Executive Compensation in the Information Technology Industry

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An innovative business practice attributed to the information technology (IT) industry is the aggressive use of employee stock options to compensate executives and other employees. In this study, we investigate whether the greater use of stock options in the IT industry can be explained on the basis of general economic relationships that apply to firms in all industries. To examine differences in compensating top executives, we estimate a system of simultaneous equations that is designed to accommodate interconnections between performance, the level of compensation, and the mix of compensation components. We document that the shares of both bonus and option pay increase with performance and that the pay level and the extent of incentive pay positively affect firm performance. We identify economic factors that may influence the use of options and show that there are significant differences in these factors between IT and other industries. We find that, while much of the greater use of options by IT firms is explained by the economic factors, significant residual differences remain. We also find that, when performance and other factors are considered, the level of executive pay in the IT industry is not higher than in other industries.
(*Information Technology Industry; Executive Compensation; Stock Options; Pay for Performance*)

1. Introduction

In selecting a form of business organization and structuring internal contracts, firms must reconcile the risk-sharing advantages of diffuse outside ownership with the motivational advantages of concentrated inside ownership (Jensen and Meckling 1976). This problem is particularly acute in the information technology (IT) industry because IT firms make large, risky investments in inventive activity where the outcomes are unpredictable, idiosyncratic, and long-term in nature. In addition, the demand for executives and other critical employees is intense in the rapidly growing IT industry, leading to high turnover of talented individuals. One of the important organizational innovations that has emerged from the IT industry is the use of stock options to attract and retain executives and key employees and align their long-term incentives with the interests of the firm. Gillmor (1997) remarks: "Silicon Valley and the technology industry in general take pride in a somewhat different system of compensation, and for the most part they should. Executive salaries in such companies tend to be generous but rational. Tech companies' primary incentives are stock options."

The use of stock options by IT firms is often attributed to their unique culture. For example, Fefer (1997) describes the "techno-culture of the San Francisco Bay area" as a "powerful mix of innovation, entrepreneurial ambition, and stock options." Fox (1997) writes: "From Intel in the 1960s to Apple in the 1970s to Silicon Graphics in the 1980s to Netscape and a host of others in the 1990s, enough Silicon Valley companies have delivered enough stock-option jackpots to enough employees to create an entirely new business culture." *The Economist* (1997) observes: "Research has increasingly concentrated in clusters . . . where there is

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"something in the air" that encourages risk-taking. This suggests that culture, irritatingly vague though it may sound, is more important to Silicon Valley's success than economic or technological factors." In this study, we question whether the way executives and other employees are compensated is uniquely attributable to the culture in the IT industry. First, we verify that IT companies (including telecommunications, hardware and electronics, and software and computer services) use more stock options in compensating executives and other employees, and then we evaluate whether the greater use of options by IT firms can be explained by economic relationships that apply to all firms.

Based on previous research, we identify economic factors (and empirical proxies) that are expected to influence the amount and mix of compensation, and the relation between the level and structure of compensation and performance. We show that there are significant quantitative differences in many of the factors between IT and other firms. We include the proxies as explanatory variables in a model of executive compensation, and estimate the model for all firms. While the economic factors explain much of the variation in the relative value of stock options granted to executives, significant residual effects are picked up by Silicon Valley and IT dummy variables, suggesting that the economic relationships specified in the model do not completely explain the greater use of options by IT firms.

Critics contend that stock options are overused by IT firms. Jeffers (1997) comments: "(O)verpaying ineffectual CEOs is regrettably becoming commonplace in technology." Some blame a lack of cost discipline on accounting rules (Bryant 1997). Under current accounting rules, options generally do not incur an accounting charge. The relevant issue is whether the value of total compensation including the ex-ante value of options granted is justifiable based on a firm's condition and circumstances. We find that, when performance and other economic factors are considered, IT executives are not paid more than non-IT executives are.

Our research extends previous research on incentive contracting in several ways. Most previous research has considered the effect of performance on pay without considering the simultaneous effect of pay on performance. We extend Boschen and Smith's (1995) simultaneous equations model by adding endogenous variables that measure the relative use of alternative forms of incentive compensation (cash bonus pay and stock options). We document that both bonus and option pay increase with performance and that total pay increases with the extent of incentive pay. We also present evidence that the level of pay and the extent of incentive pay positively affect performance.

