahlenbrach (2013) show that when firms transition from public ownership with dispersed shareholders to private ownership with strong shareholders in the form of private equity sponsors, the most significant change is that private equity owners give target firm management a significant portion of equity grants based on pre-specified performance measures such as operating cash flows and EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization). All these papers suggest that direct monitoring enforces incentive alignment, so that firms with strong shareholders exhibit greater CEO pay-performance sensitivity.

It is worth noting that all these prior studies are based on either public firms only, in particular S&P 1500 firms, or very small samples of privately-held firms, firms that have recently gone public, or leveraged buyout-target firms. We argue that the lack of sufficient cross-sectional variation in ownership concentration in samples employed by these studies prevents a sharp test of the optimal contracting theory.

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4 In subsample analyses, Hartzell and Starks (2003) show that the cost-benefit tradeoff between alternative governance mechanisms could also lead to cases where only one of the mechanisms—institutional monitoring and pay-performance sensitivity—is employed. Studying CEO compensation practices in the 1930s and 1990s, Frydman and Saks (2010) find no effect of outside blockholder ownership on CEO pay-performance sensitivity.
with respect to the role of ownership structure in CEO compensation.

2.2. Hypothesis development

Under the optimal contracting theory of Holmström (1979), shareholders design the compensation contract to maximize firm performance (such as profits) which depends on the manager’s effort and some random noises. Firm performance is verifiable and explicitly observable; however the manager’s effort is non-verifiable and difficult to observe. The first-best contract is to compensate the manager based on his effort, which require the shareholders to exert time and effort to monitor the manager and collect such information. When it is costly for the shareholders to do so, explicit (but noisy) performance measures can be used to determine the manager’s pay (the second-best contract). The first-best contract is strictly preferred to the second-best one because the uncertainty caused by the random noises is eliminated and the manager can be better incentivized. The theory thus predicts that the use of explicit performance-based contracts is less likely when there are shareholders actively monitoring the manager. Then the question is who the monitoring shareholders are?

In their seminal paper, Berle and Means (1932) argue that diffuse ownership structures in public firms reduce shareholder incentives to monitor the manager. Shleifer and Vishney (1986) further argue that large outside shareholders, in contrast, serve as effective monitors because they have a lower marginal cost of acquiring and disseminating information, while receiving a bigger share of the benefits due to their large shareholdings.

Privately-held firms often have illiquid concentrated ownership that encourages shareholders to actively monitor managerial actions (Kahn and Winton (1998), Maug (1998), and Ke, Petroni, and Safieddine (1999)). The greater separation of ownership and control, along with the free-rider problem from highly liquid disperse ownership, significantly decreases shareholder monitoring in public firms.
(Grossman and Hart (1980), Jensen (1989), and Bhide (1993)). In other words, significant differences in ownership concentration between privately-held and public firms should be associated with different levels of pay-performance sensitivity. For public (privately-held) firms there should be less (more) direct monitoring of managers by large outside shareholders and more (less) reliance on contracts that link CEO pay to explicit performance measures. The above argument leads to our first hypothesis:

*The Shareholder Monitoring Hypothesis: There is a negative association between concentrated ownership, as captured by the privately-held firm status, and CEO pay-performance sensitivity.*

There is an alternative view to the optimal contracting theory of CEO compensation. The disperse ownership in public firms prevents shareholders from negotiating compensation contracts with the CEO at arm’s length (Jensen (1989)) and the lack of arm’s-length bargaining has resulted in too little pay-performance sensitivity or pay-without-performance. Core, Holthausen, and Larcker (1999) and Bebchuk and Fried (2004) argue that public firm CEOs have too much power in setting their own pay. Morse, Nanda, and Seru (2011) further show that powerful CEOs can rig their incentive contracts, leading to poor future performance.

However, large shareholders and/or shareholders with low monitoring costs can rectify the situation by limiting the amount of the pay given to the CEO and/or by putting more pressure on the CEO to improve firm performance, which leads to greater CEO pay-performance sensitivity (Hartzell and Starks (2003) and Almazan, Hartzell, and Starks (2005)). This leads to our second hypothesis:

*The CEO Power Hypothesis: There is a positive association between concentrated ownership, as captured by the privately-held firm status, and CEO pay-performance sensitivity.*

Our empirical tests are designed to distinguish between the two hypotheses. In contrast to prior work that examines either the smallest firms in the economy or private firms in a limited number of industries, we contribute to the debate on the efficacy of different governance mechanisms by providing some of the first comparisons of CEO pay in privately-held and comparable public firms. In the next
section we describe our data and key variable construction, and present descriptive statistics.

3. Sample formation and variable construction

3.1 Sample formation

We start with U.S. privately-held and public firms with available information on firm financials and CEO compensation in Capital IQ, an affiliate of Standard & Poor’s, from 1999 to 2011. We require that public firms be traded on the NYSE, AMEX, or NASDAQ. Privately-held firms, in contrast, do not have shares traded on any stock exchanges. Firms traded in the over-the-counter market or outside the three major exchanges are excluded. Capital IQ classifies a firm as privately-held or public based on its most recent status. We search the key dates for each firm in Capital IQ’s IPO and delisting databases to help classify a firm’s privately-held (or public) status by back filling. This initial sampling results in 8,809 firm-year observations for privately-held firms and 48,094 firm-year observations for public firms. To clearly capture differences in CEO contract design between privately-held and public firms, we remove firm-year observations associated with IPOs (1,130 cases) and going private transactions (61 cases). In the end, for privately-held firms, we have a sample of 7,168 firm-year observations representing 2,492 unique firms, and for public firms, we have a sample of 45,730 firm-year observations representing 5,863 unique firms. Data for a vast majority (88%) of the private firm-year observations in our sample comes from Form 10-K (i.e., annual reports), and the remainder (12%) comes from Form S-1 (and its

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5 Since the late 1990s, Capital IQ started to provide information on executive compensation for both privately-held and public firms in the U.S., with a similar level of detail as provided by ExecuComp for S&P 1500 firms. Unique to Capital IQ, it also provides detailed background information about the CEO, including education, gender, and age.

6 It is worth noting that the public firms in our sample are more representative of public firms in the economy than the ExecuComp firms, which focus on S&P 1500 firms.
supplemental Form 424B—less than 3% of the total) due to public debt issuance. In untabulated analysis, we show that our sample firms have broad industry representation, covering all 48 industries of Fama and French (1997), with banking, business services, and retail having the highest representation among the privately-held firms, and banking, business services, and trading having the highest representation among the public firms.

3.2 Computing CEO pay

We define a CEO’s total compensation (Totalpay) in a given year as the sum of salaries (Salary), bonuses (Bonus), the grant-date value of restricted stock awards (Stock), and the grant-date Black-Scholes value of granted options (Options), and other pay (Otherpay) that includes items such as premiums for insurance policies and medical expenses.

Some privately-held firms in our sample pay their CEOs with restricted stock or the equivalent, and they report in their SEC filings the dollar value of restricted stock granted based on a hypothetical market price. In our analysis, we take the value of restricted stock granted as reported.

With respect to the value of option grants, unlike ExecuComp, Capital IQ simply records the value as reported in firms’ 10-K filings, proxy statements, or other SEC filings. If a firm just reports the number of shares underlying an option grant, Capital IQ records a zero value for that option grant. To

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7 In untabulated analysis, we find no significant difference in the level and structure of CEO pay between firms disclosing due to their size and ownership and firms disclosing due to their access to public debt. As a result, we pool both groups of private firms in our analyses.
8 Due to the changes made to compensation disclosure in 2006, bonuses are the sum of bonuses and long-term incentive plans for the period 1999-2005, and bonuses are the sum of bonuses and non-equity incentives after 2005.
9 Restricted stock awards is a data item disclosed under the stock awards column in the summary compensation table. According to Capital IQ, their restricted stock awards column discloses the dollar value of stock-related awards that do not have option-like features. Examples of these include restricted stock, restricted stock units, phantom stock, phantom stock units, common stock equivalent units, or other similar instruments that do not have option-like features.
10 There are 709 private firm-year observations where Capital IQ has the dollar value of the option grant as filed by the reporting firm. The correlation between the Capital IQ option values and the values based on our own calculation using the modified Black-Scholes approach is 0.72.
address this reporting issue in Capital IQ and to provide a fair comparison of the value of options granted to CEOs in privately-held and public firms, we estimate the value of option grants for all sample firms in a manner comparable to the ExecuComp approach.

For privately-held firms, we read their SEC filings available through Capital IQ and hand collect relevant information about CEOs’ option grants. For each option grant, the firm typically states the expiration date and a hypothetical exercise price. We compute the option grant’s Black-Scholes value by making the following assumptions: (1) the volatility is the return volatility of a public firm in the same industry and year with the closest cash flow volatility; (2) the grant-date stock price is the exercise price (the option is granted at-the-money); (3) the dividend yield is the ratio of the dividend paid out in the last year to the exercise price; (4) the time to maturity is 70% of the stated maturity; and (5) the risk-free rate is the seven-year Treasury bond yield prevailing on the grant date. In Appendix 1, we provide a detailed example of how we compute a CEO’s total pay for privately-held firms.

For public firms, around 23,000 firm-year observations are covered by the ExecuComp and the Corporate Library, from which we retrieve relevant information about CEOs’ option grants (including the number of options, strike price, grant date, and expiration date). For the remainder, we hand collect the information on option grants directly from firms’ 10-K filings, proxy statements, or other SEC filings. We then calculate the dollar value of each option grant based on ExecuComp’s modified Black-Scholes approach.

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11 Anecdotal evidence suggests that there are at least three ways for privately-held firm executives to cash out their stock and options: (1) selling them back to the issuing company in a stock repurchase transaction; (2) selling them to the acquiring firm in an acquisition deal; and (3) selling them on the public market via an IPO.

12 Note that using the levered volatility that accounts for the difference in leverage between a privately-held firm and its public peer firm does not change our main results (which are available upon request).

