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Keywords

corporation, board of directors, executive compensation, corporate culture, CEO

Disciplines

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Comments

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I. Introduction

Why are Chief Executive Officers (CEOs) of major American companies paid such large sums for their services? In the last decade, a literature has grown to offer competing explanations. Pay-for-productivity theories (Murphy (1985)) suggest that CEOs are extraordinarily productive and worth what they are paid. Tournament models (Lazear and Rosen (1981)) propose that each firm offers an optimal prize to the CEO and that lower level managerial workers strive for that prize. Neither of these theories directly considers the role of the board of directors—the body that formally sets executive salaries. In this paper, I propose a test for the explicit role of the boards of directors in determining CEO salaries. CEOs and

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their subordinates often are directors of other boards, and CEOs often have much discretion in choosing new board members. If two CEOs, or their subordinates, serve on each other's boards (they are reciprocally interlocked), then these CEOs may have both the incentive and the opportunity to raise each other's pay.

I use data on the full names, occupations, and employers of nearly 10,000 directors from more than 700 of America's major corporations to construct two measures of interlock of the boards, CEOs, and directors. I then use CEO compensation data from 1992 and other CEO-specific and firm-specific data to study the effect of interlock on CEO pay.

I find that 20% of firms are any-employee interlocked, that is any current or retired employee (including the CEO) from firm A sits on firm B's board *and* any current or retired employee (including the CEO) from firm B sits on firm A's board. Eight percent of firms are current-CEO interlocked—the current CEO of firm A serves as a director of firm B and the current CEO of firm B serves as a director of firm A. Salaries of CEOs in interlocked firms are higher than in other firms. After controlling for firm and CEO characteristics, this pay gap is reduced dramatically. However, when firms that are interlocked due to documented business relationships are considered not interlocked, the measured return to interlock is as high as 17%. There also is evidence that the return to interlock was higher in the 1970s than in the early 1990s.

II. Summary Statistics and Estimation

The sample of firms is from the Forbes magazine 500s list, so called because it is a list of the 500 largest American companies in each of four different categories: sales, profits, assets, and market value. The combined sets in 1992 yield 773 companies.

A. Summary Statistics and Data

I collected data from 1992 on the board of directors from the individual annual reports and proxy reports of each of the firms in the sample. For each director, the data include seven variables: the name of the firm for which he serves as director, his first, middle, and last name, his occupation, his principal employer, and whether he is retired. The data cover 9,804 director seats held by 7,519 individuals. There are fewer individuals than seats since some directors serve on more than one board.

When there was missing information, I supplemented the data from annual reports and proxy statements with data from The Million Dollar Directory, Standard & Poor's Register of Corporations, Directors, and Executives, The Directory of Corporate Affiliations, Who's Who in Finance and Industry, the Lexis-Nexis System, and Laser Disclosure. It was vital to collect information on all firms since the exclusion of one firm, which might be interlocked with others, could incorrectly label the remaining firms as not interlocked.

The data on the 1992 CEO salaries and personal information were collected from Forbes magazine's Annual Survey of CEO Compensation from 1993. These data cover many of the largest corporations in the U.S. and include the CEO's age, years with the firm, and years as CEO. Included are bonuses and other

compensation such as insurance policies, restricted shares that vested during the year, savings plan contributions, and club memberships. Forbes also reports stock gains, which are the value realized by the exercise of options. I primarily use three measures of compensation: salary plus bonus, salary plus bonus plus other compensation, and total compensation. Total compensation is the sum of salary, bonuses, other compensation, and exercised options. Because total compensation includes exercised options, it may not reflect current compensation as accurately as the other measures.[1]

Table 1 describes some of the characteristics of the boards of directors, the CEOs, and the firms. The sample size is 602 because data on compensation and other CEO and firm characteristics are not available for all of the original firms. The summary statistics are broken down into five groups: all firms, non-any-employee interlocked firms, any-employee interlocked firms, non-current-CEO interlocked firms, and current-CEO interlocked firms. The average number of directors per firm is 12.71. Forty-four percent of the directors are principally employed by one of the original firms in the sample.