In a separate analysis, we investigate the use of stock options to compensate employees beyond the top five executives. This is motivated by press descriptions of the pervasive use of stock options by IT firms. For example, Branson (1997) writes: "Silicon Valley employees like working hard, as long as they get the benefit of their efforts in the form of stock options. Everybody expects options. Secretaries expect options; summer interns from the Stanford Business School expect options." In a model that relates the value of options granted per employee to performance and other economic factors, we find that Silicon Valley and IT companies compensate their employees differently from other firms.

The paper is organized as follows. Section 2 describes the data set and the compensation of executives and other employees by IT and non-IT firms. Section 3 identifies economic factors expected to influence the amount and mix of compensation and compares the factors for IT and non-IT firms. Section 4 describes the empirical model. Section 5 presents the estimation results for models of executive compensation and options granted per employee. Section 6 concludes.

2. Descriptive Information

The ExecuComp data set used in this study includes information on the compensation of the top five executives at 1,724 firms included in the S&P 500, mid-cap, and small-cap indices for the years 1992 to 1996. Of the 115 different industry groups in the database, we identify 20 IT industry groups. These groups include 316 firms, as detailed in Table 1.

A grant of stock options entails an immediate trans-

Table 1 Industries Included in the IT Group

Category	S&P Industry Code	Industry Description	Number of Firms
Hardware	2255	Retail (Computers/Electronics)	6
	6020	Aerospace/Defense	16
	6070	Electronic Equipment	42
	8045	Photography/Imaging	5
	8050	Computers (hardware)	33
	8052	Computers (peripherals)	11
	8053	Electronics (components)	11
	8070	Electronics (instrument.)	12
	8080	Electronics—Semiconductors	28
	8090	Electronics—Defense	5
	8100	Equipment (Semiconductor)	5
Software and Services	8040	Computer Software/Services	42
	8200	Services (Computer Systems)	12
	8300	Services (Data Processing)	14
Telecommunications	3030	Broadcasting (TV, Radio, Cable)	10
	8030	Communications Equipment	29
	8051	Computers (networking)	7
	8610	Cellular/Wireless Telecomm.	7
	8620	Telephone	12
	8630	Telephone Long Distance	9

fer of wealth from stockholders to employees, measured by the Black-Scholes (1973) value of the options. Therefore, we define total current-period compensation to be the sum of cash compensation, the Black-Scholes value of options granted, and the value of other awards and compensation provided to the executive. The total compensation reported for an executive is made up of seven components: cash salary, cash bonus, the ex-ante value of options awarded, restricted stock awards, long-term incentive plan (LTIP) payouts, other annual compensation, and all other compensation. Table 2a through 2d provide information about the average levels and shares of the seven compensation items for top executives at the IT firms and non-IT firms included in the data set.[1] Table 2e provides information about the value of options granted per employee.[2]

Clearly, there is an increasing trend in the use of stock options by both IT and non-IT firms during the sample period, but most striking are the differences between firms in the IT industry and firms in other industries. In 1996, options accounted for more than 40% of the compensation of IT executives and less than 25% of the compensation of non-IT executives. While the average levels of salary and bonus pay are lower for the IT executives in the sample, the average total compensation for the IT executives is higher than for the non-IT executives in the sample. The mean value of option grants per employee was three times higher (and the median value was six times higher) for IT firms than non-IT firms. This evidence provides prima facie support for observations that stock options are used much more aggressively to compensate IT executives and are used more generously in compensating employees throughout IT firms.

3. Factors Affecting the Amount and Form of Compensation

3.1. Endogenous Variables

Agency theory describes reasons for linking compensation and performance. A "moral hazard" problem (Holmström 1979, Feltham and Xie 1994) occurs when the agent's effort level or allocation of effort to different tasks is not perfectly observable by the principal. An executive's incentives are aligned with the firm's by tying compensation to observable signals of current and future performance. An "adverse selection" problem (Kreps 1990) occurs when the agent is better informed about his ability than the principal is. To attract more talented managers, the firm offers a contract that is sensitive to current and future performance and managers "self-select" (Rothschild and Stiglitz 1976). "Ex-post settling up" occurs when the

[1] Firms included in the ExecuComp data set may change from year to year (because of mergers and acquisitions, bankruptcies, changes in the composition of the S&P indices, etc.). While the information in Table 2 is based on all firms included for each year, it is qualitatively similar to information for the subset of firms included in all five years.

[2] The per capita option grant is imputed using the Black-Scholes value and the percentage share of total options granted to the top five executives and the number of employees.