13 To compute the value of an option grant, ExecuComp assumes that the volatility is the annualized standard deviation of stock returns during the 60 months prior to the grant date; the grant-date stock price is the exercise price (the option is granted at-the-money), unless the company specifies otherwise; the dividend yield is the average dividend yields over a three-year period prior to the grant; the time to maturity is equal to 70% of the stated maturity; and the risk-free rate is the seven-year Treasury bond yield prevailing on the grant date.
3.3 Summary statistics

Table 1 presents descriptive statistics of our privately-held and public firm samples. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. The variables are defined in Appendix 2.

Panel A presents descriptive statistics of CEO pay. The mean (median) CEO total pay is $1.49 million ($566 thousand) for the privately-held firm sample, while the mean (median) CEO total pay is $3.02 million ($1.29 million) for the public firm sample. The two-sample t-test and Wilcoxon-test both reject the null that CEO total pay in privately-held firms is the same as that in public firms at the 1% level. On average, CEO total pay in public firms is approximately twice that in privately-held firms.

The mean (median) CEO salary and bonus in privately-held firms is $402 thousand ($324 thousand) and $355 thousand ($60 thousand), respectively, while the mean (median) CEO salary and bonus in public firms is $562 thousand ($471 thousand) and $584 thousand ($193 thousand), respectively. The mean (median) ratio of cash pay (i.e., the sum of salary and bonus) to total pay in privately-held firms is 78% (93%), while the mean (median) ratio of cash pay to total pay in public firms is 62% (63%). The median value of restricted stock and option grants is zero in privately-held firms, while the median value of option grants is $76 thousand in public firms. The mean value of CEO restricted stock and option grants in privately-held firms is $149 thousand and $318 thousand, respectively, while the mean value of CEO restricted stock and option grants in public firms is $568 thousand and $1,013 thousand, respectively. The mean (median) ratio of equity-based pay (i.e., the sum of restricted stock and option grants) to total pay in privately-held firms is 12% (0%), while the mean (median) ratio of equity-based pay to total pay in public firms is 33% (30%). The two-sample t-test and Wilcoxon-test both reject the null that the value of CEO restricted stock and option grants in privately-held firms (the ratio of
equity-based pay to total pay) is the same as that in public firms at the 1% level.

In summary, CEO total pay in privately-held firms is significantly lower compared to CEO total pay in public firms, and private firm CEOs are paid significantly less with equity-based pay. The pay difference shows up in the cash component of total pay (salary and bonus), but is particularly evident in the equity-based components of pay: restricted stock and option grants.

Panel B presents descriptive statistics of CEO characteristics. Private firm CEOs are less likely to have an MBA and are slightly younger than their counterparts in public firms. Notably, private firm CEOs in our sample are less likely to be founders or to serve as Chairman of the Board. Further, CEO ownership also differs significantly between these two groups of firms: CEOs in privately-held firms own on average 13.6% of their companies, as opposed to 4.8% ownership for public firm CEOs. The median CEO equity ownership in privately-held firms is 2.1%, while the median in public firms is 0.7%. The difference in CEO ownership across these two groups of firms is statistically significant at the 1% level.

Panel C presents descriptive statistics of firm characteristics. We show that privately-held firms tend to be smaller, younger firms with weaker accounting performance, higher cash flow volatility, slower sales growth, lower capital expenditures, lower cash holdings, far higher leverage, and fewer segments than public firms. Importantly, we show dramatic differences in levels of ownership concentrations between these two groups of firms. The mean (median) ownership by the largest outside shareholder (Top1 ownership) in privately-held firms is 37.7% (23.1%), while the mean (median) ownership by the largest outside shareholder in public firms is 10.0% (7.2%). The mean (median) ownership by the five largest outside shareholders (Top5 ownership) in privately-held firms is 46.7% (39.8%), while the mean (median) ownership by the five largest outside shareholders in public firms is 17.8% (14.1%).14 The standard deviation of Top1 (Top5) ownership for the privately-held firm sample is two to three times of

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14 Capital IQ started to provide data on largest shareholders in 2004. Hence the sample period for our analyses involving largest shareholder ownership is from 2004-2011.
that for the public firm sample. The much larger cross-sectional variation in ownership concentration combining privately-held and public firms compared to that within public firms helps provide a cleaner test of the optimal contracting theory that corporate ownership affects the relation between pay and performance.

Overall, compared to other studies of privately-held firms (see, for example, Ke, Petroni, and Safieddine (1999), Engel, Gordon, and Hayes (2002), and Cole and Mehran (2011)\(^{15}\), the privately-held firms in our sample are much more comparable to public firms in terms of size and industry coverage, and are subject to the same disclosure requirements with respect to CEO compensation as public firms.

4. Ownership concentration and performance-based pay

The univariate analysis in the previous section indicates significant differences in CEO contract design between privately-held and public firms; in particular, public firm CEOs receive more performance-based pay than their private firm counterparts. It also shows that public firms differ from private firms along a number of dimensions, such as firm size and ownership concentration. In this section, we provide a more formal test of the relation between corporate ownership and pay structures.

4.1 CEO pay-performance sensitivity in privately-held and public firms

We estimate the following panel data regression (see, for example, Murphy (1985), Aggarwal and Samwick (1999), and Graham, Li, and Qiu (2012)):

\[
\ln(CEO \ Pay) = \alpha + \beta_1 Private + \beta_2 ROA + \beta_3 Private \times ROA + \beta_4 \ln(\text{total assets}) + \beta_5 \text{CF volatility} + \beta_6 \text{Leverage} + \beta_7 \text{CEO ownership} + \text{CEO FE}s + \text{Industry FE}s + \text{Year FE}s + \epsilon, 
\]

\(^{15}\) In our sample, the median sales is $168 million for privately-held firms compared to $288 million for public firms. By way of comparison, Cole and Mehran (2011) report the median sales of $1.9 million in 2003 for their sample of privately-held firms drawn from the SSBF data.
where the dependent variable is the natural logarithm of CEO total pay or cash pay. $Private$ is an indicator variable that takes the value of one if the firm is a privately-held firm in that year, and zero otherwise. We include CEO fixed effects to control for differences in the average level of compensation across CEOs in the sample. Only the variations in a CEO’s pay and his firm’s performance relative to their averages over the sample period are used to identify the pay-performance sensitivity. The inclusion of CEO fixed effects also controls for any other aspect of the CEO or firm that may affect CEO compensation, such as the cross-sectional positive correlation between firm size and CEO pay. Further, we include industry fixed effects to control for unobserved industry-specific heterogeneity and year fixed effects to account for the time trend. The coefficient on the $Private$ indicator variable thus measures the difference in levels of CEO pay between privately-held and public firms that cannot be accounted for by differences in firm and CEO characteristics and CEO, industry, and year effects. The coefficient on the interaction term $Private \times ROA$ captures the incremental difference in pay-performance sensitivities across these two groups of firms. The results are reported in Table 2.

Panel A columns (1) and (2) present the full sample results when the dependent variable is the natural logarithm of CEO total pay. The coefficient on contemporaneous accounting performance indicates that pay is largely responsive to performance in both groups of firms. Further, the coefficient on the interaction term $Private \times ROA$ is negative and statistically significant, indicating that CEO pay responds less strongly to performance in privately-held firms compared to public firms. This is our first piece of evidence in support of the shareholder monitoring hypothesis (H1) that privately-held firms with greater ownership concentration and hence stronger shareholder monitoring employ less performance-based pay than public firms do.

Columns (1) and (2) also identify other factors that are related to CEO total pay. We show that
firm size is positively related to levels of CEO pay, as is cash flow volatility. On the other hand, leverage and CEO ownership are both negatively related to levels of CEO pay. All these findings are consistent with prior studies; see, for example, Mehran (1995), Aggarwal and Samwick (1999), and Gabaix and Landier (2008).

One concern about our analysis in columns (1) and (2) is that for private firm CEOs, the value of their stock option grants is measured with error due to the lack of information on stock prices and stock return volatility in privately-held firms. Columns (3) and (4) present the regression results when the dependent variable is the natural logarithm of CEO cash pay. We find similar results. Cash pay is positively associated with accounting performance in both privately-held and public firms, but this association is significantly weaker in privately-held firms than in public firms. It is also worth noting that the mean (median) fraction of equity-based pay (including both restricted stock and option grants) to CEO total pay is 12% (0%) in privately-held firms, while the mean (median) fraction is 33% (30%) in public firms.16

Another concern is that there might be differing incentives for tax purposes between privately-held and public firms that affect our results. Privately-held firms generally care less about financial reporting and are more likely to reduce financial accounting results to save taxes, adding noise to firm accounting performance and hence weakening the pay-performance link. To address this concern, Panel B columns (1) and (2) present the regression results when we employ a number of cash flow-based performance measures that are less susceptible to earnings management and may be more informative of managers’ actions—operating cash flow and EBITDA (Cronqvist and Fahlenbrach (2013)). We show that pay-performance sensitivity in privately-held firms compared to public firms is still weaker, whether we use operating cash flow or EBITDA as a firm performance measure. It is worth noting that our

16 In untabulated analysis, we remove privately-held firms that pay restricted stock or stock options to their CEOs and we still find stronger pay-performance sensitivity in public firms than in privately-held firms.
privately-held sample firms have to file audited financial statements to the SEC as the public firms do, which helps mitigate the concern that differences in earnings quality drive our results.

Finally, CEO compensation may be determined by not only the contemporaneous but also the lagged performance. To account for this possibility, in column (3) we use two-year accumulative ROA from year \( t-1 \) to \( t \) as the performance measure and still find that CEO pay-performance sensitivity is weaker in privately-held firms than in public firms.

Overall, the results in Table 2 show that both private and public firm CEO pay is positively and significantly related to firm accounting performance, with private firm CEO pay exhibiting a weaker association with performance. These results are consistent with the view that direct monitoring incentives are stronger in privately-held firms, which often have large shareholders with illiquid ownership serving as active monitors. As a result, boards in privately-held firms rely more on subjective performance evaluation for setting CEO pay compared to public firm boards. Our large sample evidence in support of the shareholder monitoring hypothesis (H1) is consistent with findings in Mehran (1995), Ke, Petroni, and Safieddine (1999), and Engel, Gordon, and Hayes (2002).