Table 1 also includes other characteristics of the firm such as market value of equity from COMPUSTAT and annual stock return from CRSP. Interlocked and non-interlocked firms are statistically significantly different on a number of dimensions. CEOs from interlocked firms have higher pay, more directors on their boards, and longer tenure with their firms. Interlocked firms have market value of equity more than twice that of non-interlocked firms. However, the previous year's mean cumulative stock returns for interlocked and non-interlocked firms are not significantly different.

B. Estimation

Even though CEOs may not necessarily sit on each other's compensation committees, the potential for conflicts of interest is likely to be more severe for firms that are current-CEO interlocked rather than any-employee interlocked. This is because each CEO in the pair actually interacts with other board members at board meetings roughly once each month. A positive link between any-employee interlock and CEO pay is still plausible, however, for several reasons. The pay of non-CEO managers is linked to that of the CEO. They may also strive to become the CEO. Additionally, non-CEO-interlocked employees from two firms who sit on each other's board can report information to the CEOs about the board proceedings. By providing a conduit for information, non-CEO employees can convey information to the CEOs that allows them to manipulate the compensation process or modify their own behaviors to elicit higher pay. The fact that non-CEOs can provide information to the CEOs might also encourage other board members to support higher CEO pay.

Table 2 presents compensation regressions for the three different compensation variables, measured in natural logs: ln(salary + bonus), ln(salary + bonus +

[1]For approximately half of the firms, I also analyzed, but do not report in the tables, the value of stock options granted to the CEO using data from William Mercer Inc. I added this measure of pay to salary, bonus, and other. The returns to interlock reported in this paper are similar whether including or excluding these option grants.

TABLE 1

Summary Statistics

	(1)	(2)	(3)	(4)	(5)
	All	Non-Any-Employee Interlocked	Any-Employee Interlocked	Non-Current-CEO Interlocked	Current-CEO Interlocked
CEO's Age (years)	56.98	56.75[b]	57.88[b]	56.82[c]	58.93[c]
	(0.27)	(0.32)	(0.43)	(0.29)	(0.71)
CEO's Firm Seniority (years)	23.72	22.62[b]	28.02[b]	23.27[c]	29.31[c]
	(0.49)	(0.56)	(0.87)	(0.51)	(1.38)
CEO's Seniority as CEO (years)	8.52	8.87[b]	7.17[b]	8.35[d]	10.60[d]
	(0.31)	(0.36)	(0.28)	(0.32)	(1.01)
CEO's Salary + Bonus ($millions)	1.10	1.05[b]	1.27[b]	1.07[c]	1.42[c]
	(0.04)	(0.05)	(0.06)	(0.04)	(0.21)
CEO's Salary + Bonus + Other ($millions)	1.35	1.28[b]	1.64[b]	1.32[c]	1.71[c]
	(0.05)	(0.06)	(0.08)	(0.05)	(0.13)
CEO's Total Compensation ($millions)	2.57	2.45	3.05	2.45	4.02
	(0.23)	(0.23)	(0.63)	(0.21)	(1.47)
Market Value of Equity ($millions)	4843	3783[b]	8973[b]	4498[c]	9121[c]
	(336)	(324)	(975)	(340)	(1466)
Stock Return[a] in Year $t-1$	0.48	0.49	0.44	0.48	0.51
	(0.03)	(0.03)	(0.04)	(0.03)	(0.08)
Number of Directors on Board	12.71	12.32[b]	14.24[b]	12.55[c]	14.73[c]
	(0.16)	(0.19)	(0.29)	(0.17)	(0.53)
Proportion of Directors Employed by One of Original Sample Firms	0.44	0.41[b]	0.54[b]	0.43[c]	0.54[c]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.08)
N	602	479	123	557	45

Summary statistics are presented for all, for non any-employee interlocked firms, any-employee interlocked firms, non current-CEO interlocked firms, and for current-CEO interlocked firms in the five columns, respectively. Two firms are any-employee interlocked if any current or retired employee (including CEOs) of firm A serves as a director of firm B and if any current or retired employee (including CEOs) of firm B serves as a director of firm A. Two firms are current-CEO interlocked if the current CEO of firm A serves as a director of firm B and vice versa. Data on CEO pay and characteristics are collected from Forbes, accounting data are from COMPUSTAT, and return data are from CRSP. Standard errors are in parentheses.

[a] Annual stock return computed from CRSP. Stock return data from 1991. All other data from 1992.