Table 2 Descriptive Information About Compensation in IT and Non-IT Firms

(2a) Average Levels of Compensation Components for IT Executives (in Thousands of Dollars)

	Salary	Bonus	LTIP	Options Granted	Restricted Stock	Other Annual	All Other	Total
1992	$245.4	$145.8	$89.7	$384.3	$ 27.2	$13.9	$24.9	$ 931.2
1993	252.6	154.8	70.2	365.1	26.7	13.5	35.3	918.2
1994	262.6	194.7	92.9	466.0	47.1	13.1	36.8	1113.2
1995	282.0	218.8	94.3	686.1	65.4	12.5	35.7	1394.8
1996	314.9	233.7	49.7	966.0	124.4	16.8	66.6	1772.1

(2b) Average Levels of Compensation Components for Non-IT Executives

	Salary	Bonus	LTIP	Options Granted	Restricted Stock	Other Annual	All Other	Total
1992	$277.2	$165.9	$98.0	$262.0	$ 67.2	$18.4	$32.2	$ 920.9
1993	281.8	183.9	87.9	258.1	66.5	16.8	46.5	941.5
1994	289.3	203.6	84.1	299.0	62.4	23.5	38.7	1000.6
1995	311.6	232.0	82.7	336.9	76.6	19.4	57.5	1116.7
1996	344.2	314.6	88.9	565.1	109.1	22.7	76.9	1521.5

(2c) Percentage Shares of Compensation Components for IT Executives

	Salary	Bonus	LTIP	Options Granted	Restricted Stock	Other Annual	All Other
1992	46.6%	18.3%	2.4%	26.6%	2.5%	1.2%	2.4%
1993	45.7	19.7	2.0	26.6	1.8	1.3	2.9
1994	41.1	20.1	1.8	29.9	2.6	1.3	3.2
1995	37.8	19.8	2.6	33.3	2.4	1.0	3.1
1996	34.5	14.8	2.2	40.6	3.5	1.2	3.2

(2d) Percentage Shares of Compensation Components for Non-IT Executives

	Salary	Bonus	LTIP	Options Granted	Restricted Stock	Other Annual	All Other
1992	51.6%	18.4%	3.1%	18.1%	3.6%	1.5%	3.7%
1993	50.2	19.2	2.9	18.0	3.9	1.4	4.4
1994	49.2	20.0	2.5	19.3	3.5	1.4	4.1
1995	47.2	19.6	3.3	19.9	4.0	1.4	4.6
1996	42.3	19.6	3.6	24.5	4.4	1.4	4.2

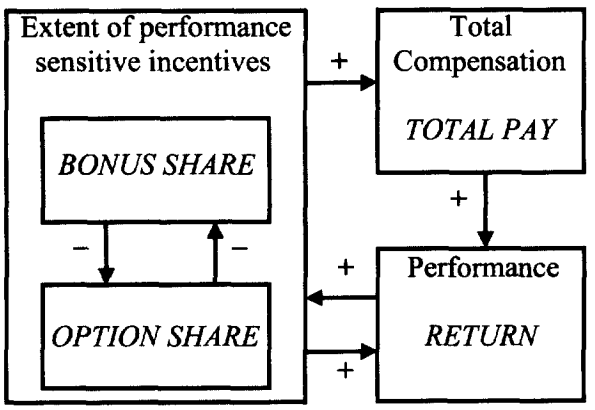
(2e) Per Capita Option Grant for IT Firms and Non-IT Firms

	Mean		Median	
	IT	non-IT	IT	non-IT
1992	$4,885	$2,646	$1,694	$503
1993	5,241	2,343	2,720	536
1994	6,563	2,581	2,639	608
1995	7,919	2,426	3,869	558
1996	9,449	3,094	4,548	745

firm adjusts the manager's expected total pay periodically as information about ability is revealed through performance (Fama 1980, Gibbons and Murphy 1992). In each of these models, pay is sensitive to performance. Several empirical studies support the sensitivity of executive pay to performance (e.g., Murphy 1985, 1986; Jensen and Murphy 1990; Ely 1991).