4.2 Alternative explanations

So far we have focused on the difference in ownership concentration between privately-held and public firms to explain the differential pay-performance sensitivity. These two groups of firms may also differ in other dimensions that might have implications on CEO performance-based pay, including stock liquidity, threats from the market for corporate control, the availability of different performance measures, and job responsibilities. As we elaborate below, these differences cannot explain our findings of greater sensitivity of CEO pay to operating performance in public firms than in privately-held firms.

First, public firms clearly have more liquid stock than privately-held firms and greater liquidity
increases the information content in stock prices, leading to more adoption of stock-based compensation in public firms (Holmström and Tirole (1993)). Jayaraman and Milbourn (2012) show that stock liquidity indeed increases the sensitivity of CEO pay to stock prices, but has no impact on the sensitivity of CEO pay to accounting performance. Given that we are comparing CEO pay-performance sensitivity with respect to accounting performance across public and privately-held firms, stock liquidity is unlikely to drive our results.

Second, without publicly-traded stock, privately-held firms are less likely to be the targets of hostile takeovers than are public firms. Davila and Penalva (2006) find that firms with greater takeover protection put more weight on accounting-based performance measures (such as ROA) in setting CEO pay. Thus, the lack of disciplining from the market for corporate control in privately-held firms should make their CEO pay more closely linked to accounting performance than public firms do, which is opposite to our findings.

Third, compared to public firms, privately-held firms have more limited options in the types of objective performance measures available to align CEO incentives with shareholders. For example, privately-held firms do not have market-determined performance measures such as stock returns or have limited usage of stock option grants. As pointed out by Ke, Petroni, and Safieddine (1999), this difference should however make CEO pay in privately-held firms to be more sensitive to accounting performance measures than CEO pay in public firms, which again is opposite to our findings. Thus, the difference in the availability of performance measures is unlikely to explain our results.

Finally, the job responsibilities of CEOs may differ across these two groups of firms. For example, public firm CEOs need to be more skilled at dealing with analysts, activist institutional investors, the financial press, and regulators. This requirement suggests that the sensitivity of CEO pay to firm performance should be weaker in public firms compared to that in privately-held firms, because public
firm CEOs need to exert considerable effort in dealing with many other aspects associated with being a public firm in addition to managing its operation, which is opposite to our findings. In other words, the different skill sets involved in running a public firm versus a privately-held firm are unlikely to drive our findings of differential CEO pay-performance sensitivity in these two groups of firms.

In summary, although privately-held firms and public firms differ along a number of dimensions that might potentially impact on CEO performance-based pay, we conclude that the difference in ownership concentration is the key driver of the observed difference in pay-performance sensitivity.

4.3 Towards a better understanding of ownership concentration and CEO pay-performance sensitivity

The evidence in Table 2 suggests that between privately-held and public firms, the former employ less performance-based pay than the latter because of the presence of direct shareholder monitoring. On the other hand, Hartzell and Starks (2003) and Cronqvist and Fahlenbrach (2013) show that shareholder monitoring leads to strong pay-performance sensitivity. Thus, it is important for us to reconcile the somewhat opposite findings in the literature. Table 3 replicates our analysis in Table 2 by replacing the Private indicator variable with continuous measures of ownership concentration—Top1 (Top5) ownership. Table 1 Panel C has shown that (five) largest outside shareholders in privately-held firms have significantly larger holdings than those in public firms.

Panel A estimates the specification in Equation (1), pooling the privately-held and public firms. We show that using either measure of ownership concentration, the presence of direct shareholder monitoring is negatively and significantly associated with CEO pay-performance sensitivity, again consistent with the shareholder monitoring hypothesis (H1).

One might argue that firm and CEO characteristics might affect compensation contract design differently in privately-held and public firms. Panel B estimates the specification in Equation (1)
(replacing the Private indicator variable with the ownership concentration measure) separating privately-held firms, non-S&P 1500 public firms, and S&P 1500 firms. Columns (1) and (2) show that within the privately-held firm sample, ownership concentration significantly reduces CEO pay-performance sensitivity. Similarly, columns (3) and (4) show that within the non-S&P 1500 public firm sample, ownership concentration also significantly reduces CEO pay-performance sensitivity employing both accounting and stock performance. Strikingly, in columns (5) and (6), when we examine the relation between ownership concentration and pay-performance sensitivity limited to S&P 1500 firms—the largest public firms in the U.S.—we show that using either measure of ownership concentration and either operating or stock performance, the presence of direct shareholder monitoring significantly increases CEO pay-performance sensitivity, consistent with the CEO power hypothesis (H2). Our results suggest that the variation in the monitoring mechanism between privately-held and public firms is different from the variation in the monitoring mechanism within public firms. In well-scrutinized public firms like S&P 1500 firms, large institutional shareholders monitor the pay-setting process closely and strengthen the association between CEO pay and objective firm performance measures. By contrast, private firm shareholders exert direct monitoring due to large illiquid ownership stakes and better access to management, and thus the monitoring mechanism in private firms is more likely to be a direct evaluation of managers’ effectiveness.17

To further explore the potential non-linear relation between levels of ownership concentration and CEO performance-based pay, Figure 1 plots CEO pay-performance sensitivity across Top 1 (Top 5) ownership deciles. There is a clear inverted-U shaped pattern where the pay-performance sensitivity

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17 Cadman, Klasa, and Matsunaga (2010) compare CEO pay in S&P 1500 firms and non-S&P 1500 firms. They find that the positive relation between institutional ownership concentration and the CEO pay-performance sensitivity of option grants, as first shown by Hartzell and Starks (2003) among S&P 1500 firms, becomes negative and significant among non-S&P 1500 firms. They interpret these findings as consistent with the latter having more concentrated institutional ownership and hence a reduced need for performance-based pay. Our findings in Panel B are consistent with Cadman, Klasa, and Matsunaga (2010).
increases until the third ownership decile and decreases thereafter.

In Panel C, we estimate an expanded specification to Equation (1) by adding a quadratic term of $Top1 \ (Top5) \ ownership$ and its interaction term with ROA. We show the coefficient on the interaction term $Top1 \ (Top5) \ ownership \times \ ROA$ is positive and significant, and the coefficient on the interaction term $Top1 \ (Top5) \ ownership^2 \times \ ROA$ is negative and significant, confirming the inverted-U shaped relation between ownership concentration and CEO performance-based pay.

In summary, by pooling privately-held and public firms with diverse levels of ownership concentration, we are able to reconcile mixed evidence from prior work and show an inverted-U shaped relation between ownership concentration and CEO pay-performance sensitivity. Our findings suggest that, while concentrated ownership largely substitutes for CEO performance-based pay, large shareholders indeed tend to reinforce the link between CEO pay and performance when their ownership stake is at the low end (in this case, their costs of direct monitoring are large while their benefits from direct monitoring are small).

4.4 CEO pay in privately-held and public firms

So far, we have focused on the differential effects of firm performance on CEO pay across privately-held and public firms. A related question is how differently do other firm and CEO characteristics influence CEO pay in these two groups of firms? Under the view that privately-held firms rely more on soft information and less on objective information to compensate their CEOs, we expect that explicit firm and CEO characteristics (such as firm size and CEO ownership) have smaller effects on CEO compensation in privately-held firms than in public firms. Using an approach similar to the one used in Conyon, Core, and Guay (2011) and Fernandes et al. (2013) to examine cross-country pay differences, we estimate the following OLS regression to compare determinants of CEO pay in privately-held and
public firms:

\[
\ln(\text{CEO Pay}) = \alpha + \beta_1 \text{Private} + \beta_2 \ln(\text{total assets}) + \beta_3 \text{Performance measures} \\
+ \beta_4 \text{Other firm characteristics} + \beta_5 \text{CEO characteristics} + \text{Industry FEs} + \text{Year FEs} + \epsilon,
\]

where the dependent variable is the natural logarithm of CEO total pay. We introduce firm size, other firm characteristics, and CEO characteristics in stages when presenting our regression results in Table 4.

In column (1), we only control for firm size and industry and year fixed effects. The coefficient on the Private indicator variable is negative and significant, implying a privately-held firm paying its CEO less than its public firm counterpart. Further, CEO pay is strongly and positively associated with firm size, as first shown by Murphy (1985). In column (2), we introduce other firm characteristics known to be important determinants of CEO pay (see, for example, Sloan (1993), Core, Holthausen, and Larcker (1999), and Gao (2010)). The coefficient on the Private indicator variable remains negative and significant. Further, CEO pay is positively associated with firm size, operating performance, cash flow volatility, capital expenditures, cash holdings, and the number of segments, and negatively associated with leverage. In column (3), we further add CEO characteristics and show that the coefficient on the Private indicator variable remains negative and significant. The lower CEO pay in privately-held firms is consistent with the optimal contracting theory that public firm CEOs will demand higher compensation for bearing the risk associated with greater pay-performance sensitivity (Harris and Raviv (1979) and Holmström (1979)).

In addition to the significant firm-level determinants uncovered in column (2), pay is higher for CEOs who have an MBA degree or who are also Chairman of the Board, while pay is lower

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18 Working for a privately-held firm is not the same as working for a public firm. Leading a public firm may entail more stress, less privacy regarding compensation, more exposure to negative media coverage, and more work dealing with investors/analysts. Any or all of these factors could contribute to public firm CEOs to be paid more than private firm counterparts. Further, given the different challenges of leading a public firm, it is certainly possible that these firms demand executives with greater talent, and thus may pay a premium for this talent. We acknowledge these possibilities, which are beyond the scope of the current paper.
for CEOs close to retirement or CEOs with large shareholdings.

Columns (1)-(3) are based on a pooled regression where we restrict the coefficients on the firm and CEO characteristics to be the same across privately-held and public firms. In columns (4) and (5), we separately examine pay determination in privately-held and public firms to further explore the differences across these two groups of firms. The regression specifications in columns (4) and (5) are similar to that in column (3), except that there is no Private indicator variable, and in column (5) for public firms there is contemporaneous stock return. We report the F statistics associated with the Chow-test for different coefficients on the same firm characteristics across these two groups of firms in column (6).