[b] Indicates that the mean value for this variable is statistically different for non-any-employee interlocked firms relative to any-employee interlocked firms at the 1% level of significance.

[c] Indicates that the mean value for this variable is statistically different for non-current-CEO interlocked firms relative to current-CEO interlocked firms at the 1% level of significance.

[d] Indicates that the mean value for this variable is statistically different for non-current-CEO interlocked firms relative to current-CEO interlocked firms at the 5% level of significance.

other compensation), and ln(total compensation). The table is arranged into two panels: Panel A shows the effects of any-employee interlock on CEO pay and Panel B shows current-CEO interlock. Without controlling for other firm and individual characteristics, the coefficients in Table 2, Panel A, row 1, columns 1 (0.291), 4 (0.357), and 7 (0.314), imply that compensation of CEOs in any-employee interlocked firms is estimated to be 34 to 43% higher than in other firms. These pay gaps are estimated using the standard conversion $e^{\beta} - 1$, where the βs come from the coefficients on interlock from the regressions in Table 2. Using the same simple conversion, the regressions from columns 1, 4, and 7 of Table 2, Panel B imply that CEO compensation in current-CEO interlocked firms is estimated to be 46 to 52% higher than in other firms. All of these differences are statistically significant at the 1% level. There is a substantial difference in CEO pay for interlocked CEOs relative to non-interlocked CEOs, no matter how interlock or pay are measured.

Columns 2, 5, and 8 of Table 2, Panel A include as additional regressors the age of the CEO and its square, the CEO's seniority in the firm and its square, the

TABLE 2

Least Squares Regressions for Estimates of the Return to Interlock and Other Determinants of CEO Pay

	ln(salary + bonus)			ln(salary + bonus + other)			ln(total compensation)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. Focus on ANY-EMPLOYEE interlock. Two firms are any-employee interlocked if any current or retired employee of firm A serves as a director of firm B and vice versa. Interlock measures constructed by the author from various sources.									
ANY-EMPLOYEE Interlock	0.291*** (4.716)	0.092 (1.583)		0.357*** (5.289)	0.142** (2.204)		0.314*** (3.323)	0.060 (0.665)	
ANY-EMPLOYEE Interlock (with any business relationships considered not interlocked)			0.116* (1.805)			0.165** (2.309)			0.045 (0.448)
CEO's Age (years)		0.137*** (3.832)	0.137*** (3.827)		0.156*** (3.932)	0.156*** (3.935)		0.195*** (3.517)	0.196*** (3.530)
(CEO's Age)^2/100		−0.118*** (3.695)	−0.118*** (3.684)		−0.133*** (3.752)	−0.133*** (3.747)		−0.164*** (3.292)	−0.164*** (3.302)
CEO's Firm Seniority (years)		−0.020** (2.507)	−0.020** (2.536)		−0.021** (2.360)	−0.021** (2.387)		−0.019 (1.526)	−0.019 (1.518)
(CEO's Firm Seniority)^2/100		0.032* (1.830)	0.032* (1.842)		0.032* (1.653)	0.032* (1.664)		0.021 (0.804)	0.021 (0.801)
CEO's Seniority as CEO (years)		0.028*** (3.621)	0.029*** (3.673)		0.028*** (3.272)	0.029*** (3.329)		0.032*** (2.657)	0.032*** (2.650)
(CEO's seniority as CEO)^2/100		−0.042* (1.796)	−0.043* (1.842)		−0.040 (1.566)	−0.042 (1.621)		−0.030 (0.828)	−0.030 (0.833)
ln(Market Value of Equity) in ln($millions)		0.232*** (10.470)	0.231*** (10.499)		0.250*** (10.225)	0.251*** (10.290)		0.332*** (9.682)	0.334*** (9.788)
(Stock Return)$_{(t-1)}$		0.030 (0.754)	0.028 (0.703)		0.017 (0.401)	0.014 (0.328)		0.180*** (2.934)	0.178*** (2.913)
Number of Directors on Board		0.011* (1.784)	0.012* (1.833)		0.013* (1.774)	0.013* (1.851)		0.001 (0.141)	0.002 (0.176)
20 Industry Indicators	no	yes	yes	no	yes	yes	no	yes	yes
Constant	13.646*** (489.639)	8.813*** (8.235)	8.190*** (8.255)	13.806*** (451.927)	7.584*** (6.898)	7.573*** (6.897)	14.105*** (330.467)	5.953*** (3.862)	5.912*** (3.839)
R^2	0.034	0.306	0.307	0.043	0.299	0.300	0.016	0.275	0.274