In addition to relating pay and performance, each of the agency models links performance to pay. In the ex-post settling up model, performance is positively impacted by total pay because pay reflects the firm's assessment of the executive's ability (Boschen and Smith 1995). In the self-selection and moral hazard models, pay-for-performance compensation contracts lead to improved firm performance (Kahn and Scherer 1990, Abowd 1990, Banker et al. 1996) by attracting and retaining more talented executives, and motivating greater congruence between their actions and the firm's interests. Algebraically, the proportion of total pay attributable to pay-for-performance incentive pay

Figure 1 **Interconnectedness of Total Compensation, Performance, Bonus Share, and Option Share**



increases as performance improves. Increased reliance on pay-for-performance incentives imposes greater risk on the executive, and, because of the higher risk premium, the expected value of the total pay is also increased. Thus, agency theory posits simultaneous relations between performance and the level and mix of pay.

Because our primary objective is to investigate differences in the level and mix of compensation between IT and other firms, we seek to understand how the level of compensation is affected by the mix of pay and how the mix of pay is affected by firm performance and other economic factors. Figure 1 depicts the basic structure of our model of four interconnected variables: firm performance as measured by stock returns (*RETURN*), total compensation including the ex-ante value of options granted (*TOTAL PAY*), bonus as a percentage of total pay (*BONUS SHARE*) and options granted as a percentage of total pay (*OPTION SHARE*).[3] Table 3 provides statistical comparisons of these variables for IT and non-IT firms. This evidence indicates that *TOTAL PAY* and *RETURN* are significantly higher for IT firms (mean of *TOTAL PAY* is $1,239,780 for IT and $1,101,550 for non-IT, mean of *RETURN* is 29.20% versus 16.48%), *BONUS SHARE* is slightly but significantly lower for IT firms (mean of 18.71% versus 19.41%), and *OPTION SHARE* is much higher for IT firms (mean of 31.63% versus 20.00%).

The bonus share and the option share represent important dimensions of the mix of compensation. Based on extensive empirical and anecdotal evidence, cash bonus is expected to be positively related to current firm performance as measured by stock returns. Limited and conflicting evidence exists about relations between the ex-ante value of stock options to current performance (Murphy 1985, Baber et al. 1996, Talmor and Wallace 1998). In contrast to cash pay, option grants provide continuing long-term incentives and impose additional risk on executives. Because stock options have continuing incentive value, firms may be willing to pay a risk premium to entice executives to substitute options for cash compensation.

In our model, *TOTAL PAY* is related to performance through the *BONUS SHARE* and *OPTION SHARE*, each of which may vary with current performance.[4] To analyze the separate effects of performance on bonus share and option share, we must control for the possibility of substitution between cash bonus pay and option pay. As the use of incentive compensation increases, the risk imposed on executives increases. Therefore, the sensitivity of total pay to the bonus share and option share may be greater than would be suggested by algebraic relations between total pay and shares of total pay.[5] And because stock options impose continuing risk on the executive, requiring payment of a higher risk premium, the sensitivity of total compensation to the option share may be greater than the sensitivity of total compensation to the bonus share.

[3] We consider firm performance as measured by stock returns (Murphy 1985, Jensen and Murphy 1990, Gibbons and Murphy 1992, Garen 1994, Haubrich 1994, and Boschen and Smith 1995) and not by other signals about a manager's effort or ability, such as those provided by accounting measures of performance.

[4] Table 2 shows that bonus pay, option pay, and salary make up more than 85% of total compensation. Because we use the bonus share and option share of total compensation in our model, variability of bonus pay and option pay is defined relative to salary and other components of compensation.

[5] Algebraically, a 1% increase in a compensation share implies a (1/(0.99−share before increase)) percent increase in total pay. Evaluated at the mean value of *BONUS SHARE* of 19.20% (for the sample used in our estimation), this would imply a 1.25% increase in *TOTAL PAY* for a 1% increase in *BONUS SHARE*. Evaluated at the mean *OPTION SHARE* of 29.14%, this would imply a 1.43% increase in *TOTAL PAY* for a 1% increase in *OPTION SHARE*.