We find that the coefficients on firm characteristics tend to be significantly larger in public firms than those in privately-held firms (with the exception of the coefficient on the number of segments). This evidence provides support for our conjecture that due to a lack of direct shareholder monitoring in public firms, these firms rely more on objective performance measures including firm size, ROA, and capital expenditures. Moreover, we show that the coefficients on CEOs being Chairman of the Board, being retiring CEOs, and CEO ownership are significantly larger in public firms than those in privately-held firms (with the exception of the coefficient on the CEO being a male), suggesting that in the absence of direct shareholder monitoring in public firms, CEO pay in these firms is more influenced by CEO career concerns (whether close to retirement or not), CEO power (being Chairman of the Board), and CEO-shareholder alignment (CEO ownership).

In summary, the results in Table 4 provide further support for the shareholder monitoring hypothesis (H1) that direct shareholder monitoring associated with concentrated ownership reduces boards’ reliance on explicit performance-based contracts.
5. Dealing with self-selection

To address firms’ self-selection into staying privately-held versus being public when comparing these two groups of firms in CEO contract design, we take a multi-pronged approach: 1) using a transition sample where privately-held firms go through IPOs to become publicly listed; 2) implementing propensity score-matching based on observable firm and CEO characteristics; and 3) running two-stage least squares (2SLS) regressions with instrumental variables (IVs).

5.1 The transition sample

We examine changes in CEO pay-performance sensitivity for a set of firms that undergo a change in ownership status. Using the transition sample allows us to compare the same firm as both a privately-held and public firm, and thus to control for the time-invariant unobservable firm characteristics.

We identify 1,130 firms during our sample period 1999-2011 that transition from privately-held to publicly-listed. To clearly compare CEO performance-based pay in privately-held firms with that in public firms, we remove observations of CEO pay in the IPO year from the regression. Table 5 presents the results. The dependent variable is the natural logarithm of CEO total pay. Pre-IPO is an indicator variable that takes the value of one for the pre-IPO period, and zero otherwise. The key variable of interest is the interaction term, Pre-IPO × ROA, which captures the difference in pay-performance sensitivity between the pre-IPO period and the post-IPO period.

In column (1), we restrict the sample period from two years prior to two years after the IPO. The

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20 It is very difficult to get information on CEO compensation for firms owned by private equity firms, or transitioning from public to private ownership. Based on a sample of 20 LBO deals, Cronqvist and Fahlenbrach (2013) show that private equity sponsors tend to re-design CEO compensation contracts after going-private transactions. Due to data limitations, we do not examine CEO pay at firms moving from public to private ownership.
coefficient on $Pre-IPO \times ROA$ is negative and significant, indicating that pre-IPO firms have significantly lower pay-performance sensitivity compared to the same firms after IPOs. We obtain the same results when employing a sample period from three years prior to three years after the IPO in column (2) or when using all available firm-year observations around the IPO in column (3).\textsuperscript{21}

Overall, the results in Table 5 suggest a significant permanent increase in CEO pay-performance sensitivity as firms transition from privately-held to publicly-listed, consistent with our main findings based on cross-sectional evidence.

5.2 The propensity score-matched sample

One might argue that IPO firms do not represent the general population of public and privately-held firms well. To mitigate this concern, we employ a matching technique to examine differences in CEO pay-performance sensitivity between privately-held and public firms in general. The matching procedure controls for selection based on observable firm and CEO characteristics. Our data are well suited to the matching approach, given that we have a much larger pool of potential matches (the public firm sample), compared to the treatment group (the privately-held firm sample), which increases the likelihood of finding close matches for the privately-held firms among the public firms.

The matching procedure that we employ is a one-to-one nearest neighbor matching with replacement (Heckman, Ichimura, and Todd (1997)). The matching starts with a probit regression, using three different specifications to better capture the choice between being a private-held or public firm: 1) $\ln(\text{total assets})$ and industry and year fixed effects; 2) $\ln(\text{total assets}), \text{ROA}, \text{cash flow volatility, leverage, CEO ownership, and industry and year fixed effects}$; and 3) the same set of explanatory variables used in column (3) of Table 4, and the $Private$ indicator variable as the dependent variable. Then using the

\textsuperscript{21} In untabulated analysis, we limit the IPO sample to have the same CEO both before and after the IPO and show that our main findings remain unchanged.
predicted probabilities—propensity scores—from the estimated probit regressions, we match to each private firm-year observation a public firm-year observation that minimizes the absolute value of the difference between propensity scores.

Table 6 presents differences in CEO pay-performance sensitivity in privately-held firms and their matched public firms using the three different matching criteria discussed above. We find that the pay-performance link is significantly weaker in privately-held firms than that in public firms, consistent with our main findings based on cross-sectional evidence.

5.3 The two-stage least squares regression with instrumental variables

Under the 2SLS regression approach, in the first stage, we run a regression to predict the firm’s ownership status, which could be either the Private indicator variable or the continuous measure of ownership concentration. In the second stage, we use the predicted ownership status as the independent variable and examine how it influences CEO pay-performance sensitivity. For the purpose of identification, we need IVs that affect a firm’s propensity of staying privately-held (or ownership concentration), but do not affect its CEO pay directly other than through the effect of ownership.

Liu and Ritter (2011) show that the industry-level underwriter concentration increases the cost of going public via IPO underpricing. It is hard to expect that this measure could be related to individual firms’ CEO performance-based pay. Our first IV for the private status of a firm is this underwriter concentration measure, computed as the ratio of the # of IPOs by the top five lead underwriters in a given industry to the total # of IPOs in that industry using the sample period 1999-2011. Officer (2007) shows that due to poor stock liquidity, private firm targets are acquired at a discount relative to comparable public firm targets. Our second IV is this private firm illiquidity discount, constructed as follows. Using completed acquisition deals from 1999-2011, we first obtain the price-to-EBIT ratio for each target firm.
We then compute a private target’s illiquidity discount as the difference between its own price-to-EBIT ratio to the median price-to-EBIT ratio of all public targets in the same industry. The private firm illiquidity discount is obtained as the median discount across all private targets in the same industry. Again, it is hard to expect that this measure could be related to individual firms’ CEO performance-based pay.

Table 7 Panel A presents the results. The positive coefficients on the two IVs indicate that a privately-held firm is more likely to stay private if (1) there is an underwriter monopoly in the IPO market and (2) the illiquidity discount of being a private target is big.\textsuperscript{22} Column (2) shows that after controlling for self-selection into different ownership status, there is a weaker pay-performance link in privately-held firms compared to public firms.

In Panel B, we use the initial industry-median ownership concentration as the IV for the firm-level ownership concentration variable, following Lin, Ma, Malatesta, and Xuan (2013). The basic idea is that a firm’s ownership structure is correlated with the historical industry-level ownership structure, but it is unlikely that firm-level CEO pay-performance sensitivity is directly correlated with the historical industry-level ownership structure. For each sample firm, we compute the initial industry median ownership concentration variables at the beginning of our sample period. The positive coefficient on the IV in column (1) indicates that there is a strong industry effect in ownership structure. Column (2) shows that after controlling for self-selection into different levels of ownership concentration, there is a weaker pay-performance link in firms with greater ownership concentration compared to firms with less ownership concentration.

In summary, controlling for self-selection, our main findings on the overall negative relation between ownership concentration and performance-based pay remain qualitatively unchanged, supporting \textsuperscript{22} Note that following Officer (2007), the discount variable is constructed as the difference between private firm valuation multiple and its peer public firm valuation multiple.
the shareholder monitoring hypothesis (\(H_1\)).

6. Conclusions

In this paper, we take advantage of a unique dataset on CEO pay in privately-held and public firms to help understand CEO contract design and reconcile the mixed evidence on whether there is a substitute or complementary relation between ownership concentration and CEO pay-performance sensitivity. We argue that the private-versus-public dichotomy allows for a more powerful test of the optimal contracting theory because the variation in the level of ownership concentration across these two groups of firms is likely to be at least as substantial as the variation within public firms. Further, CEO contract design in large privately-held U.S. firms is in itself interesting given a lack of data prior to our study.

Using a comprehensive sample of privately-held and public firms over the period 1999-2011, we first show that both private and public firm CEO pay is positively and significantly related to firm accounting performance, and that the pay-performance link is much stronger in public firms. Reconciling prior literature, we further show that there is an inverted-U shaped relation between ownership concentration and CEO pay-performance sensitivity: There is an overall negative relation between ownership concentration and CEO performance-based pay, while at the low end of ownership concentration, there is a positive relation between the two. Finally, we show that our main findings are robust to controlling for firm self-selection into different ownership structures and to different measures of firm accounting performance. Overall, our results support the view that concentrated ownership structure substitutes for CEO performance-based compensation contracts.

Our analyses focus on two governance mechanisms, ownership concentration and performance-based pay. It is likely that other governance mechanisms, including the board of directors
and the market for corporate control, are similarly interrelated. We expect that examining interactions and efficacies of different governance mechanisms will likely be a fruitful area for further research.
Appendix 1: Computing CEO pay in privately-held firms

Mr. Daniel Thomas is the CEO of Concentra Operating Corp. The company, based in Addison, Texas, was founded in 1979, and operates in the healthcare industry. In 2004, Mr. Thomas received $568,654 as salary, $850,000 as bonus, $1,636,500 as a restricted stock grant, 200,000 shares of option grant, and $18,146 as other compensation, consisting of his life insurance policy and medical expenses.

With respect to the restricted stock grant, the footnote of the 10-K filings stated, “Because there is no active trading market for Concentra’s common stock, we rely on the Compensation Committee to determine in good faith the fair value of securities underlying awards at the time they are granted…”

The firm’s 10-K filings also provided relevant information about the option grant: It expires in 10 years and has a strike price of $15. We apply the Black-Scholes formula with the following input:

- **Strike price:** 15
- **Volatility:** 0.931 (the return volatility of a public firm that is in the healthcare industry and has the closest cash flow volatility to that of Concentra Operating Corp. in the year 2004)
- **Grant-date price:** 15 (assuming that the options are granted at-the-money)
- **Dividend yield:** zero (the firm’s dividend payment is zero in the previous year)
- **Time to maturity:** 70% × 10 = 7 years (following the ExecuComp’s method, we apply 70% of the stated time to maturity)
- **Risk-free rate:** 3.94% (the 7-year Treasury bond yield prevailing on the grant date)

In the end, we obtain a value of $2,431,975 for his option grant.