(continued on next page)

TABLE 2 (continued)

Least Squares Regressions for Estimates of the Return to Interlock and Other Determinants of CEO Pay

	ln(salary + bonus)			ln(salary + bonus + other)			ln(total compensation)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B. Focus on CURRENT-CEO interlock. Two firms are current-CEO interlocked if the current CEO of firm A serves as a director of firm B and vice versa.									
CURRENT-CEO Interlock	0.381***	0.068		0.377***	0.039		0.418***	0.004	
	(4.011)	(0.793)		(3.591)	(0.413)		(2.878)	(0.032)	
CURRENT-CEO Interlock (with any business relationships considered not interlocked)			0.158 (1.528)			0.130 (1.134)			−0.028 (0.177)
CEO's Age (years)		0.139*** (3.895)	0.138*** (3.867)		0.160*** (4.034)	0.159*** (4.006)		0.197*** (3.557)	0.198*** (3.564)
$(\text{CEO's Age})^2/100$		−0.120*** (3.753)	−0.119*** (3.725)		−0.137*** (3.846)	−0.136*** (3.820)		−0.165*** (3.328)	−0.166*** (3.335)
CEO's Firm Seniority (years)		−0.019** (2.428)	−0.020** (2.470)		−0.020** (2.243)	−0.020** (2.274)		−0.018 (1.494)	−0.018 (1.489)
$(\text{CEO's Firm Seniority})^2/100$		0.031* (1.792)	0.031* (1.824)		0.031 (1.601)	0.031 (1.623)		0.021 (0.791)	0.021 (0.788)
CEO's Seniority as CEO (years)		0.027*** (3.410)	0.026*** (3.367)		0.027*** (3.064)	0.026*** (0.009)		0.032*** (2.599)	0.032*** (2.626)
$(\text{CEO's Seniority as CEO})^2/100$		−0.039* (1.679)	−0.039* (1.652)		−0.038 (1.471)	−0.037 (1.435)		−0.029 (0.808)	−0.030 (0.825)
ln(Market Value of Equity) in ln($millions)		0.238*** (10.927)	0.237*** (11.018)		0.262*** (10.880)	0.261*** (10.941)		0.338*** (10.031)	0.339*** (10.150)
$(\text{Stock Return})_{(t-1)}$		0.029 (0.723)	0.027 (0.681)		0.015 (0.336)	0.014 (0.310)		0.178*** (2.911)	0.178*** (2.913)
Number of Directors on Board		0.012* (1.849)	0.011* (1.779)		0.014* (1.921)	0.013* (1.854)		0.002 (0.196)	0.002 (0.215)
20 Industry Indicators	no	yes	yes	no	yes	yes	no	yes	yes
Constant	13.676*** (526.578)	8.079*** (8.138)	8.122*** (8.198)	13.851*** (483.014)	7.366*** (6.690)	7.417*** (6.746)	14.138*** (356.382)	5.850*** (3.805)	5.829*** (3.792)
R^2	0.025	0.303	0.305	0.019	0.293	0.295	0.012	0.274	0.274

The dependent variables are, respectively, ln(salary + bonus), ln(salary + bonus + other compensation), and ln(total compensation). Other compensation includes such items as insurance policies, restricted shares that vested during the year, savings plan contributions, and memberships to clubs. Total compensation = salary + bonus + other compensation plus exercised options. These salary data are from Forbes magazine and are for 1992.

***significant at 0.01, **significant at 0.05, and *significant at 0.10.

There are 602 observations. (*t*-statistics are in parentheses).