Table 3 Comparison of Economic Factors for IT and Non-IT Firms

		Mean			Median		
Economic factors	Variables	IT Firms	Non-IT Firms	*p*-Value for Test of Difference	IT Firms	Non-IT Firms	*p*-Value for Test of Difference
Endogenous	TOTAL PAY	1239.78	1101.55	0.0001	699.98	586.67	0.0001
	RETURN	29.20	16.48	0.0001	17.59	10.45	0.0001
	BONUS SHARE	18.71	19.41	0.0001	16.58	18.34	0.0001
	OPTION SHARE	31.63	20.00	0.0001	30.37	15.32	0.0001
Moral Hazard	Sales growth	24.99	13.71	0.0001	18.47	7.70	0.0001
	Book to market	0.40	0.50	0.0001	0.35	0.48	0.0001
	Dividend payout	11.09	39.76	0.0001	0.00	18.23	0.0001
Adverse Selection	Industry turnover	7.86	7.44	0.0001	7.52	7.01	0.0001
	Age	49.32	51.35	0.0001	50	51	0.0001
Precision, Risk and Innovation	Volatility	0.43	0.32	0.0001	0.45	0.29	0.0001
Executive Ownership	Stock held/total pay	29.44	19.89	0.1799	0.58	0.97	0.0001
	Stock held/firm equity	10.13	14.67	0.3418	0.35	0.54	0.0001
	Options held/total pay	5.30	3.62	0.0001	3.21	2.30	0.0001
	Options held/firm equity	80.70	4.14	0.3096	2.36	1.46	0.0001
Income Taxes	State tax rate	7.08	5.49	0.0001	7.13	6.00	0.0001
Debt/Interest Coverage	Debt to assets	0.11	0.20	0.0001	0.06	0.18	0.0011
	Times interest earned	56.07	37.85	0.0014	4.36	2.33	0.0001
Size	ln(sales)	6.54	6.87	0.0001	6.27	6.85	0.0001
Options Granted per Employee	Per-capita option grant	5989.15	2907.70	0.0001	2266.10	615.06	0.0001

3.2. Economic Factors

One of our objectives is to evaluate the extent to which economic factors explain differences in the level and mix of compensation between IT and non-IT firms. Therefore, based on previous literature, we identify economic factors (and their empirical proxies) that may influence firm performance and the structure of incentive pay, particularly the relative weight placed on stock options. Proxies for the economic factors are included as exogenous variables in an empirical model that includes equations for each of the endogenous variables. Table 3 provides descriptive information about the exogenous variables for IT and non-IT firms.

Moral Hazard. Moral hazard problems are greater in firms where the manager's effort can have a larger impact on firm performance, and where the manager's actions are more difficult to observe. These conditions are present in firms with more growth prospects (Smith and Watts 1992). Clinch (1991) and Gaver and Gaver (1993) find greater use of stock options in growth firms that need to extend the managers' time horizon for decision making. We use present sales

growth (*sales growth*) as an indicator of future growth, the book-to-market ratio (*book to market*) as an inverse indicator of growth opportunities and dividend payout (*dividend payout*) as an indicator of the absence of growth prospects (Gaver and Gaver 1996). Because growth is achieved over the long term, these variables are likely to influence both the extent of incentive pay and the mix of incentive components. The descriptive statistics in Table 3 indicate that *sales growth* is higher for IT firms, *book to market* is lower for IT firms, and *dividend payout* is lower for IT firms.

Adverse Selection. The problem of attracting and retaining talented executives is more acute when the demand for executives is stronger. Stock options may reduce executive turnover because of vesting provisions and because they increase in value with tenure (Salop and Salop 1976). Therefore, the option share and total pay may increase with the demand for executives. We use executive turnover for an industry (*industry turnover*) as a proxy for demand for executives.[6] We measure *industry turnover* as the number of employees included in the top five positions for all of the firms in an industry during our five years of data divided by the number of firm-years.[7] The Table 3 comparisons indicate that the mean value of *industry turnover* is higher for IT firms.

Information about managers' abilities may be gleaned from past performance. Age provides information about the length of time that companies have had to learn about the ability of executives (Murphy 1986). Therefore, the adverse selection problem—and, consequently, performance-sensitivity including emphasis on stock options—may decline with the manager's age (*age*). An alternative argument based on managers' career horizons (Gibbons and Murphy 1992) suggests that managers become less concerned about the consequences of long-term decisions as they approach retirement. Under this argument, the emphasis on stock options would increase with age. Total pay may also be influenced by age. Older executives may demand higher pay because they have more experience-based ability. Alternatively, older executives may be paid less because they are less mobile. The Table 3 information indicates that, in our sample, IT executives are slightly younger than non-IT executives.