The total compensation for Mr. Thomas in year 2004 is thus $5,505,275 ($568,654 + $850,000 + $1,636,500 + $2,431,975 + $18,146).

Capital IQ covers Concentra Operating Corp. up to 2006. Over the coverage period, the CEO, Mr. Thomas, did not exercise this option or sell any of his stock holdings. We do observe that one VP sold his share holdings back to Concentra upon his resignation.
## Appendix 2:
### Variable definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>An indicator variable that takes the value of one if a firm is a privately-held firm, and zero otherwise.</td>
</tr>
<tr>
<td>Pre-IPO</td>
<td>An indicator variable that takes the value of one if a sample year is prior to an IPO, and zero otherwise.</td>
</tr>
<tr>
<td>Top1 ownership</td>
<td>The number of shares owned by the single largest outside shareholder normalized by the total number of shares outstanding.</td>
</tr>
<tr>
<td>Top5 ownership</td>
<td>The number of shares owned by the five largest outside shareholders normalized by the total number of shares outstanding.</td>
</tr>
<tr>
<td>Cashpay</td>
<td>The sum of salary and bonus.</td>
</tr>
<tr>
<td>Stock</td>
<td>When privately-held and public firms in our sample pay their CEOs with restricted stock, we take the value of restricted stock as reported by the firm.</td>
</tr>
<tr>
<td>Options</td>
<td>For public firms, we calculate the dollar value of each option grant, based on ExecuComp’s modified Black-Scholes approach. To compute the value of an option grant, ExecuComp assumes: (1) the volatility is the annualized standard deviation of stock returns during the 60 months prior to the grant date; (2) the risk-free rate is the seven-year Treasury bond yield prevailing on the grant date; (3) the grant-date stock price is the exercise price (the option is granted at-the-money), unless the company specifies otherwise; (4) the dividend yield is the average of dividend yields over a three-year period prior to the grant; and (5) the time to maturity is equal to 70% of the stated maturity. With respect to the value of option grants for private firm CEOs, we hand collect relevant information and make the following assumptions to compute the value: (1) the volatility is the return volatility of a public firm in the same industry and year with the closest cash flow volatility; (2) the risk-free rate is the seven-year Treasury bond yield prevailing on the grant date; (3) the grant-date stock price is the exercise price (the option is granted at-the-money); (4) the dividend yield is the ratio of the dividend paid out in the last year to the exercise price; and (5) the time to maturity is 70% of the stated maturity.</td>
</tr>
<tr>
<td>Equity-based pay</td>
<td>The sum of the grant-date value of restricted stock awards ((Stock)) and the Black-Scholes value of granted options ((Options)).</td>
</tr>
<tr>
<td>Otherpay</td>
<td>Other CEO annual compensation, such as premiums for insurance policies and medical expenses.</td>
</tr>
<tr>
<td>Totalpay</td>
<td>The sum of a CEO’s salary, bonus, the grant-date value of restricted stock awards ((Stock)), the Black-Scholes value of granted options ((Options)), and other pay ((Otherpay)).</td>
</tr>
<tr>
<td>Cashpay/Totalpay</td>
<td>The sum of salary and bonus as a percentage of totalpay.</td>
</tr>
<tr>
<td>Equity-based pay/Totalpay</td>
<td>The equity-based pay as a percentage of totalpay.</td>
</tr>
<tr>
<td>Stock/Totalpay</td>
<td>The value of restricted stock awards as a percentage of totalpay.</td>
</tr>
<tr>
<td>Options/Totalpay</td>
<td>The Black-Scholes value of granted options as a percentage of totalpay.</td>
</tr>
<tr>
<td>MBA</td>
<td>An indicator variable that takes the value of one if a CEO holds an MBA degree, and zero otherwise.</td>
</tr>
<tr>
<td>Male CEO</td>
<td>An indicator variable that takes the value of one if a CEO is a male, and zero otherwise.</td>
</tr>
<tr>
<td>Founder</td>
<td>An indicator variable that takes the value of one if a CEO is one of the founders, and zero otherwise.</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>Chairman</td>
<td>An indicator variable that takes the value of one if a CEO is Chairman of the Board, and zero otherwise.</td>
</tr>
<tr>
<td>Retiring CEO</td>
<td>An indicator variable that takes the value of one if a CEO is over 60 years old, and zero otherwise.</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>The number of shares owned by a CEO normalized by the total number of shares outstanding. For public firms, we first collect the ownership data from ExecuComp, Corporate Library, and IRRC; for firms not covered in those databases, we hand collect the ownership data from annual reports and proxy statements. For privately-held firms, we hand collect the ownership data from annual reports and proxy statements.</td>
</tr>
<tr>
<td>ROA</td>
<td>Return on assets, computed as EBIT normalized by total assets.</td>
</tr>
<tr>
<td>CF</td>
<td>Operating cash flow normalized by total assets.</td>
</tr>
<tr>
<td>EBITDA</td>
<td>EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) normalized by total assets.</td>
</tr>
<tr>
<td>Two-year ROA</td>
<td>Two-year accumulative ROA.</td>
</tr>
<tr>
<td>Stock return</td>
<td>Annual stock return.</td>
</tr>
<tr>
<td>CF volatility</td>
<td>The standard deviation of industry-median-adjusted quarterly operating cash flows over the previous eight quarters.</td>
</tr>
<tr>
<td>Capex</td>
<td>Capital expenditures normalized by total assets.</td>
</tr>
<tr>
<td>Cash</td>
<td>Cash holdings normalized by total assets.</td>
</tr>
<tr>
<td>Leverage</td>
<td>The book value of leverage normalized by total assets.</td>
</tr>
<tr>
<td>Firm age</td>
<td>The number of years since a firm’s incorporation.</td>
</tr>
<tr>
<td>Number of segments</td>
<td>The number of segments that a firm operates.</td>
</tr>
<tr>
<td>Underwriter concentration</td>
<td>Based on completed IPOs from 1999-2011, the ratio of the # of IPOs by the top five lead underwriters in a given industry to the total # of IPOs in that industry.</td>
</tr>
<tr>
<td>Private firm illiquidity discount</td>
<td>Based on completed acquisition deals from 1999-2011. We first obtain the price-to-EBIT ratio for each target firm. We then compute a private target’s illiquidity discount as the difference between its own price-to-EBIT ratio to the median price-to-EBIT ratio of all public targets in the same industry. The private firm illiquidity discount is obtained as the median discount across all private targets in the same industry.</td>
</tr>
<tr>
<td>Initial industry top1 ownership</td>
<td>The industry median top1 ownership in 2004 (the first year of our sample period with information available on top1 ownership).</td>
</tr>
<tr>
<td>Initial industry top5 ownership</td>
<td>The industry median top5 ownership in 2004 (the first year of our sample period with information available on top5 ownership).</td>
</tr>
</tbody>
</table>
References:


Farre-Mensa, Joan, 2013. Comparing the cash policies of public and private firms, Harvard University working paper.


Gao, Huasheng, Jarrad Harford, and Kai Li, 2013b. Shareholder concentration and horizon effects on CEO turnover-performance sensitivity, Nanyang Technological University working paper.


Figure 1. Ownership concentration and CEO pay-performance sensitivity

The sample consists of 4,253 private firm-year observations and 28,310 public firm-year observations from 2004-2011, with available data on largest shareholding variables from Capital IQ. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. We first split the sample into ten Top1 (Top5) ownership deciles, and we then run the pay-performance regression specification similar to Equation (1) without the Private indicator variable and the interaction between the Private indicator variable and ROA within each ownership decile. The coefficient on ROA captures the pay-performance sensitivity. Panel A presents the plot of different pay-performance sensitivities (i.e., the coefficient on ROA, in Y-axis) across Top1 ownership deciles (in X-axis). Panel B presents the plot of different pay-performance sensitivities (in Y-axis) across different Top5 ownership deciles (in X-axis).

Panel A: Top1 ownership and CEO pay-performance sensitivity

Panel B: Top5 ownership and CEO pay-performance sensitivity
Table 1. Descriptive statistics

The sample consists of 7,168 private firm-year observations and 45,730 public firm-year observations from 1999-2011, obtained from Capital IQ. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. Panel A presents descriptive statistics of CEO pay. Panel B presents descriptive statistics of CEO characteristics. Panel C presents descriptive statistics of firm characteristics. The sample with available data on largest shareholding variables consists of 4,253 private firm-year observations and 28,310 public firm-year observations from 2004-2011. The last two columns of each table present test statistics of the t-test and the Wilcoxon test of differences in CEO pay, CEO characteristics, and firm characteristics between the privately-held and public firm samples. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: CEO pay characteristics

<table>
<thead>
<tr>
<th></th>
<th>Privately-Held Firms</th>
<th>Public Firms</th>
<th>Test of Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (1)</td>
<td>Median (2)</td>
<td>StdDev (3)</td>
</tr>
<tr>
<td>Totalpay (K)</td>
<td>1491</td>
<td>566</td>
<td>3030</td>
</tr>
<tr>
<td>Salary (K)</td>
<td>402</td>
<td>324</td>
<td>337</td>
</tr>
<tr>
<td>Bonus (K)</td>
<td>355</td>
<td>60</td>
<td>768</td>
</tr>
<tr>
<td>Cashpay/Totalpay</td>
<td>78%</td>
<td>93%</td>
<td>29%</td>
</tr>
<tr>
<td>Stock (K)</td>
<td>149</td>
<td>0</td>
<td>816</td>
</tr>
<tr>
<td>Options (K)</td>
<td>318</td>
<td>0</td>
<td>1443</td>
</tr>
<tr>
<td>Equity-based pay/Totalpay</td>
<td>12%</td>
<td>0%</td>
<td>24%</td>
</tr>
<tr>
<td>Stock/Totalpay</td>
<td>4%</td>
<td>0%</td>
<td>13%</td>
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<tr>
<td>Options/Totalpay</td>
<td>8%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Otherpay (K)</td>
<td>125</td>
<td>14</td>
<td>365</td>
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</table>
### Panel B: CEO characteristics