CEO's seniority as CEO and its square, ln(firm market value), the lagged annual stock market return, and the number of directors on the board. The regressions also include 20 industry indicator variables collected from Forbes, which are not reported in the table. Compensation increases at a declining rate with the CEO's age and seniority. The coefficient on lagged stock return is positive, but statistically significant only for the total compensation measure.[2]

The effect of market value of equity is highly statistically significant. The functional form for this variable in a compensation regression is important not only for its own sake, but also for the effect it has on the other covariates. For example, if I use the actual level (instead of the natural log) of the firm's market value as a control, the coefficient on any-employee interlock in Table 2, Panel A, column 2, row 1 is 0.179 with a t-statistic of 3.0 rather than 0.092 with a t-statistic of 1.58. As reported in Table 1, larger firms are more likely to interlock than smaller firms. Market value and interlock are so highly correlated that specifying market value as linear seriously affects the coefficient on interlock. The Appendix and Appendix Figure 1 describe in more detail why it is more appropriate to specify ln(market value of equity) than levels as a covariate. The ln(market value) specification is also consistent with the literature (see, for example, Murphy (1985)). Alternative ways to control for firm size, such as that described in the Appendix, yield estimates of the return to interlock almost identical to those reported in Table 2. The coefficient on the any-employee interlock variable falls to 0.092 (Table 2, Panel A, column 2) and becomes statistically insignificant at conventional levels when the control variables are included in the regression.

Column 5 of Table 2, Panel A repeats the analysis of column 2 while using ln(salary + bonus + other compensation) as the dependent variable. The results are similar to those presented in column 2, except that the return to any-employee interlock is higher (0.142) and significant at the 5% level. Since any-employee interlock produces a larger effect on this dependent variable, I investigated other compensation more closely. Ninety-three percent of the firms in the sample offer their CEOs at least some other compensation. Other compensation is, on average, 13.5% of salary plus bonus plus other. If I use the 93% of firms with non-zero other compensation and run a least squares regression of ln(other compensation) on the complete list of control variables from Table 2, the return to interlock is much higher than reported in the table. The coefficient on any-employee interlock implies a difference of 57.1% with a t-statistic of 3.0. The coefficient on current-CEO interlock implies a relatively smaller difference of 25.9%, however. If, instead, I use the entire set of data, including observations with zero other compensation, tobit specifications censoring either at 1 or at the minimum of other non-zero compensation yield even larger effects. Even though other compensation is a relatively small part of remuneration, interlocking has a significant effect on it. Because it is less tangible than salary, individual directors may be able to influence other compensation more easily than salary.

Column 8 of Table 2 uses ln(total compensation) as the dependent variable and includes the same set of control variables as reported in columns 2 and 5.

[2]Although there are some significant outliers in CEO pay, results are similar if I use median regressions (Koenker and Bassett (1978)) rather than OLS. The OLS estimates are reported in this paper.

The coefficient on the interlock variable is smaller than those reported in columns 2 and 5 and insignificant. I have reported the results for total compensation for completeness even though, as I mentioned earlier, this dependent variable includes the value of exercised options and not the value of options when granted. This variable potentially has a lot of noise associated with it as the exercise of options can be quite irregular over time.

Interlocks may simply reflect legitimate business relationships such as customer/supplier, banking, or other business relationships, and not the cronyism implied by Rees (1992). For each interlocked firm, I examined annual reports, proxy statements, 10Ks, and 10Qs to determine why these firms were interlocked with one another. For each firm, I searched by computer through the reports for the name of the firm to which it was interlocked. When I found the name of an interlocked firm, I made a determination as to why the interlocks took place. For example, firms can be interlocked because one firm supplies goods or services to the other or because they participate in a joint venture with one another. A number of firms seem to be interlocked because of documented business relationships. For example, 26% of any-employee interlocked firms and 36% of current-CEO interlocked firms had identifiable business relationships. Although a large fraction of interlocks remains unexplained by these relationships, it is plausible that cronyism is less of a problem in firms with such formal business arrangements.

In columns 3, 6, and 9 of Table 2, Panel A, those interlocked firms that have documented business relationships are redefined as not interlocked and the analysis of columns 2, 5, and 8 is repeated. For the first two measures of compensation, when controlling for firm and CEO characteristics, the point estimates for the return to interlock are higher when firms with business relationships are considered to be *not* interlocked (compare column 3 to column 2 and column 6 to column 5). Redefining interlock leaves only those firms with potentially the largest opportunity for agency problems.