Precision, Risk, and Innovation. When the performance signal used to evaluate the agent's performance is less precise, performance sensitivity of compensation is lower because the agent bears more risk caused by variance in the performance signal (Banker and Datar 1989). Thus, the extent of incentive pay (*BONUS SHARE* and *OPTION SHARE*) may be negatively related to stock return volatility (*volatility*). Stock return volatility may be related to the use of stock options in a variety of ways. Because managers may be unable to diversify or hedge the risk associated with stock options, their willingness to substitute stock options for cash bonus pay may decline with volatility. On the other hand, the firm may increase the value of option grants to compensate managers for bearing risk. Stock return volatility may also be an indicator of innovative activity. Innovation is long-term in nature, high-risk (defined as a high probability of failure and the potential for very high returns), unpredictable (defined as many possible outcomes which cannot be prespecified), labor-intensive, and idiosyncratic (Holmström 1989). Francis and Smith (1995) find that innovation favors concentrated inside ownership as opposed to diffuse outside ownership. Because stock options provide managers with incentives that are similar to ownership incentives, volatility may have a positive effect on the use of stock options. Finally, there is a positive algebraic relation between the Black-Scholes value of options and volatility. The Table 3 comparisons indicate that volatility is much higher for the IT firms in our sample.

Executive Ownership. Morck et al. (1988) distinguish between two types of ownership effects, convergence of interests and entrenchment. These effects have different implications for compensation. Under convergence of interests, executive ownership aligns incentives and reduces the need for performance-

[6] The presence of options may reduce turnover. Under those circumstances, this proxy would be less informative.

[7] A change in the composition of the top five executives for a specific firm does not necessarily indicate that executives have left the firm. There may be internal changes in the ranking of the highest paid executives.

sensitive compensation (Benston 1985, Murphy 1985). Under entrenchment (Jensen and Meckling 1976), high levels of executive ownership insulate the manager from market discipline, which may lead to greater personal consumption of firm resources (higher total pay) and suboptimal decision making (lower firm performance). Convergence of interests occurs as ownership in the firm increases relative to the executive's other wealth. Entrenchment occurs as the executive's ownership level becomes larger relative to other shareholders. Therefore, we define holdings in two ways, relative to the executive's own compensation and relative to the market value of firm equity. We use separate variables for stock holdings (*stock held/total pay* and *stock held/firm equity*) and option holdings (*options held/total pay* and *options held/firm equity*). The value of stock held is measured as the closing stock price for the year multiplied by the number of shares held. The value of options held is measured as the closing stock price multiplied by the number of options held. This, of course, overstates the value of the options. We account for this in our discussion of the results.

Along another dimension, total compensation may be negatively affected by option holdings because managers' mobility in the marketplace may decline as option holdings increase (Scouras 1997). The Table 3 comparisons indicate that while the mean level of stock holdings is higher for executives at IT firms, the median level of stock holdings is actually lower. Both the mean and median level of option holdings are greater for executives at IT firms.

Income Taxes. Section 162(m) of the Revenue Reconciliation Act of 1993 limits deductibility by the firm of an executive's compensation to $1 million unless the compensation is linked to specific performance criteria such as stock returns. Therefore, *BONUS SHARE* and *OPTION SHARE* may be higher for executives who earn total compensation greater than $1 million. We use a dummy variable (*million dollar rule*) for total compensation greater than $1 million. While the provisions of Section 162(m) formally took effect on January 1, 1994, companies may have anticipated the effects in their compensation planning in 1993. Therefore, we include a separate dummy variable for total compensation greater than $1 million in 1993 (*million dollar rule 93*). The Table 3 comparisons indicate that total compensation is higher for the IT firms in our study.

The tax deferral benefit that employees receive when options are substituted for cash compensation increases with the effective tax rate.[8] Therefore, the option share of total compensation may increase with the individual income tax rate facing the executive. Total compensation may also be affected by the individual tax rate because managers may demand higher compensation in places with higher tax rates. We use the individual state income tax rate to proxy for differences in individual tax rates facing executives.[9] The Table 3 data indicate that the state tax rate is higher for IT firms. This corresponds to the higher concentration of IT firms in California and other high tax rate states.

Debt and Interest Coverage. A company's debt level (*debt to assets*) may influence its use of incentive pay. John and John (1993) suggest that companies with greater reliance on debt financing may use less incentive-based pay because incentive-based pay may encourage risk taking by executives, and debtholders prefer less risky projects. Garvey and Mawani (1999), on the other hand, observe that stock options may be used to limit the selection of suboptimal risky projects when debt levels are high. The Table 3 data indicate that *debt to assets* is much lower at IT firms.