<table>
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<th>Test of Differences</th>
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</thead>
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<tr>
<td></td>
<td>Mean (1)  Median (2) StdDev (3)</td>
<td>Mean (4)  Median (5) StdDev (6)</td>
<td>t-test (4) – (1) Wilcoxon test (5) – (2)</td>
</tr>
<tr>
<td>MBA</td>
<td>0.18 0</td>
<td>0.38</td>
<td>0.23 0</td>
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<tr>
<td>Male CEO</td>
<td>0.97 1</td>
<td>0.16</td>
<td>0.98 1</td>
</tr>
<tr>
<td>Founder</td>
<td>0.08 0</td>
<td>0.28</td>
<td>0.11 0</td>
</tr>
<tr>
<td>Chairman</td>
<td>0.47 0</td>
<td>0.50</td>
<td>0.62 1</td>
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<tr>
<td>CEO age</td>
<td>53 53 8</td>
<td>55 55 8.12</td>
<td>2*** 2***</td>
</tr>
<tr>
<td>Retiring CEO</td>
<td>0.21 0</td>
<td>0.41</td>
<td>0.29 0</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>13.57% 2.12% 22.92% 4.75% 0.72% 10.13%</td>
<td>-7.44%*** -1.28%***</td>
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</tr>
</tbody>
</table>

### Panel C: Firm characteristics

<table>
<thead>
<tr>
<th></th>
<th>Privately-Held Firms</th>
<th>Public Firms</th>
<th>Test of Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (1)  Median (2) StdDev (3)</td>
<td>Mean (4)  Median (5) StdDev (6)</td>
<td>t-test (4) – (1) Wilcoxon test (5) – (2)</td>
</tr>
<tr>
<td>Total assets (M)</td>
<td>2776 313 10515</td>
<td>4455 633 13394</td>
<td>1680*** 320***</td>
</tr>
<tr>
<td>Sales (M)</td>
<td>908 168 2506</td>
<td>2241 288 6194</td>
<td>1333*** 120***</td>
</tr>
<tr>
<td>ROA</td>
<td>3.45% 4.08% 14.26% 4.49% 5.33% 13.61%</td>
<td>1.04%*** 1.25%***</td>
<td></td>
</tr>
<tr>
<td>CF volatility</td>
<td>3.04% 1.74% 3.59% 2.66% 1.84% 2.78%</td>
<td>-0.38%*** 0.11%</td>
<td></td>
</tr>
<tr>
<td>Sales growth</td>
<td>25.65% 6.59% 71.80% 17.80% 8.46% 51.94%</td>
<td>-7.85%*** 1.87%</td>
<td></td>
</tr>
<tr>
<td>Capex</td>
<td>4.14% 2.10% 6.05% 4.15% 2.37% 5.45%</td>
<td>0.01% 0.27%***</td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>10.18% 4.17% 16.58% 17.08% 7.60% 21.03%</td>
<td>6.90%*** 3.43%***</td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>46.96% 46.53% 32.24% 25.21% 20.95% 20.43%</td>
<td>-21.74%*** -25.58%***</td>
<td></td>
</tr>
<tr>
<td>Firm age</td>
<td>28 11 36 44 28 39</td>
<td>16*** 17***</td>
<td></td>
</tr>
<tr>
<td>Number of segments</td>
<td>1.51 1 1.03 2.02 1 1.41</td>
<td>0.51*** 0***</td>
<td></td>
</tr>
<tr>
<td>Top1 ownership</td>
<td>37.71% 23.10% 36.95% 9.97% 7.21% 11.81%</td>
<td>-27.74%*** -15.89%***</td>
<td></td>
</tr>
<tr>
<td>Top5 ownership</td>
<td>46.69% 39.80% 40.34% 17.77% 14.11% 16.73%</td>
<td>-28.92%*** -25.69%***</td>
<td></td>
</tr>
</tbody>
</table>
## Table 2. CEO pay-performance sensitivity in privately-held and public firms

The sample consists of 7,168 private firm-year observations and 45,730 public firm-year observations from 1999-2011, obtained from Capital IQ. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. Panel A presents the baseline regression results. Panel B presents the regression results using alternative performance measures. CEO, industry, and year fixed effects (FEs) are included in the regressions and the heteroskedasticity-consistent standard errors (in brackets) account for possible correlation within a firm cluster. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

### Panel A: CEO total and cash compensation

<table>
<thead>
<tr>
<th></th>
<th>Ln(Totalpay)</th>
<th>Ln(Cashpay)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Private</td>
<td>-0.297***</td>
<td>-0.133***</td>
</tr>
<tr>
<td>[0.038]</td>
<td>[0.037]</td>
<td>[0.057]</td>
</tr>
<tr>
<td>ROA</td>
<td>1.075***</td>
<td>0.862***</td>
</tr>
<tr>
<td>[0.040]</td>
<td>[0.039]</td>
<td>[0.059]</td>
</tr>
<tr>
<td>Private × ROA</td>
<td>-0.915***</td>
<td>-0.609***</td>
</tr>
<tr>
<td>[0.156]</td>
<td>[0.152]</td>
<td>[0.233]</td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.326***</td>
<td></td>
</tr>
<tr>
<td>[0.007]</td>
<td></td>
<td>[0.011]</td>
</tr>
<tr>
<td>CF volatility</td>
<td>1.538***</td>
<td></td>
</tr>
<tr>
<td>[0.183]</td>
<td></td>
<td>[0.277]</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.222***</td>
<td>-0.098***</td>
</tr>
<tr>
<td>[0.024]</td>
<td></td>
<td>[0.037]</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.449***</td>
<td>-0.650***</td>
</tr>
<tr>
<td>[0.049]</td>
<td></td>
<td>[0.075]</td>
</tr>
<tr>
<td>Constant</td>
<td>14.007***</td>
<td>7.386***</td>
</tr>
<tr>
<td>[0.114]</td>
<td>[0.191]</td>
<td>[0.171]</td>
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<tr>
<td>CEO, Industry, and Year FEs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>52,898</td>
<td>52,898</td>
</tr>
<tr>
<td>Adj R2</td>
<td>5%</td>
<td>41%</td>
</tr>
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</table>
Panel B: Using alternative performance measures

<table>
<thead>
<tr>
<th></th>
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<th>(3)</th>
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</thead>
<tbody>
<tr>
<td>Private</td>
<td>-0.139***</td>
<td>-0.121***</td>
<td>-0.140***</td>
</tr>
<tr>
<td></td>
<td>[0.037]</td>
<td>[0.039]</td>
<td>[0.038]</td>
</tr>
<tr>
<td>CF</td>
<td>0.482***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.040]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private × CF</td>
<td>-0.344***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.115]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBITDA</td>
<td></td>
<td>0.786***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.040]</td>
<td></td>
</tr>
<tr>
<td>Private × EBITDA</td>
<td></td>
<td>-0.449***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.015]</td>
<td></td>
</tr>
<tr>
<td>Two-year ROA</td>
<td></td>
<td></td>
<td>0.442***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.023]</td>
</tr>
<tr>
<td>Private × Two-year ROA</td>
<td></td>
<td></td>
<td>-0.276***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.012]</td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.336***</td>
<td>0.331***</td>
<td>0.318***</td>
</tr>
<tr>
<td></td>
<td>[0.008]</td>
<td>[0.007]</td>
<td>[0.008]</td>
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<tr>
<td>CF volatility</td>
<td>1.359***</td>
<td>1.487***</td>
<td>1.556***</td>
</tr>
<tr>
<td></td>
<td>[0.184]</td>
<td>[0.183]</td>
<td>[0.183]</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.231***</td>
<td>-0.227***</td>
<td>-0.220***</td>
</tr>
<tr>
<td></td>
<td>[0.024]</td>
<td>[0.024]</td>
<td>[0.024]</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.449***</td>
<td>-0.448***</td>
<td>-0.451***</td>
</tr>
<tr>
<td></td>
<td>[0.050]</td>
<td>[0.050]</td>
<td>[0.050]</td>
</tr>
<tr>
<td>Constant</td>
<td>7.202***</td>
<td>7.246***</td>
<td>7.537***</td>
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<td></td>
<td>[0.192]</td>
<td>[0.191]</td>
<td>[0.192]</td>
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<tr>
<td>CEO, Industry, and Year FEs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>52,898</td>
<td>52,898</td>
<td>52,898</td>
</tr>
<tr>
<td>Adj R2</td>
<td>41%</td>
<td>41%</td>
<td>41%</td>
</tr>
</tbody>
</table>
Table 3. Ownership concentration and CEO pay-performance sensitivity

The sample consists of 4,253 private firm-year observations and 28,310 public firm-year observations from 2004-2011, with available data on largest shareholding variables from Capital IQ. The dependent variable is the natural logarithm of CEO total pay. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. Panel A presents the regression results pooling the privately-held and public firms. Panel B presents the regression results separating the privately-held, non-S&P1500 public firms, and S&P1500 firms. Panel C presents the regression results pooling the privately-held and public firms and introducing a quadratic term of Top1 (Top5) ownership and its interaction term with ROA. CEO, industry, and year fixed effects (FEs) are included in the regressions and the heteroskedasticity-consistent standard errors (in brackets) account for possible correlation within a firm cluster. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Pooling privately-held and public firms

