RAND Journal of Economics
Vol. 31, No. 1, Spring 2000
pp. 165–179

The impact of regulation on CEO labor markets

Darius Palia*

I examine empirically whether the executive labor market helps to slot managers with higher education quality into jobs where they can obtain greater returns from their human capital skills. Comparing a sample of regulated gas and electric firms with manufacturing firms, I find that utilities attract CEOs with a lower-quality education than unregulated firms do. Comparing a sample of airline firms pre- and postderegulation, airlines have CEOs with a higher-quality education postderegulation. These results suggest that the labor market slots CEOs with a lower quality of education into regulated business environments.

1. Introduction

■ One of the major functions of the executive labor market is to identify quality managers (see Rosen, 1992). Do better managers work for firms where they are needed most and where they reap the greatest awards from their ability? One might examine this issue by comparing the quality of chief executive officers (CEOs) of regulated and unregulated firms. There are at least two reasons why one might expect better CEOs to work for unregulated firms. Because electric and gas utilities are regulated, CEOs have less managerial discretion, so the corporate returns to ability are lower than in the unregulated manufacturing sector. Second, as Joskow, Rose, and Shepard (1993) have shown, for political reasons, utility CEOs have lower pay-performance sensitivities than their counterparts in the unregulated sector do; that is, they receive lower financial rewards for good performance, resulting in lower personal returns to ability.[1] Jensen and Murphy (1990b) suggest that a highly sensitive pay-for-performance system will attract high-ability people to self-select into a company.

* Columbia University and UCLA; darius.palia@anderson.ucla.edu.

I thank two anonymous referees, Ann Bartel, Judy Chevalier, Doug Diamond, Larry Glosten, William Greene, Steve Kaplan, Lalith Munasinghe, Kevin J. Murphy, Carlene Palia, Sam Peltzman, Canice Prendergast, Nancy Rose, Sherwin Rosen, David Scharfstein (the Editor), Jake Thomas, Joe Tracy, Rob Vishny, Catherine Wolfram, and seminar participants at Columbia and Chicago for helpful comments and discussions. I also thank Stacey Kole for providing me with some data on airlines, Maggie Newman for editorial assistance, and the Faculty Research Fund at Columbia University for financial support. All errors remain my responsibility.

[1] For example, regulators could disallow large pay packages out of concern about the intense media attention during times of rate increases or service difficulties. See "Lilco Chairman Declines a Much-Criticized Increase in His $580,000 Salary" *The New York Times*, February 24, 1995, p. B6.

The major impediment to examining the effect of regulation on managerial ability is deriving a reliable metric of managerial quality. There are many aspects of managerial quality, none of which is easy to measure. One crude proxy is educational background. Chevalier and Ellison (1999) have shown that mutual funds whose managers were educated at better universities (those with higher average SAT scores) tend to outperform other funds on a risk-adjusted basis. As in Chevalier and Ellison, CEO quality in this article is proxied by a measure of the CEO's education quality. These definitions of CEO quality have major limitations. For example, better CEOs might possess more intangibles such as leadership characteristics, unobservable industry experience, or social networks that have little to do with educational background.

To examine whether labor markets slot managers with a higher-quality education to firms where they can get greater returns from their human capital, I examine two sets of firms. The first set consists of regulated electric and gas utilities and a control sample of unregulated manufacturing firms. This sample allows me to analyze the impact of regulation on the types of executives who are matched to the firm's investment opportunity set and compensation policy. The second set of firms consists solely of airline firms. Whereas in the next few years the utility industry is expecting true deregulation, in which retail customers can choose their own provider (see Joskow, 1997), the U.S. airline industry has already undergone deregulation with the passage of the Airline Deregulation Act of 1978. Examining this sample allows me to test whether the types of executives matched to a firm's investment opportunity set and compensation policy *change* due to deregulation. Specifically, we can examine whether the education quality of airline executives changed before and after 1978 to test whether airlines have higher education quality in the postderegulation era.

I proxy CEO education quality by the prestige of the institution from which the executive earned his degree. I control for differences in ranking by discipline and for rankings of colleges around the time the CEOs earned their degrees. Separate rankings for undergraduate and postgraduate programs are created. Utilities seem to have more engineers and lawyers and fewer MBAs. More important, fewer CEOs from utilities have attended a top-ranked undergraduate, engineering, law, or business school than have CEOs of manufacturing firms. An education-quality variable is then created using graduation from a top-ranked school of any type. Utilities are found to have a statistically significantly lower level of education quality than do manufacturing firms. These results generally suggest that the labor market sorts executives according to their education quality, slotting a lower level of education quality to the regulated environment of utilities.

One might also examine the education quality of the executives who move from the regulated to the unregulated sector or vice versa. Executives invest in their own human capital at three levels: general schooling, firm-specific investments, and industry-specific investments. These three levels of human capital are not easily transferable, and therefore a large number of executives do not leave their firm or industry.[2]

To examine whether education quality changes when firms are deregulated, I examine the second sample that consists solely of airline firms.[3] This sample allows me

[2] In my sample, 67% of utility CEOs have utility experience only, statistically significantly lower than the 94.7% of manufacturing CEOs who have only manufacturing experience. While a few utilities hired CEOs with experience in manufacturing (13.6%), there was hardly any converse migration from the regulated sector to the unregulated sector (.8%). Most of this movement, however, is much below CEO rank.