The *times interest earned* ratio measures a company's earnings against its interest costs. A low ratio may indicate a cash shortage. Companies can preserve cash by paying executives and other employees with options. Table 3 indicates that *times interest earned* is much higher

[8] The U.S. tax code distinguishes between "incentive" stock options and "nonqualifying" stock options. Most options granted during 1992–1996 were nonqualifying. For these options, the gain realized at exercise is taxed as ordinary income to the employee in the year of exercise. Because cash compensation is taxable upon receipt, an employee's investment base is immediately reduced. Because option compensation is taxable in the year of exercise, employees have a larger investment base (before exercise) than they would have if they were paid in cash.

[9] We use the individual state tax rate for the state where the company's headquarters are located as an imperfect proxy for differences in income taxes faced by executives. Executives may work in one state and live in another. We do not attempt to measure other types of taxes (property taxes, sales taxes, etc.) that influence the total tax paid.

for IT companies in our sample. This is largely a result of the smaller debt levels in the IT companies.

Size and Regulation. Rosen (1982) argues that the observed systematic relationship between executive compensation and firm size can be attributed to larger, more complex firms hiring better managers. We use the natural log of sales (*ln(sales)*) as a measure of firm size and expect total compensation to increase with the log of sales. The Table 3 comparisons indicate that the IT firms are slightly smaller than the non-IT firms in our sample.

Smith and Watts (1992) argue that the level of total compensation and the emphasis on incentive pay should be lower for managers at regulated companies. We use dummy variables to identify regulated non-IT industries (*regulated non-IT*) and regulated IT industries (*regulated IT*).

Options Granted per Employee. In our general model, we include the *per capita option grant* in the return equation under the hypothesis that firm performance improves with the use of stock option compensation for all employees. From the Table 3 data, we see that the *per capita option grant* is much higher at the IT companies than at the non-IT companies in our sample.

4. Empirical Model

The empirical model is a simultaneous equations system that includes the four endogenous variables and, as exogenous variables, the economic factors identified above. The model also includes, as predetermined variables in some equations, lagged values of the endogenous variables, and, as exogenous variables in the return equation, the accounting return on assets and its lagged value.[10] For empirical purposes, we use the natural log of total compensation (Murphy 1985, Abowd 1990, Jensen and Murphy 1990). The complete specification, as described in this section, is presented as Model 1 in Table 4.

[10] If capital markets are informationally efficient, actual stock returns are not predictable using historical/known data. Expected stock returns, however, may be influenced by variables that affect risk/return relations. Current and lagged *ROA* are used because stock returns are positively related to changes in accounting returns (Ball and Brown 1968).

Lagged Endogenous Variables. Murphy (1985) observed that an executive's level of compensation in a single period depends on a history of observed performance as well as performance in the current year, and that failure to include information about the executive's past performance would cause an omitted variable problem. To reduce this problem, Murphy and others (e.g., Lambert and Larcker 1987, Jensen and Murphy 1990, Janakiraman et al. 1992) use a first-difference specification that relates the change in compensation to current period performance. But, as Boschen and Smith (1995) observe, first-difference specification of the compensation variable implicitly assumes that performance has a *permanent* effect on pay as firms learn about the executive's ability and revise their prior assessment. In the ex-post settling-up model (Fama 1980, Gibbons and Murphy 1992), the compensation change associated with a performance shock is not permanent except in the special case where the manager's true productivity evolves as a random walk. Thus, the relation between compensation and performance may have both permanent and transient components. If there is decay over time in the compensation response to a performance shock, the first-difference approach is overly restrictive. In their compensation equation, Boschen and Smith find that the coefficient on the lagged compensation variable is significantly less than one, indicating decay over time in the compensation response.[11] Instead of restricting the coefficients on the lagged compensation variables to equal one, we include the lagged values as independent variables in the *TOTAL PAY*, *OPTION SHARE*, and *BONUS SHARE* equations.

The lagged value of total pay is included in the *RETURN* equation because performance is affected by the sensitivity of pay to performance in the agency models. In their performance equation, Boschen and Smith (1995) find that the coefficient on lagged com-

[11] Using a long-time series of data, Boschen and Smith (1995) experimented with multiple lags and found significant lagged effects that dampened over time and were very small after three lags. We limit our specification to one lag because we have only five years of data. We find greater emphasis on current performance and a much greater dampening between the current and first lag than Boschen and Smith found with their sample spanning the years 1948–1990.