Panel B of Table 2 repeats the analysis of Panel A but focuses on current-CEO interlocks. Without conditioning on other covariates, firms that are current-CEO interlocked pay their CEOs substantially higher pay. In columns 2, 5, and 8, when covariates are introduced, the point estimates on interlock fall and are insignificant. However, when interlocks that can be explained by business relationships are considered not interlocked, in columns 3, 6, and 9, the return to interlock rises substantially for the first two measures of pay. Given the earlier discussion of the differences in the two types of interlock, it is plausible to expect a higher return for current-CEO interlock relative to any-employee interlock. In fact, however, it is not higher. But when interlocks explained by business relationships are redefined as not interlocked, the current-CEO interlock coefficients are larger compared with the any-employee interlock coefficients than discussed earlier, at least for the first two measures of pay.

I have repeated the analyses reported earlier using compensation data for the years before and after the focus of this study, 1991 and 1993. Results using the compensation data from 1991 and 1993 are qualitatively similar to those reported above for 1992.

III. Return to Interlock over Time

To study the effects of interlock over time, I obtained a data set from Bearden and Mintz (1985) who studied the largest 252 firms in terms of sales in 1976. Their data are quite similar to mine in that they also study very large firms. I was able to construct any-employee interlock measures for 1976 using their data. The fraction of any-employee interlocked firms in the sample constructed from their data is 7.54%. Following their selection procedure and using my 1992 data yields an any-employee interlock fraction of 28.57%. Note that this is higher than the 20% reported earlier for the 1992 data—as the very largest firms are more likely to interlock. For the comparison described in this section, the sample construction of the data sets is identical, although the fraction interlocked in 1992 is much higher.

Table 3 presents a comparison of the returns to interlock in 1976 with those in 1992 and shows that the return to interlock is higher in 1976. Panel A of Table 3 presents results for the dependent variable ln(salary + bonus) and Panel B for ln(total compensation). The middle compensation category from Table 2, which includes other compensation, is not included in Table 3 since data on other compensation are not available for 1976. Column 1 presents regression results using the full sample from 1992 and column 2 presents results for the 1992 subsample, which only includes the largest 252 firms in terms of sales. There is not a significantly different return to interlock using the entire 1992 data set rather than the smaller subset of firms. Column 3 uses the same sample selection criteria as column 2 but uses data from 1976 instead of 1992. In column 3, the return to any-employee interlock is very high and statistically significant, 21.3 and 16.6%, respectively, for the dependent variables.

TABLE 3

Return to Any-Employee Interlock Using Data from Two Periods, 1992 and 1976

	(1) Full Sample 1992	(2) Largest Firms by Sales 1992	(3) Largest Firms by Sales 1976
Panel A. Dependent Variable: ln(salary + bonus)			
ANY-EMPLOYEE Interlock	0.092	0.115	0.213***
	(1.583)	(1.603)	(2.696)
$\bar{R}^2$	0.306	0.225	0.295
Panel B. Dependent Variable: ln(total compensation)			
ANY-EMPLOYEE Interlock	0.060	0.139	0.166**
	(0.665)	(1.240)	(1.983)
$\bar{R}^2$	0.275	0.210	0.340
N	602	213	232

The dependent variables in Panels A, and B, respectively, are ln(salary +bonus) and ln(total compensation). Total compensation = salary + bonus + other compensation (which includes such items as insurance policies, restricted shares that vested during the year, savings plan contributions, and memberships to clubs) + exercised options. The data in columns 1 and 2 are for 1992 and the data in column 3 are from 1976. The data used to construct the interlock variables used in column 3 are from Bearden and Mintz (1985). All specifications also control for 20 industry indicator variables, age of the CEO and its square, seniority of the CEO in the firm and its square, seniority of the CEO as CEO and its square, ln(firm value), and the number of directors on the board. The largest 252 firms in 1992 (column 2) and the largest 252 firms in 1976 (column 3) were used to construct the any-employee interlock variables. Sample sizes differ from 252 as not all other information is available for all firms.

***significant at 0.01, and **significant at 0.05. (*t*-statistics are in parentheses).

It is particularly interesting that the *return* to interlock is higher in 1976 than 1992, especially given that the *fraction* of interlocked firms is much higher in 1992 than in 1976. In light of a comment by Jensen and Murphy (1990) that "disclosure of top-management compensation can guard against 'looting' by management (in collusion with 'captive' boards of directors)," it is surprising that the true fraction interlocked is smaller in the later period since disclosure has become more common and SEC rules more strict. The data suggest that although firms are more likely to have interlocking relationships, these are not being translated into substantially higher pay for CEOs.