[3] Kole and Lehn (1995) find that airlines experienced significant increases in CEO pay levels and pay-performance sensitivities after deregulation. They find that equity ownership became more concentrated and CEO option grants increased significantly after deregulation. Accordingly, I do not examine for the changes in the pay-performance sensitivities of airline CEOs, but I do test for changes in executive quality pre- and postderegulation.

to check whether the differences in the quality of a CEO's education between utilities and manufacturing firms are due to regulation or to other factors that are correlated with higher pay-performance sensitivities. More CEOs have MBAs in the deregulated period than in the regulated period. More important, CEO education quality statistically significantly increased after deregulation. This increase cannot be attributed to general trends of increases in CEO quality over time, because the manufacturing sample shows no statistically significant increase after deregulation.

As in Joskow, Rose, and Shepard (1993),[4] differences in the levels of pay and the pay-performance sensitivities between utilities and unregulated firms are next examined. I extend their study by evaluating the entire compensation contract (which includes the value of options granted and stock ownership) rather than examining only salary, bonus, and the dollar gains from already exercised options. Consistent with Jensen and Murphy's (1990a) results, I find that most of the differences arise from options and stock ownership. The difference between the two industries in the sensitivity of salary and bonus to performance is only about one cent for a $1,000 increase in shareholder wealth; another $16.69 difference in pay-performance sensitivity is from the rest of the compensation contract ($13.61 if one excludes the equity ownership of company founders).

The article is organized as follows. In Section 2, managerial education quality, performance, pay, and equity holdings are defined. Section 3 describes the data. The empirical tests and results are presented in Section 4. Section 5 concludes.

2. Defining managerial quality, performance, pay, and equity holdings

■ **Managerial quality.** My crude proxy for CEO quality is a measure of the CEO's education. Rather than concentrate on the quantity of education—most CEOs have college and graduate degrees—I focus on differences in educational quality. Are the CEOs of utilities less likely to have graduated from a top school than the CEOs of manufacturing firms?

To examine this question, I use Coleman's (1973) ranking of the 13 top undergraduate programs in the 1960s, approximately the time that the CEOs in the sample were pursuing an undergraduate degree. These undergraduate colleges, other than engineering colleges, in alphabetical order are Brown, Columbia, Cornell, Dartmouth, Duke, Georgetown, Harvard, Johns Hopkins, Northwestern, Pennsylvania, Princeton, Stanford, and Yale. In engineering, I choose six schools that are in the ten top-ranked schools in 1964 in three of the four fields of chemical engineering, civil engineering, electrical engineering, and mechanical engineering (Cartter, 1966). Given that the CEO's resume does not give the engineering speciality, this procedure allows me to choose the top engineering programs. Alphabetically, they are Berkeley, Cal Tech, Illinois, Michigan, MIT, and Stanford.

I also check whether utilities attract executives with different postgraduate qualifications than do manufacturing firms. Different jobs require different education skills; for example, utilities might need more lawyers to deal with regulation and governmental bureaucracies. I check whether the CEO had a law degree or a business degree to proxy the general set of skills that they learned in postgraduate school. If an executive had a joint degree, each degree was counted as half. Once again, the proxy for

[4] The Joskow, Rose, and Shepard study is closest in nature to this article. Joskow, Rose, and Wolfram (1996) is an intraindustry study that examines the differences in pay levels of only utility CEOs. Jolls (1995) is a theoretical article that derives the optimal CEO contract under a regulated environment. Smith and Watts (1992) is an industry-level examination of CEO compensation.

education quality uses the earliest rankings of postgraduate college programs found. Note that the ranking of programs in law is not necessarily the same as in business. For the MBA degree, I use the earliest ranking of programs (MBA, 1974) to obtain the nine top-ranked schools. Alphabetically, they are Carnegie, Chicago, Columbia, Harvard, Michigan, Sloan, Stanford, Tuck, and Wharton. For law, the earliest rankings (Useem and Karabel, 1986) give the nine top-ranked law schools in 1974. Alphabetically, they are Berkeley, Chicago, Columbia, Harvard, Michigan, NYU, Pennsylvania, Stanford, and Yale. The education quality variable takes the value of unity if the CEO obtained an undergraduate degree from a top-ranked school, or an engineering degree from a top-ranked school, or an MBA from a top-ranked school, or a law degree from a top-ranked school, and zero otherwise. I followed the same procedure to measure the education quality of airline CEOs.