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top1 ownership</td>
<td>-0.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.040]</td>
<td></td>
</tr>
<tr>
<td>Top5 ownership</td>
<td>-0.097***</td>
<td>-0.097***</td>
</tr>
<tr>
<td></td>
<td>[0.032]</td>
<td>[0.032]</td>
</tr>
<tr>
<td>ROA</td>
<td>0.778***</td>
<td>0.719***</td>
</tr>
<tr>
<td></td>
<td>[0.059]</td>
<td>[0.060]</td>
</tr>
<tr>
<td>Top1 ownership × ROA</td>
<td>-1.673***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.349]</td>
<td></td>
</tr>
<tr>
<td>Top5 ownership × ROA</td>
<td>-0.651***</td>
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</tr>
<tr>
<td></td>
<td>[0.232]</td>
<td></td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.326***</td>
<td>0.326***</td>
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<tr>
<td></td>
<td>[0.011]</td>
<td>[0.011]</td>
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<tr>
<td>CF volatility</td>
<td>1.322***</td>
<td>1.293***</td>
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<td>[0.242]</td>
<td>[0.242]</td>
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<tr>
<td>Leverage</td>
<td>-0.246***</td>
<td>-0.245***</td>
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<tr>
<td></td>
<td>[0.033]</td>
<td>[0.033]</td>
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<tr>
<td>CEO ownership</td>
<td>-0.705***</td>
<td>-0.688***</td>
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<td>[0.071]</td>
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<tr>
<td>Constant</td>
<td>7.463***</td>
<td>7.481***</td>
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<td>[0.267]</td>
</tr>
<tr>
<td>CEO, Industry, and Year FEs</td>
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<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>32,563</td>
<td>32,563</td>
</tr>
<tr>
<td>Adj R2</td>
<td>42%</td>
<td>42%</td>
</tr>
</tbody>
</table>
Panel B: Separating privately-held, non-S&P1500 public, and S&P1500 firms

<table>
<thead>
<tr>
<th></th>
<th>Privately-Held Firms</th>
<th>Non-S&amp;P1500 Public Firms</th>
<th>S&amp;P1500 Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Top1 ownership</td>
<td>-0.002</td>
<td>0.157**</td>
<td>-0.227</td>
</tr>
<tr>
<td></td>
<td>[0.070]</td>
<td>[0.065]</td>
<td>[0.142]</td>
</tr>
<tr>
<td>Top5 ownership</td>
<td>-0.109*</td>
<td>0.108**</td>
<td>-0.170*</td>
</tr>
<tr>
<td></td>
<td>[0.060]</td>
<td>[0.048]</td>
<td>[0.101]</td>
</tr>
<tr>
<td>ROA</td>
<td>0.303*</td>
<td>0.299*</td>
<td>0.547***</td>
</tr>
<tr>
<td></td>
<td>[0.168]</td>
<td>[0.174]</td>
<td>[0.123]</td>
</tr>
<tr>
<td>Stock return</td>
<td>0.069***</td>
<td>0.072***</td>
<td>0.051***</td>
</tr>
<tr>
<td></td>
<td>[0.013]</td>
<td>[0.013]</td>
<td>[0.019]</td>
</tr>
<tr>
<td>Top1 ownership × ROA</td>
<td>-1.145**</td>
<td>-1.210***</td>
<td>3.436**</td>
</tr>
<tr>
<td></td>
<td>[0.551]</td>
<td>[0.445]</td>
<td>[1.514]</td>
</tr>
<tr>
<td>Top5 ownership × ROA</td>
<td>-0.658*</td>
<td>-0.660**</td>
<td>1.679**</td>
</tr>
<tr>
<td></td>
<td>[0.401]</td>
<td>[0.282]</td>
<td>[0.746]</td>
</tr>
<tr>
<td>Top1 ownership × Stock return</td>
<td>-0.161*</td>
<td>0.500*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.085]</td>
<td>[0.256]</td>
<td></td>
</tr>
<tr>
<td>Top5 ownership × Stock return</td>
<td>-0.115**</td>
<td>0.249**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.057]</td>
<td>[0.120]</td>
<td></td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.203***</td>
<td>0.201***</td>
<td>0.299***</td>
</tr>
<tr>
<td></td>
<td>[0.038]</td>
<td>[0.038]</td>
<td>[0.015]</td>
</tr>
<tr>
<td>CF volatility</td>
<td>0.304</td>
<td>0.243</td>
<td>1.340***</td>
</tr>
<tr>
<td></td>
<td>[0.511]</td>
<td>[0.509]</td>
<td>[0.283]</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.049</td>
<td>-0.044</td>
<td>-0.192***</td>
</tr>
<tr>
<td></td>
<td>[0.093]</td>
<td>[0.093]</td>
<td>[0.043]</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.709***</td>
<td>-0.707***</td>
<td>-0.482***</td>
</tr>
<tr>
<td></td>
<td>[0.108]</td>
<td>[0.102]</td>
<td>[0.109]</td>
</tr>
<tr>
<td>Constant</td>
<td>9.123***</td>
<td>9.186***</td>
<td>5.580***</td>
</tr>
<tr>
<td></td>
<td>[0.804]</td>
<td>[0.803]</td>
<td>[0.704]</td>
</tr>
<tr>
<td>CEO, Industry, and Year FEs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>4,253</td>
<td>4,253</td>
<td>15,504</td>
</tr>
<tr>
<td>Adj R2</td>
<td>14%</td>
<td>13%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Panel C: The non-linear relation between ownership concentration and CEO pay-performance sensitivity

<table>
<thead>
<tr>
<th></th>
<th>Top1 ownership (1)</th>
<th>Top5 ownership (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top1 ownership</td>
<td>0.039</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.085]</td>
<td></td>
</tr>
<tr>
<td>Top1 ownership(^2)</td>
<td>-0.007</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.096]</td>
<td></td>
</tr>
<tr>
<td>Top5 ownership</td>
<td></td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.082]</td>
</tr>
<tr>
<td>Top5 ownership(^2)</td>
<td></td>
<td>-0.070</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.095]</td>
</tr>
<tr>
<td>ROA</td>
<td>0.632***</td>
<td>0.597***</td>
</tr>
<tr>
<td></td>
<td>[0.060]</td>
<td>[0.063]</td>
</tr>
<tr>
<td>Top1 ownership × ROA</td>
<td>1.309**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.530]</td>
<td></td>
</tr>
<tr>
<td>Top1 ownership(^2) × ROA</td>
<td>-4.914***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.893]</td>
<td></td>
</tr>
<tr>
<td>Top5 ownership × ROA</td>
<td></td>
<td>1.755***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.435]</td>
</tr>
<tr>
<td>Top5 ownership(^2) × ROA</td>
<td></td>
<td>-4.123***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.633]</td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.323***</td>
<td>0.322***</td>
</tr>
<tr>
<td></td>
<td>[0.011]</td>
<td>[0.011]</td>
</tr>
<tr>
<td>CF volatility</td>
<td>1.306***</td>
<td>1.276***</td>
</tr>
<tr>
<td></td>
<td>[0.242]</td>
<td>[0.242]</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.246***</td>
<td>-0.241***</td>
</tr>
<tr>
<td></td>
<td>[0.033]</td>
<td>[0.033]</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.708***</td>
<td>-0.687***</td>
</tr>
<tr>
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<td>[0.073]</td>
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<td>Constant</td>
<td>7.510***</td>
<td>7.546***</td>
</tr>
<tr>
<td></td>
<td>[0.268]</td>
<td>[0.267]</td>
</tr>
<tr>
<td>CEO, Industry, and Year FEs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>32,563</td>
<td>32,563</td>
</tr>
<tr>
<td>Adj R2</td>
<td>41%</td>
<td>41%</td>
</tr>
</tbody>
</table>
### Table 4. CEO pay in privately-held and public firms

The sample consists of 7,168 private firm-year observations and 45,730 public firm-year observations from 1999-2011, obtained from Capital IQ. The dependent variable is the natural logarithm of CEO total pay. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. Industry and year fixed effects (FEs) are included in the regressions and the heteroskedasticity-consistent standard errors (in brackets) account for possible correlation within a firm cluster. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Privately-Held Firms</th>
<th>Public Firms</th>
<th>F statistic of Chow test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Private</td>
<td>-0.389***</td>
<td>-0.313***</td>
<td>-0.258***</td>
<td></td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.451***</td>
<td>0.470***</td>
<td>0.447***</td>
<td>0.389***</td>
</tr>
<tr>
<td></td>
<td>[0.023]</td>
<td>[0.025]</td>
<td>[0.025]</td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>0.734***</td>
<td>0.765***</td>
<td>0.205*</td>
<td>0.810***</td>
</tr>
<tr>
<td></td>
<td>[0.059]</td>
<td>[0.058]</td>
<td>[0.115]</td>
<td></td>
</tr>
<tr>
<td>Stock return</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF volatility</td>
<td>3.200***</td>
<td>3.146***</td>
<td>1.619***</td>
<td>3.593***</td>
</tr>
<tr>
<td></td>
<td>[0.264]</td>
<td>[0.263]</td>
<td>[0.520]</td>
<td></td>
</tr>
<tr>
<td>Sales growth</td>
<td>0.024***</td>
<td>0.018*</td>
<td>0.021</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>[0.009]</td>
<td>[0.009]</td>
<td>[0.019]</td>
<td></td>
</tr>
<tr>
<td>Capex</td>
<td>0.965***</td>
<td>0.945***</td>
<td>0.706**</td>
<td>0.989***</td>
</tr>
<tr>
<td></td>
<td>[0.149]</td>
<td>[0.147]</td>
<td>[0.274]</td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>0.693***</td>
<td>0.692***</td>
<td>0.463***</td>
<td>0.706***</td>
</tr>
<tr>
<td></td>
<td>[0.051]</td>
<td>[0.049]</td>
<td>[0.105]</td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.064*</td>
<td>-0.054</td>
<td>0.029</td>
<td>-0.079*</td>
</tr>
<tr>
<td></td>
<td>[0.036]</td>
<td>[0.036]</td>
<td>[0.062]</td>
<td></td>
</tr>
<tr>
<td>Ln(firm age)</td>
<td>0.006</td>
<td>0.005</td>
<td>0.010</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>[0.008]</td>
<td>[0.008]</td>
<td>[0.013]</td>
<td></td>
</tr>
<tr>
<td>Number of segments</td>
<td>0.012*</td>
<td>0.015**</td>
<td>0.079***</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>[0.007]</td>
<td>[0.007]</td>
<td>[0.017]</td>
<td></td>
</tr>
<tr>
<td>MBA</td>
<td>0.121***</td>
<td>0.135***</td>
<td>0.108***</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>[0.017]</td>
<td>[0.017]</td>
<td>[0.019]</td>
<td></td>
</tr>
<tr>
<td>Male CEO</td>
<td>0.045</td>
<td>0.220**</td>
<td>0.011</td>
<td>3.42*</td>
</tr>
<tr>
<td></td>
<td>[0.041]</td>
<td>[0.105]</td>
<td>[0.043]</td>
<td></td>
</tr>
<tr>
<td>Founder</td>
<td>-0.042</td>
<td>0.004</td>
<td>-0.038</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>[0.031]</td>
<td>[0.067]</td>
<td>[0.034]</td>
<td></td>
</tr>
<tr>
<td>Chairman</td>
<td>0.147***</td>
<td>0.072**</td>
<td>0.155***</td>
<td>4.62**</td>
</tr>
<tr>
<td></td>
<td>[0.015]</td>
<td>[0.035]</td>
<td>[0.017]</td>
<td></td>
</tr>
<tr>
<td>Retiring CEO</td>
<td>-0.111***</td>
<td>0.007</td>
<td>-0.115***</td>
<td>7.59***</td>
</tr>
<tr>
<td></td>
<td>[0.016]</td>
<td>[0.041]</td>
<td>[0.017]</td>
<td></td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.698***</td>
<td>-0.408***</td>
<td>-1.039***</td>
<td>19.03***</td>
</tr>
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<td></td>
<td>[0.074]</td>
<td>[0.103]</td>
<td>[0.102]</td>
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<tr>
<td>Constant</td>
<td>4.796***</td>
<td>4.141***</td>
<td>4.524***</td>
<td>5.451***</td>
</tr>
<tr>
<td></td>
<td>[0.135]</td>
<td>[0.143]</td>
<td>[0.148]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td><strong>Industry FEs</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Year FEs</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td><strong>Observations</strong></td>
<td>52,898</td>
<td>52,898</td>
<td>52,898</td>
<td>7,168</td>
</tr>
<tr>
<td><strong>Adj R2</strong></td>
<td>54%</td>
<td>56%</td>
<td>57%</td>
<td>56%</td>
</tr>
</tbody>
</table>
### Table 5. The transition sample