IV. Agency

To study whether the fraction of employees interlocked is larger than would be expected by chance, I ran simulations to examine what fraction of firms would be interlocked if directors were randomly assigned to board positions. We should not think a priori that this fraction is zero. To test whether the portion of firms that are any-employee interlocked is simply an artifact of random assignment, I simulated what the true fraction interlocked would be under a set of simple assumptions. First, I assumed that the directors who are currently in my sample are the entire population of potential directors. Second, I assumed that for each of 999 iterations of randomly assigning directors, each director had a probability of 1 of being reassigned a spot in the pool. Finally, I assumed that interlocks are allowed within an industry.[3] I effectively sorted each of the 9,804 director positions and randomly put directors back into positions. I did this 999 times and each time computed the fraction interlocked. Although each of the assumptions tends to overestimate the simulated fraction interlocked, actual board directors interlock much more often than would occur by random chance: the actual number interlocked is five times the simulated level.

There is some reason to believe that interlock is due to agency conflicts. First, simulation estimates suggest that interlocking happens far more often than can be explained by random chance. Second, although up to one-third of interlocks can be explained by business relationships, a large fraction of interlocking cannot be explained in this way. Finally, the return to interlock is higher when firms with documented business relationships are considered not interlocked. Taken together, these facts suggest that interlock could be due to agency problems.

V. Econometric Issues

A. Sample Selection

Because of the way I constructed the sample, some firms that may actually be interlocked may artificially look not interlocked. If directors tend to associate with directors of firms like their own in terms of firm value, then firms near the bottom of the sample may be interlocked with firms just below them (who are out of the sample). Also, firms high in value have fewer directors to choose from if

[3] According to the Clayton Act of 1914, employees of one firm cannot serve as directors of another firm in the same industry.

they want directors from like firms. To study this possibility, I split the sample in half in terms of the market value of equity of the firms. If the sample construction is a problem, then there should be a larger effect of interlock on CEO pay for firms with high equity value than for firms with low equity value.[4] Firms in the upper half of the value distribution are any-employee interlocked 33% of the time, and those in the lower half of the value distribution are any-employee interlocked only 8% of the time. However, selection is not systematically driving the results, since the coefficient on interlocked is higher and more significant in high value firms if the dependent variable is a function of salary plus bonus, but lower if the dependent variable is a function of either salary plus bonus plus other compensation or total compensation.

B. Unobserved Heterogeneity

The interpretation of the models in Tables 2 and 3 depends on the assumption that CEOs in companies with different levels of interlock are otherwise identical, conditional on the observed control variables. However, there is some reason to suspect this is not the case. Since there are large differences in the observable characteristics of CEOs of interlocked and non-interlocked firms, it is likely that there are additional explanations for CEO pay beyond those already stated, including interlock. If interlock is just a proxy for other, unobserved variables, then controlling for other variables as well may at least partially reduce the effect of interlock.

I have considered several possibilities for additional controls. One is the fraction of the board of directors that is principally employed by one of the firms in the sample. Forty-four percent of the directors are employed by one of the large firms. The coefficient on this variable in a compensation regression could have a few interpretations. First, it could be interpreted as a measure of cronyism. Second, it could be interpreted as a measure of firm quality. If a higher fraction of the board members from large firms implies a more prestigious firm, this could translate into higher CEO pay. Also, Morck, Schliefer, and Vishny (1989) have suggested that Tobin's Q may proxy for the ability of the managers. Additionally Abowd, Kramarz, and Margolis (1993) and Rosen (1982) have argued that firms with above average wages may have workers of above average ability, so I have controlled for a crude measure of the average firm wage by using the total labor and related expenses of the firm divided by the total employees (collected from COMPUSTAT). Finally, I controlled for the occupational distribution of the board members by including 12 indicator variables for board member occupations: CEO, chairman, president, vice-chairman, vice-president, professor, attorney, doctor, government official, consultant, businessman, and other. If boards organized in particular ways are more likely to be interlocked and more likely to have higher paid CEOs, then interlock could be a proxy for good management and not cronyism. Collectively controlling for these measures reduces the return to interlock slightly. Although the

[4] Another way to see if directors tend to come from similar firms in terms of firm market value of equity is to measure the correlation between firm value and average value of the firms that principally employ the directors. This is difficult, however, as many directors are employed by organizations outside of the sample of firms, such as universities and foundations.

data do not allow for more sophisticated tests for unobserved heterogeneity, these results using additional controls suggest that additional covariates might further reduce the measured return to interlock.