□ **Performance.** Principal-agent theory suggests that managerial pay should be related to managerial actions in order to align the insurance motive of the manager with the wealth-maximizing incentive of the shareholder. Although there is little doubt that CEO pay is related to performance, a debate has arisen as to whether stock market returns or accounting returns are more informative for executive incentives. Whereas Jensen and Murphy (1990a) and Murphy (1985) confine their definition of performance to stock returns, and different transformations thereof, some studies use accounting numbers as the relevant measure of performance (see Kostiuk, 1990). Given the potential for misrepresentation in accounting numbers, I restrict my analysis to stock market measures. Specifically, I calculate the Jensen and Murphy (1990a) measure of shareholder wealth (defined as market value of the firm times the return made during the year) and the Smith and Watts (1992), Shin and Stulz (1998) measure of Tobin's Q (defined as the ratio of total assets minus book value of equity plus market value of equity to total assets).[5]

□ **Pay.** There are many mechanisms by which compensation policy provides value-increasing incentives to improve a CEO's performance. These mechanisms can be classified into performance-based bonus and salary, stock options, and performance-based dismissal actions. Two definitions of CEO pay are employed. The first definition includes the dollar value of a CEO's salary and bonus in the current year only. Given that CEO equity ownership is not under the direct control of the compensation committee, this definition excludes stock ownership in examining changes in the level of CEO pay. The second definition of pay includes the dollar value of a CEO's salary and bonus in the current year, the value of stock options granted, and the change in the value of options outstanding. To value the stock options, I use the Black and Scholes (1973) option valuation model assuming continuously paid dividends (Noreen and Wolfson, 1981; Murphy, 1985; and Jensen and Murphy, 1990a). Most executive options have a ten-year maturity.

□ **Equity holdings.** Although equity holdings can be bought by the CEO independent of the direct shares he is given by the compensation committee, equity ownership does align incentives between CEOs and their shareholders, allowing me to create a definition of CEO wealth invested in the firm that includes equity holdings. I use this definition in examining the pay-performance relationship; in particular, I use year-end

[5] Perfect and Wiles (1994) show that simple measures of Q are highly correlated (with Pearson correlation coefficients greater than .9) with more complicated Q measures (such as constructed by Lindenberg and Ross (1981)).

stock prices to compute the value of equity that a CEO holds in the firm. As in Hall and Liebman (1998), I include only vested options in the CEO's options holdings; vested options from the CEO's equity holdings reported in the proxy statement are excluded. Hence, the percentage of equity held by the CEO in the firm is used as the measure of CEO equity holdings. Because founders of companies generally own a large percentage of their firms, I also calculate the percentage of equity held by all non-founder CEOs.

3. Data description

■ To create two samples of firms, I begin by examining Standard and Poor's *Compustat.* The first sample of firms consists of all gas and electric utilities (SIC codes 4910, 4911, 4922–24, 4930, and 4931) and a randomly selected control group of manufacturing firms (SIC codes 2000–3999). Then I exclude firms for whom stock return data are not available from the Center for Research in Security Prices (CRSP) for the six-year period 1988 to 1993. The resulting sample consists of 74 gas and electric utilities and 101 manufacturing firms. The second sample of firms consists solely of 21 regulation-era airlines, a listing of which I obtained from Stacey Kole. For both samples, all CEO-specific career data (for example, schooling, tenure with the firm, tenure as CEO, previous jobs held) are obtained from various issues of Marquis's *Who's Who in Finance and Industry,* Dun and Bradstreet's *Reference Book of Corporate Managements,* and Standard and Poor's *Register of Corporations, Directors, and Executives.*

In the first sample, I obtain all CEO compensation variables from the annual proxy statements filed by firms with the Securities and Exchange Commission. All proxy statements for the six years 1988 to 1993 are examined. Each firm's yearly stock return is calculated from CRSP's daily stock return file, as the geometric return from the daily return file. All firm-specific data (for example, annual dividend paid, capital expenditure, total assets) are obtained from *Compustat.* The 1988 to 1993 interest rates on ten-year constant-maturity Treasury bonds are obtained from the 1995 *Economic Report of the President.* Most firms in the first sample have six years of complete compensation data for the period 1988 to 1993. Specifically, this sample has 1,026 compensation observations and education data on 223 CEOs. The second sample of 21 airline firms has all 90 CEOs with available education data for the period 1971 to 1997.

4. Empirical tests and results

■ The results of examining firm-specific variables for differences between utilities and manufacturing firms are given in Table 1. The average asset size of utilities is greater than the average asset size of manufacturing firms. However, the market value of the unregulated group of firms, which captures the discounted value of growth options, is much higher, suggesting that the market credits these firms with higher values. I next examine the firm's Tobin's Q values, defined as the ratio of total assets (item6) minus book value of equity (item60) plus market value of equity (item23 times item25), to total assets (see Smith and Watts, 1992, and Shin and Stulz, 1998). The average Tobin's Q for utilities is 1.15—lower than manufacturing firms, which is 1.72. This difference is statistically significant at the 1% level. Utilities also have a statistically significantly lower median Q value than do manufacturing firms. Utilities tend to have larger capital expenditures, which is not surprising given their larger fixed costs. Utilities also undertake less research and development expenditures than do manufacturing firms, consistent with the idea that they invest less in expenditures for future technologies.

TABLE 1 Description of Firm-Specific Variables

	Utilities					Manufacturing					*t*-statistic for Differences in Means
	Mean	Median	Standard Deviation	Minimum	Maximum	Mean	Median	Standard Deviation	Minimum	Maximum	
Assets	53.60	28.11	58.97	.426	263.8	39.61	25.56	184.8	.222	2515.1	1.75
Market value	22.35	11.31	25.35	.180	141.8	31.90	24.87	89.47	.058	895.27	−2.48
Tobin's Q	1.148	1.137	.126	.870	1.735	1.715	1.335	1.121	.470	9.509	−12.3
Capital expenditure to book value of assets	.063	.055	.032	.013	.214	.059	.053	.035	.005	.254	2.05
R&D expenditure to book value of assets	.000	.000	.001	.000	.001	.042	.027	.047	.000	.210	−19.9
Standard deviation of daily stock returns	.011	.010	.006	.005	.066	.025	.020	.017	.004	.183	−18.1
Stock return β	.436	.408	.225	.127	1.141	.868	.873	.533	.241	3.705	−17.6

Note: Sample consists of 74 gas and electric utilities and 101 unregulated manufacturing firms from 1988 to 1993. Firm financial variables are in constant 1993 hundred million dollars.