The sample consists of 1,130 IPO deals from 1999-2011. The dependent variable is the natural logarithm of CEO total pay. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. Column (1) is based on the period from year -2 to year +2 around the IPO year (year 0). Column (2) is based on the period from year -3 to year +3 around the IPO year. Column (3) is based on all available firm-year observations around the IPO year. CEO, industry, and year fixed effects (FEs) are included in the regressions and the heteroskedasticity-consistent standard errors (in brackets) account for possible correlation within a firm cluster. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Year -2 to +2</th>
<th>Year -3 to +3</th>
<th>All Firm-Years around IPO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Pre-IPO</td>
<td>-0.077</td>
<td>-0.131**</td>
<td>-0.173***</td>
</tr>
<tr>
<td></td>
<td>[0.075]</td>
<td>[0.057]</td>
<td>[0.033]</td>
</tr>
<tr>
<td>ROA</td>
<td>0.519***</td>
<td>0.479***</td>
<td>0.350***</td>
</tr>
<tr>
<td></td>
<td>[0.126]</td>
<td>[0.110]</td>
<td>[0.080]</td>
</tr>
<tr>
<td>Pre-IPO × ROA</td>
<td>-0.250**</td>
<td>-0.259**</td>
<td>-0.254***</td>
</tr>
<tr>
<td></td>
<td>[0.114]</td>
<td>[0.102]</td>
<td>[0.085]</td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.252***</td>
<td>0.275***</td>
<td>0.320***</td>
</tr>
<tr>
<td></td>
<td>[0.037]</td>
<td>[0.031]</td>
<td>[0.021]</td>
</tr>
<tr>
<td>CF volatility</td>
<td>1.980***</td>
<td>1.996***</td>
<td>1.291***</td>
</tr>
<tr>
<td></td>
<td>[0.629]</td>
<td>[0.526]</td>
<td>[0.377]</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.104</td>
<td>-0.030</td>
<td>-0.025</td>
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<tr>
<td></td>
<td>[0.093]</td>
<td>[0.080]</td>
<td>[0.059]</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.177</td>
<td>-0.095</td>
<td>-0.127</td>
</tr>
<tr>
<td></td>
<td>[0.286]</td>
<td>[0.234]</td>
<td>[0.168]</td>
</tr>
<tr>
<td>Constant</td>
<td>9.190***</td>
<td>8.879***</td>
<td>7.892***</td>
</tr>
<tr>
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<td>[0.778]</td>
<td>[0.648]</td>
<td>[0.453]</td>
</tr>
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<td>CEO, Industry, and Year FEs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
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<td>Observations</td>
<td>3,312</td>
<td>4,190</td>
<td>6,662</td>
</tr>
<tr>
<td>Adj R2</td>
<td>10%</td>
<td>11%</td>
<td>16%</td>
</tr>
</tbody>
</table>
Table 6. Propensity score matching

The sample consists of 7,168 private firm-year observations and their propensity score-matched public firm-year observations, using the nearest neighbor matching. The dependent variable is the natural logarithm of CEO total pay. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. In column (1), the variables we use in matching are ln(total assets) and industry and year fixed effects. In column (2), the variables we use in matching are ln(total assets), ROA, cash flow volatility, leverage, CEO ownership, and industry and year fixed effects. In column (3), the variables we use in matching are the full set of firm and CEO characteristics used in column (4) of Table 4. CEO, industry, and year fixed effects (FEs) are included in the regressions and the heteroskedasticity-consistent standard errors (in brackets) account for possible correlation within a firm cluster. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>-0.163**</td>
<td>-0.019</td>
<td>-0.042</td>
</tr>
<tr>
<td></td>
<td>[0.065]</td>
<td>[0.082]</td>
<td>[0.097]</td>
</tr>
<tr>
<td>ROA</td>
<td>0.600***</td>
<td>0.821***</td>
<td>0.645***</td>
</tr>
<tr>
<td></td>
<td>[0.105]</td>
<td>[0.090]</td>
<td>[0.096]</td>
</tr>
<tr>
<td>Private × ROA</td>
<td>-0.346**</td>
<td>-0.619***</td>
<td>-0.406***</td>
</tr>
<tr>
<td></td>
<td>[0.143]</td>
<td>[0.133]</td>
<td>[0.139]</td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>0.240***</td>
<td>0.225***</td>
<td>0.215***</td>
</tr>
<tr>
<td></td>
<td>[0.017]</td>
<td>[0.016]</td>
<td>[0.017]</td>
</tr>
<tr>
<td>CF volatility</td>
<td>1.159***</td>
<td>0.484</td>
<td>0.266</td>
</tr>
<tr>
<td></td>
<td>[0.332]</td>
<td>[0.309]</td>
<td>[0.297]</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.084*</td>
<td>-0.104**</td>
<td>-0.136***</td>
</tr>
<tr>
<td></td>
<td>[0.045]</td>
<td>[0.043]</td>
<td>[0.045]</td>
</tr>
<tr>
<td>CEO ownership</td>
<td>-0.483***</td>
<td>-0.367***</td>
<td>-0.254***</td>
</tr>
<tr>
<td></td>
<td>[0.064]</td>
<td>[0.059]</td>
<td>[0.059]</td>
</tr>
<tr>
<td>Constant</td>
<td>9.012***</td>
<td>9.120***</td>
<td>9.196***</td>
</tr>
<tr>
<td></td>
<td>[0.368]</td>
<td>[0.360]</td>
<td>[0.367]</td>
</tr>
<tr>
<td>CEO, Industry, and Year FEs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>14,336</td>
<td>14,336</td>
<td>14,336</td>
</tr>
<tr>
<td>Adj R2</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
</tbody>
</table>
Table 7. Two-stage least squares (2SLS) regressions with instrumental variables

The dependent variable is the natural logarithm of CEO total pay. Definitions of the variables are provided in Appendix 2. All dollar values are in 2011 dollars. All continuous variables are winsorized at the 1st and 99th percentiles. In Panel A, the sample consists of 7,168 private firm-year observations and 45,730 public firm-year observations from 1999-2011. In the first stage, we run a probit regression to predict the Private indicator variable, using two instrumental variables: underwriter concentration and private firm illiquidity discount. In the second stage, we replace the Private indicator variable by its predicted value from the first stage. In Panel B, the sample consists of 4,253 private firm-year observations and 28,310 public firm-year observations from 2004-2011, with available data on largest shareholding variables from Capital IQ. In the first stage, we run an OLS regression to predict the (five) largest shareholding variable, using initial industry (five) largest shareholding variable as the instrumental variable. In the second stage, we replace the (five) largest shareholding variable by its predicted value from the first stage. CEO, industry, and year fixed effects (FEs) are included in the second-stage regressions and the heteroskedasticity-consistent standard errors (in brackets) account for possible correlation within a firm cluster. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: 2SLS with instrumental variables for the Private indicator variable

<table>
<thead>
<tr>
<th>First Stage Probit Predicting Private (1)</th>
<th>Second Stage OLS (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td>[0.117]</td>
</tr>
<tr>
<td>Private × ROA</td>
<td>-1.093***</td>
</tr>
<tr>
<td></td>
<td>[0.261]</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.297***</td>
</tr>
<tr>
<td></td>
<td>[0.058]</td>
</tr>
<tr>
<td></td>
<td>0.956***</td>
</tr>
<tr>
<td></td>
<td>[0.051]</td>
</tr>
<tr>
<td>Ln(total assets)</td>
<td>-0.161***</td>
</tr>
<tr>
<td></td>
<td>[0.004]</td>
</tr>
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<tr>
<td>Pseudo R2/Adj R2</td>
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Panel B: 2SLS with instrumental variable for ownership concentration

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<th>First Stage Predicting Top1 Ownership</th>
<th>First Stage Predicting Top5 Ownership</th>
<th>Second Stage OLS</th>
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<td>-3.871</td>
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