VI. Concluding Comments

Previous study of the compensation of CEOs has excluded detailed analysis of the group that actually sets CEO pay, the board of directors. This work uses data on the composition of the boards of directors of America's largest firms as well as information on CEO compensation and firm characteristics to test the hypothesis that CEOs who are reciprocally interlocked with other CEOs via their boards of directors can raise their wages above those of their counterparts who are not interlocked. There is a substantial amount of interlock. About 20% of firms are any-employee interlocked. Roughly 8% of firms are current-CEO interlocked. Interlocked CEOs earn, on average, significantly higher pay than non-interlocked CEOs. After controlling for firm and CEO characteristics, this pay gap is reduced dramatically. However, when firms that are interlocked due to documented business relationships are considered not interlocked, the measured return to interlock is as high as 17%. There is also evidence that the return to interlock was higher in the 1970s than in the early 1990s.

Appendix. Discussion of ln(Firm Market Value of Equity) Functional Form Assumption in the ln(Compensation) Regression

Table 1 demonstrates that interlocked firms are, on average, twice as large as non-interlocked firms. In the regressions of CEO pay on firm characteristics, the specification of functional form of the market value of the firm is crucial to the coefficient on interlock.

To test what specification for firm size was appropriate, I ran a series of regressions like the following,

$$\begin{aligned}\ln(\text{salary} + \text{bonus}) = {} & \alpha + \beta_1(\text{CEO's Age}) + \beta_2(\text{CEO's Age})^2 \\ & + \beta_3(\text{CEO's firm seniority}) + \beta_4(\text{CEO's firm seniority})^2 \\ & + \beta_5(\text{CEO's seniority as CEO}) + \beta_6(\text{CEO's seniority as CEO})^2 \\ & + \beta_7(\text{stock return})_{t-1} + \beta_8(\text{number of directors on board}) \\ & + \sum_{i=2}^{20} \text{Industry}_i \Gamma_i + \sum_{j=2}^{20} \left[(\text{value size group})_j\right] \theta_j + \epsilon.\end{aligned}$$

This regression is simply ln(salary + bonus) on many standard CEO and firm-level characteristics as well as 19 other variables that are indicators for firm market value of equity. Since there is a constant, one of the group of 20 is omitted from the regression. To construct these firm market value of equity size groups, I sorted the data by market value and assigned the smallest 5% to $(\text{value size group})_1$ and so on up to the largest 5% in $(\text{value size group})_{20}$. The coefficients of interest are the 19

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$\widehat{\theta}_j$ coefficients. Appendix Figure 1 plots these 19 coefficients on the vertical axis and ln(average of each of the 19 firm value size groups) on the horizontal axis. The straight line in the figure suggests that a log-linear specification is appropriate—that is, the regressions should include ln(firm market value of equity) and not the level. The results of this analysis are robust to changes in the covariates and dependent variables in the equation above.

APPENDIX FIGURE 1

Coefficients on Value Indicator Variables

Points in the figure are the 19 $\widehat{\theta}_j$ estimates from the following regression:

$$\begin{aligned}\ln(\text{salary} + \text{bonus}) = {} & \alpha + \beta_1(\text{CEO's age}) + \beta_2(\text{CEO's age})^2 \\ & + \beta_3(\text{CEO's firm seniority}) + \beta_4(\text{CEO's firm seniority})^2 \\ & + \beta_5(\text{CEO's seniority as CEO}) + \beta_6(\text{CEO's seniority as CEO})^2 \\ & + \beta_7(\text{stock return})_{t-1} + \beta_8(\text{number of directors on board}) \\ & + \sum_{i=2}^{20} \text{Industry}_i \Gamma_i + \sum_{j=2}^{20} \left[(\text{value size group})_j\right] \theta_j + \epsilon.\end{aligned}$$

To construct the market value of equity size groups, I sorted the data by firm market value of equity and assigned the smallest 5% to $(\text{value size group})_1$ and so on up to $(\text{value size group})_{20}$. Since there is a constant, one of the group of 20 is omitted from the regression. The other variables are described in the text and other tables.