To differentiate between the risk profiles of the two groups of firms, I calculate the daily standard deviation of returns and β of each of the two groups. Utilities have a daily standard deviation of .01 and manufacturing firms a daily standard deviation of .03. The average β of utilities is .44, and the average β of the unregulated group is .87. These differences in risk are statistically significant at the 1% level. On the one hand, the standard principal-agent framework would suggest that the pay of utility CEOs should be more closely tied to performance; since risk is lower in utilities, the adverse consequences of linking pay to performance for risk-averse managers are lower. Joskow, Rose, and Shepard (1993) suggest that regulation directly and indirectly restricts the pay-performance sensitivities of utilities' managers. On the other hand, a higher pay-performance sensitivity might be unnecessary to generate managerial effort, because of the lack of competition that utilities face.

Table 2 examines my main hypothesis—that utility CEOs graduate from lower-quality universities. Almost all CEOs had at least one college degree. However, utility CEOs were more likely to have an engineering degree (32.7%) than manufacturing CEOs (16.4%). This difference is statistically significant and is consistent with utilities having more engineers, given the technology involved in their industry. Among CEOs with engineering degrees, utilities had only 6.1% from a top school, compared to 35.0% for the unregulated sample. The difference is statistically significant. Even among the CEOs with undergraduate degrees other than engineering, utilities had a statistically significantly lower percentage from a top school (8.8%) than did the unregulated group of firms (19%). This suggests that the quality of a utility CEO's undergraduate education is lower than the quality of an unregulated firm CEO's undergraduate education.

I now examine the postgraduate education characteristics of the CEOs. There is no statistically significant difference in the percentage of masters-level education, or of Ph.D.-level education, between utility CEOs and manufacturing-firm CEOs. Consistent with the evidence on undergraduate education, the amount of education for postgraduate work is not significantly different between the two groups of CEOs. However, the differences in the quality of postgraduate education are more striking. Utilities have a higher statistically significant percentage of CEOs with a law degree (27.7%) than do the firms in the unregulated group (4.5%), consistent with the proposition that utilities need lawyers who can deal with government agencies. Perhaps these executives are promoted to the chief executive position because of their expertise in dealing with legal issues and bureaucracies. However, only 28.6% of these lawyers are from a top school, whereas 81.8% of the few manufacturing CEOs who have law degrees are from a top school, and this difference is statistically significant. A statistically significantly higher percentage of manufacturing firms have CEOs with an MBA (37.7%) than do utilities (13.4%). Once again, the unregulated sample has a statistically significantly higher percentage from top business schools (73.9%) than utilities do (33.3%).

The education-quality variable, which takes the value of unity if the executive graduated from a top-ranked school, shows that utilities have 18.3% of their CEOs graduating from a top-ranked school, which is statistically significantly lower than the 52.1% of manufacturing firms' CEOs who have graduated from a top-ranked school. All these results show differences in educational quality between utilities and manufacturing firms, with manufacturing firms consistently drawing more CEOs from a top-ranked school.[6] Strongly consistent with the managerial-quality hypothesis, these results show support of sorting among executives according to managerial education quality.

[6] Using the current college-specific index created by the University of Rochester, Murphy (1987) examines a small sample of 18 utilities and finds that utility CEOs have a lower quality of education than do manufacturing CEOs. This article examines a larger sample of utility firms, proxies for quality by the rankings of schools obtained at the time the CEOs earned their degrees, and controls for school heterogeneity (across fields of study and by graduate and undergraduate program).

TABLE 2 Differences in Amount and Quality of Education

	Utilities	Manufacturing	*t*-statistics for Differences in Percentage[a]
Number of CEOs with available education data	101	122	
Undergraduate level			
Number (%) of CEOs with a college degree	101 (100%)	120 (98.4%)	1.43
Number (%) of CEOs with a college degree, other than engineering	68 (67.3%)	100 (82.0%)	−2.52
Number (%) of CEOs with a college degree, other than engineering, from a top school	6 (8.8%)	19 (19.0%)	−1.95
Number (%) of CEOs with an engineering degree	33 (32.7%)	20 (16.4%)	2.83
Number (%) of CEOs with an engineering degree from a top school	2 (6.1%)	7 (35.0%)	−2.53
Graduate level			
Number (%) of CEOs with a masters-level post-graduate degree	63 (62.4%)	73 (59.8%)	.39
Number (%) of CEOs with a Ph.D.	2 (2.0%)	8 (6.6%)	−1.74
Number (%) of CEOs with a law degree	28 (27.7%)	5.5 (4.5%)	4.80
Number (%) of CEOs with a law degree from a top school	8 (28.6%)	4.5 (81.8%)	−2.87
Number (%) of CEOs with an MBA	13.5 (13.4%)	46 (37.7%)	−4.39
Number (%) of CEOs with an MBA from a top school	4.5 (33.3%)	34 (73.9%)	−2.82
Education quality			
Number (%) of CEOs from a top school of any type	18.5 (18.3%)	62.5 (52.1%)	−5.66

Note: If any CEO had a joint degree, each degree was given half a point.
[a] I conduct a *t*-test for the differences in the percentages between the two groups of firms given their different samples sizes.

Whereas the previous cross-sectional analysis examines educational quality differences across regulated and unregulated industries, I now examine whether deregulation is followed by an increase in CEO education quality. Table 3 presents the change in airline CEOs' education quality over time. The Airline Deregulation Act of 1978 allows us to split the sample into two subperiods: a regulated era, from 1971 to 1977, and a deregulated era, from 1978 to 1997. All airline CEOs have at least one college degree. There are no statistically significant differences in the percentage of undergraduate degrees (including engineering) earned by airline CEOs in the regulated era when compared to the unregulated era. Among the CEOs with undergraduate degrees other than engineering, the regulated era has a statistically significantly lower percentage from a top school (24.0%) compared to the deregulated era (62.9%).

Examining the postgraduate education characteristics of the CEOs, I find no statistically significant differences in the amount of education when proxied by masters-level graduate education, law, or Ph.D. A statistically significantly higher percentage of CEOs have MBAs in the unregulated era (27.8%) than in the regulated era (5.6%).

TABLE 3 Changes in CEO Education Quality over Time: Evidence from a Sample of Airline Firms

	Regulated[a] Era (1971–1977)	Unregulated Era (1978–1997)	*t*-statistics for Differences in Percentage
Undergraduate level			
Number (%) of CEOs with a college degree	36 (100%)	54 (100%)	.00
Number (%) of CEOs with a college degree, other than engineering	25 (69.4%)	35 (64.8%)	.46
Number (%) of CEOs with a college degree, other than engineering, from a top school	6 (24.0%)	22 (62.9%)	−3.29
Number (%) of CEOs with an engineering degree	11 (30.6%)	19 (35.2%)	−.46
Number (%) of CEOs with an engineering degree from a top school	1 (9.1%)	2 (10.5%)	−.13
Graduate level			
Number (%) of CEOs with a masters-level post-graduate degree	23 (63.9%)	30 (55.6%)	.79
Number (%) of CEOs with a Ph.D.	2 (5.6%)	0 (.0%)	1.45
Number (%) of CEOs with a law degree	9 (25.0%)	9 (16.7%)	.95
Number (%) of CEOs with a law degree from a top school	3 (33.3%)	7 (77.8%)	−2.12
Number (%) of CEOs with an MBA	2 (5.6%)	15 (27.8%)	−3.09
Number (%) of CEOs with an MBA from a top school	0 (.0%)	12 (80.0%)	−7.75
Education quality			
All airlines: number (%) of CEOs from a top school of any type	10 (27.8%)	43 (79.6)	−5.60
Surviving airlines:[b] number (%) of CEOs from a top school of any type	6 (54.5%)	11 (84.6)	−1.67
Exiting airlines: number (%) of CEOs from a top school of any type	4 (16.0%)	32 (78.0)	−6.35

Note: All 90 CEOs had available educational data. All statistics are based on criteria described in Table 2.
[a] Airlines were deregulated with the passage of the Airline Deregulation Act of 1978.
[b] The independent surviving airlines from the regulated era are Alaska, American, Delta, Southwest, United, and USAir. All other airlines have exited CRSP after 1978.

Similar to utilities, there are no statistically significant differences in the airline CEOs' education levels in the two eras. There are, however, significant differences in the quality of postgraduate education between the two periods. The unregulated era has a statistically significantly greater percentage of CEOs with a law degree from a top-ranked school (77.8%) than does the regulated era (33.3%). The unregulated era also has a statistically significantly higher percentage from top business schools (80.0%) than does the regulated era (0%). There are very few CEOs with MBAs in the regulated era. Importantly, the education-quality variable that takes the value of unity (if the executive graduated from a top-ranked school of any type) shows that in the regulated era, 27.8% of the CEOs graduated from a top-ranked school of any type, which is

statistically significantly lower than the 79.6% of CEOs who graduated from a top-ranked school of any type in the deregulated period. All these results are strongly consistent with the CEO education-quality hypothesis, suggesting that managerial labor markets slot higher education quality in the deregulated environment than in the regulated era.

One difficulty with this analysis is that many airlines went bankrupt after deregulation. To test whether there were differences in CEO quality between airlines that folded and those that survived, I split the sample into two subsamples. The first subsample consists of the six surviving independent airlines from the regulation period: Alaska, American, Delta, Southwest, United, and USAir. The other 15 airlines exited CRSP after 1978; they comprise my second subsample. 54.5% of the CEOs of surviving airlines graduated from a top-ranked school of any type in the regulated era, which is statistically significantly lower than the 84.6% of CEOs who graduated from a top-ranked school of any type in the deregulated period. In contrast, 16.0% of the CEOs of airlines that exited the industry graduated from a top-ranked school of any type in the regulated era, which is statistically significantly lower than the 78% of CEOs who graduated from a top-ranked school of any type in the deregulated period. Further, in the regulated era, the surviving airlines have a statistically significantly higher percentage graduating from a top school of any type than do the exiting airlines. These results suggest that both surviving and exiting airlines significantly increased their CEO quality after deregulation, with most of the increase coming from exiting airlines.

To ensure that the increase in airline CEO education quality in the deregulated era is not due to an overall trend of firms generally hiring CEOs who graduated from a top school of any type, I check whether the manufacturing sector also underwent such a hiring change (results not reported in Table 3). 72.7% of manufacturing CEOs (96 out of a total of 132 CEOs) graduated from a top school of any type during 1971–1977. This percentage is not statistically significantly different (with a t-statistic of -1.10) from the 77.9% of manufacturing CEOs (197 out of a total of 253 CEOs) who graduated from a top school of any type during 1978–1997. Further, the increase in airline CEO quality in the deregulated period is significantly higher than the increase in manufacturing CEO quality in the same period (with a t-statistic of 10.18). These results suggest that the increase in airline CEO quality was not due to a general trend of all companies increasing their hiring from top schools.

As did Joskow, Rose, and Shepard (1993), I next examine differences in the levels of pay and the pay-performance sensitivities between utilities and manufacturing firms. I extend their study by observing the entire compensation contract, rather than only salary, bonus, and the dollar gains from already exercised options. Is the dollar value of CEO pay lower in utilities than in manufacturing firms? I use the CEO's salary and bonus in the current year as the proxy for total salary and bonus. Sample averages of the dollar value of salary and bonus, the value of stock options granted and outstanding, and equity holdings are presented in panel A of Table 4.[7] The dollar value of salary and bonus in manufacturing companies is much greater than the dollar value of salary and bonus in utilities. A similar result is found for the difference in the dollar value of options granted and outstanding. In examining the equity holdings of CEOs (because equity can be bought in the stock market and is therefore not included in the definition

[7] When one incorporates data (obtained from *Forbes*) on other payments such as long-term compensation plans, thrift-plan contributions, company-paid health insurance plans, and restricted stock awards that are vested or released from restrictions, the results do not change dramatically. Because this information is not available for the full sample, I restrict my analysis to salary and bonus, options granted and outstanding, and equity holdings.

of CEO pay; see Murphy (1985)), I find that CEOs of utilities own fewer shares than do CEOs of manufacturing firms. In summary, CEOs in utilities earn a much lower level of pay than do CEOs of manufacturing firms, strongly consistent with Joskow, Rose, and Shepard's findings.

One might suggest that these differences in pay levels can be attributed to differences in a CEO's tenure and age. The average age of the utility CEO is 56.94 years (with an associated standard deviation of 5.986 and median years of 57), and the average age of a manufacturing CEO is 57.36 years (with an associated standard deviation of 5.986 and median years of 58), suggesting no significant differences. Interestingly, the tenure of the utility CEO is much lower than that of his counterpart in the manufacturing sector. The average tenure of the utility CEO is 5.7 years (with an associated standard deviation of 5.248 and median years of 4), and the average tenure of a manufacturing CEO is 9.4 years (with an associated standard deviation of 8.79 and median years of 9). Thus, utility CEOs are neither older nor more entrenched in their jobs than are manufacturing CEOs.

I now examine the difference in pay-performance sensitivities between the two groups of firms. Given that the sensitivity of salary and bonus to performance is not directly observable, I estimate a firm fixed-effects model that includes year dummies. The results of these regressions are given in panel B of Table 4. As in Jensen and Murphy (1990a), performance is measured by shareholder wealth, defined as the stock returns earned during the year multiplied by the price at the beginning of the year multiplied by the number of shares outstanding. Shareholder wealth is expected to be positively related to compensation. For both sectors, the coefficient on shareholder wealth is positive and statistically significant, consistent with Jensen and Murphy (1990a). However, the coefficient on shareholder wealth is much larger for manufacturing firms than for utilities, and this difference is statistically significant. This result suggests that utilities have a significantly lower pay-performance relationship than do manufacturing firms, when pay is defined as salary and bonus.

The sensitivity of performance to options and equity owned by the CEO is directly observable. The average percentage of utilities that have an option plan for their CEO is only 47.95%, whereas most manufacturing companies (90.10%) have an option plan.[8] When the percentage of options granted to total shares in the firm is calculated, utility CEOs have been granted .024% of the total shares, and manufacturing CEOs have been granted .273% of the total shares. This difference is statistically significant at the 1% level. The average percentage of options outstanding to total shares for utilities is .068%, and for manufacturing .611%, for a statistically significant difference of .543%. Jensen and Murphy (1990a) show that the distribution of equity holdings is extremely skewed, and they suggest the use of median rather than average percentage of equity holdings. I calculated both median and average but, finding the distribution to be skewed, concentrated my analysis on median values. The median percentage of total equity held by utility CEOs is .052%, and the median percentage of total equity held by CEOs of unregulated firms is 1.246%, for a statistically significant difference of 1.194%. Given that a few manufacturing firms have founder CEOs, with their associated high equity ownership levels, the median equity holdings of nonfounder CEOs is also calculated. The median percentage of total equity held by the manufacturing firm's CEO drops slightly to .938%, for a statistically significant difference of .886%. These

[8] The Wilcoxon test shows that utility CEOs have a statistically significantly lower median percentage of total shares in options granted and options outstanding than do manufacturing CEOs. Therefore, the median results are not qualitatively different from those in Table 4.

TABLE 4 Differences in Compensation

	Utilities	Manufacturing	*t*-statistics for Differences
Panel A: Differences in the Levels of Pay			
Salary and bonus	490.86	990.63	−2.99
Options granted and outstanding	47.94	492.90	−6.47
Equity holdings	1,131.94	41,733.21	−5.95
Panel B: Differences in Pay-Performance Sensitivities			
Company-specific, fixed-effect regression of salary and bonus on shareholder wealth	.200 (.107)	.900 (.334)	−1.99
Options and stock ownership variables:			
Number of firms where data on option plans is not missing	73	101	
Number of firms with option plans	35	91	
Average percentage of companies with option plans	47.95%	90.10%	−6.43
Average percentage of total equity on which CEO has options granted	.024%	.273%	−7.49
Average percentage of total equity on which CEO has options outstanding	.068%	.611%	−5.34
Average percentage of total equity held by CEO	.174%	6.142%	−11.41
Median percentage of total equity held by CEO	.052%	1.246%	−5.60
Median percentage of total equity held by CEOs who are not founders	.052%	.938%	−4.88

	Utilities	(Differences)	Manufacturing
Summary of differences in pay-performance sensitivities: change in CEO wealth for a $1,000 change in shareholder wealth			
Salary and bonus	$.002	($.007)	$.009
Options granted	$.149	($1.491)	$1.640
Options outstanding	$.411	($3.255)	$3.666
Median equity holdings (including founders)	$.522	($11.942)	$12.464
Median equity holdings (excluding founders)	$.522	($8.861)	$9.383
Total pay-performance sensitivity (including founders)	$1.084	($16.695)	$17.779
Total pay-performance sensitivity (excluding founders)	$1.084	($13.614)	$14.698

Note: All compensation variables and shareholdings are measured in thousands of dollars. Shareholder wealth is expressed in hundred-million-dollar units. The regressions include significant year effects that are not reported. All monetary variables are in constant 1993 dollars.

results on options and equity holdings show a much stronger sensitivity to performance for manufacturing firms than for utilities.

The pay-performance sensitivity of the entire compensation contract (salary and bonus, options granted, and options outstanding) and equity holdings for a $1,000 increase in shareholder wealth is summarized as follows. For the sensitivity of salary and bonus to shareholder wealth, there is a one-cent difference in pay-performance sensitivity between utilities and manufacturing firms. As in Jensen and Murphy (1990a) and Sloan (1993), I use 60 cents as the average increase in option values for a dollar increase in stock prices. This translates into a $.1491 increase in CEO compensation for a $1,000 increase in shareholder wealth for utilities, and a $1.640 increase in CEO compensation for a $1,000 increase in shareholder wealth for manufacturing companies. For outstanding options, the difference in sensitivities between utilities and manufacturing firms is $3.255 for a $1,000 increase in shareholder wealth. Utilities therefore have a total pay-performance sensitivity of 56 cents for a $1,000 increase in shareholder wealth (where pay is defined as salary and bonus, options granted, and options outstanding), whereas manufacturing firms have a total pay-performance sensitivity of $5.315 for a $1,000 increase in shareholder wealth. This results in a sensitivity difference of $4.755 between regulated and manufacturing firms.

To measure the sensitivity of CEO wealth to performance, I now include in the analysis the equity holdings of the CEO. The difference in pay-performance sensitivities when the founder CEO's equity holdings are excluded is shown below in square brackets. The wealth of a utility CEO goes up by $.522 cents for each $1,000 increase in shareholder wealth, whereas the wealth of an unregulated-firm CEO goes up by $12.464 [$9.383] for each $1,000 increase in shareholder wealth, for a difference of $11.942 [$8.861] for each $1,000 increase in shareholder wealth. These results suggest that differences in shareholdings between utility and manufacturing CEOs have a significant impact on differences in CEO wealth.

In summary, the results of Table 4 offer strong evidence that utilities have a much lower pay-performance sensitivity than do unregulated manufacturing firms, and this sensitivity is largely driven by contingent-claim securities such as options and shareholdings. That is, the wealth of a utility CEO goes up by $1.084 for each $1,000 increase in shareholder wealth, whereas the wealth of an unregulated firm CEO goes up by $17.779 [$14.698] for each $1,000 increase in shareholder wealth, for a difference of $16.695 [$13.614] for each $1,000 increase in shareholder wealth. Note that most of the difference in pay-performance sensitivity can be attributed to unexercised options and stock ownership and not to salary and bonus. These results suggest that utilities attract executives with lower education quality who also have a lower pay-performance sensitivity when compared to their counterparts in manufacturing firms.

5. Conclusions

■ This article shows that managers with seemingly higher-quality education are less likely to work for regulated utilities than for manufacturing firms, and that deregulation of the airline industry was associated with an increase in CEO education quality. There are two related interpretations of the evidence. The first is that the returns to CEO quality are lower in regulated industries, hence the best CEOs are employed outside the regulated sector. The other interpretation is that for political reasons, the compensation of CEOs of regulated firms is restricted. Thus, high-quality CEOs are less likely to work for regulated firms.

One should interpret these results with caution. The main difficulty is that my measure of education quality is itself a crude measure of managerial quality. Clearly,

there are other aspects of managerial quality that are unobservable and difficult to measure—such as leadership skills, industry experience, social networks, and good judgment. Future research might examine whether industries with extremely high investment opportunity sets and high human capital investment (for example, brokerage and investment banking firms, venture capital firms, computer companies, and biotechnology companies) have higher-quality CEOs. Further, when total deregulation of the utility industry occurs, one might expect to see a higher CEO pay-performance sensitivity and a substantial difference in the executives they hire.[9]

References

BLACK, F. AND SCHOLES, M.S. "The Pricing of Options and Corporate Liabilities." *Journal of Political Economy*, Vol. 81 (1973), pp. 637–659.

CARTTER, A.M. *An Assessment of Quality in Graduate Education*. Washington, D.C.: American Council of Education, 1966.

CHEVALIER, J. AND ELLISON, G. "Are Some Mutual Fund Managers Better Than Others? Cross-Sectional Patterns in Behavior and Performance." *Journal of Finance*, Vol. 54 (1999), pp. 875–899.

COLEMAN, R. "Report on College Characteristics." Mimeo, Harvard-MIT Joint Center for Urban Affairs, 1973.

HALL, B. AND LIEBMAN, J. "Are CEOs Really Paid Like Bureaucrats?" *Quarterly Journal of Economics*, Vol. 113 (1998), pp. 653–691.

JENSEN, M.C. AND MURPHY, K.J. "Performance Pay and Top-Management Incentives." *Journal of Political Economy*, Vol. 98 (1990a), pp. 225–264.

——— AND ———. "CEO Incentives—It's Not How Much You Pay, But How." *Journal of Applied Corporate Finance*, Vol. 3 (1990b), pp. 36–49.

JOLLS, C. "Managerial Contracts at Regulated Firms." Mimeo, Harvard Law School, 1995.

JOSKOW, P.L. "Restructuring, Competition and Regulatory Reform in the U.S. Electricity Sector." *Journal of Economic Perspectives*, Vol. 11 (1997), pp. 119–138.

———, ROSE, N.L., AND SHEPARD, A. "Regulatory Constraints on CEO Compensation." *Brookings Papers on Economic Activity, Microeconomics* (1993), pp. 1–72.

———, ———, AND WOLFRAM, C.D. "Political Constraints on Executive Compensation: Evidence from the Electric Utility Industry." *RAND Journal of Economics*, Vol. 27 (1996), pp. 165–182.

KOLE, S. AND LEHN, K. "Deregulation and the Governance of Airlines." Mimeo, University of Pittsburgh, 1995.

KOSTIUK, P.F. "Firm Size and Executive Compensation." *Journal of Human Resources*, Vol. 25 (1990), pp. 90–105.

LINDENBERG, E.B. AND ROSS, S.A. "Tobin's Q Ratio and Industrial Organization." *Journal of Business*, Vol. 54 (1981), pp. 1–32.

MURPHY, K.J. "Corporate Performance and Managerial Remuneration: An Empirical Analysis." *Journal of Accounting and Economics*, Vol. 7 (1985), pp. 11–42.

———. "Executive Compensation in Regulated Industries." Mimeo, University of Rochester, 1987.

NOREEN, E.W. AND WOLFSON, M.A. "Equilibrium Warrant Pricing Models and Accounting for Stock Options." *Journal of Accounting Research*, Vol. 19 (1981), pp. 384–398.

PERFECT, S.B. AND WILES, K. "Alternative Constructions of Tobin's Q: An Empirical Comparison." *Journal of Empirical Finance*, Vol. 1 (1994), pp. 313–341.

Reference Book of Corporate Managements. New York: Dun and Bradstreet, various issues.

Register of Corporations, Directors, and Executives. New York: Standard and Poor, various issues.

ROSEN, S. "Contracts and the Market for Executives." In L. Werin and H. Wijkander, eds., *Contract Economics*. Oxford: Blackwell, 1992.

SHIN, H. AND STULZ, R. "Are Internal Capital Markets Efficient?" *Quarterly Journal of Economics*, Vol. 113 (1998), pp. 531–552.

SLOAN, R.G. "Accounting Earnings and Top Executive Compensation." *Journal of Accounting and Economics*, Vol. 16 (1993), pp. 55–100.

[9] For example, Ken Lay, CEO of Enron Corp, a sophisticated energy firm that has recently entered the deregulated wholesale electric and gas sector, states that "you acquire the skills you need. I not only had to attract ability from investment banking houses, commercial banks, and elsewhere, but also had to compete against them. We also had to go up against the big consulting firms for some of the new MBAs coming out of our graduate schools" (*Fortune*, June 1997, p. 87).

SMITH, C.W. AND WATTS, R.L. "The Investment Opportunity Set and Corporate Financing, Dividend, and Compensation Policies." *Journal of Financial Economics*, Vol. 32 (1992), pp. 263–292.

The 15 Top-Ranked Graduate Business Schools in the United States. MBA (1974), pp. 21–25.

USEEM, M. AND KARABEL, J. "Pathways to Top Corporate Management." *American Sociology Review*, Vol. 51 (1986), pp. 184–200.

Who's Who in Finance and Industry. Chicago: Marquis, various issues.