Table 4 Estimation of Simultaneous Equations Model

(4a) Estimation of the *LN(TOTAL PAY)* Equation

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value
INTERCEPT	1.1810	0.0001	1.1777	0.0001	1.1795	0.0001	1.2239	0.0001
SILICON VALLEY					−0.0393	0.3449	0.2230	0.0548
IT-SILICON VALLEY							−0.2883	0.0190
IT			−0.0657	0.0010	−0.0668	0.0014		
IT-HARDWARE							−0.0895	0.0003
IT-SOFTWARE							−0.0330	0.4075
IT-TELECOM							−0.0151	0.7513
$LN(TOTAL\ PAY)_{t-1}$	0.5030	0.0001	0.5017	0.0001	0.4987	0.0001	0.4929	0.0001
BONUS SHARE	0.0148	0.0001	0.0150	0.0001	0.0154	0.0001	0.0152	0.0001
OPTION SHARE	0.0240	0.0001	0.0246	0.0001	0.0251	0.0001	0.0243	0.0001
Industry turnover	−0.0120	0.0020	−0.0113	0.0037	−0.0109	0.0048	−0.0120	0.0017
Age	0.0084	0.0001	0.0085	0.0001	0.0085	0.0001	0.0080	0.0001
Stock held/total pay	0.0000	0.7917	0.0000	0.8329	0.0000	0.8659	0.0000	0.7690
Stock held/firm equity	0.0007	0.0235	0.0007	0.0239	0.0008	0.0189	0.0008	0.0169
Options held/total pay	−0.0166	0.0001	−0.0201	0.0001	−0.0197	0.0001	−0.0198	0.0001
Options held/firm equity	0.0067	0.0001	0.0064	0.0001	0.0061	0.0001	0.0066	0.0001
State tax rate	0.0043	0.0358	0.0054	0.0090	0.0061	0.0049	0.0067	0.0016
ln(sales)	0.1493	0.0001	0.1476	0.0001	0.1459	0.0001	0.1524	0.0001
Regulated non-IT	0.1009	0.0013	0.0962	0.0022	0.1012	0.0012	0.0945	0.0022
Regulated IT	0.0856	0.1341	0.1392	0.0195	0.1412	0.0180	0.0905	0.2129

(4b) Estimation of the *RETURN* Equation

	Model 1		Model 2		Model 3		Model 4	
INTERCEPT	−10.7519	0.1810	−11.9734	0.1361	−10.9995	0.1736	−10.0440	0.2147
LN(TOTAL PAY)	14.7179	0.0001	14.9482	0.0001	14.4059	0.0001	13.7524	0.0001
$LN(TOTAL\ PAY)_{t-1}$	−15.6158	0.0001	−15.6044	0.0001	−15.2111	0.0001	−14.7148	0.0001
BONUS SHARE	0.4924	0.0001	0.4896	0.0001	0.4959	0.0001	0.5373	0.0001
OPTION SHARE	0.3928	0.0001	0.3698	0.0001	0.3909	0.0001	0.3810	0.0001
ROA	1.2429	0.0001	1.2524	0.0001	1.2427	0.0001	1.2776	0.0001
ROA_{t-1}	−0.8465	0.0001	−0.8558	0.0001	−0.8439	0.0001	−0.9230	0.0001
Volatility	14.2488	0.0221	14.9966	0.0159	13.4196	0.0309	14.0950	0.0237
Stock held/total pay	0.0489	0.0006	0.0489	0.0006	0.0489	0.0006	0.0508	0.0003
Stock held/firm equity	−0.0683	0.0214	−0.0702	0.0179	−0.0695	0.0191	−0.0751	0.0110
Options held/total pay	1.5237	0.0001	1.5208	0.0001	1.4843	0.0001	1.4190	0.0001
Options held/firm equity	−0.6268	0.0001	−0.6150	0.0001	−0.6109	0.0001	−0.6040	0.0001
Per capita option grant	0.0002	0.0199	0.0002	0.0242	0.0002	0.0328	0.0002	0.0342

Tables 4(a) to 4(d) present results of three-stage least squares estimation of models with *LN(TOTAL PAY)*, *RETURN*, *OPTION SHARE*, and *BONUS SHARE* as endogenous variables and economic factors described in Table 3 as exogenous variables. Model 2 includes a dummy variable for firms in the *IT* industries and Model 3 includes dummy variables for firms located in *SILICON VALLEY* and in the *IT* industries. Model 4 includes dummy variables for *SILICON VALLEY* firms, *IT* firms in *SILICON VALLEY*, and *HARDWARE*, *SOFTWARE*, and *TELECOM* firms. System-weighted r-squared = 0.561 for Model 1, 0.562 for Model 2, 0.565 for Model 3, and 0.569 for Model 4. The *p*-values are reported for two-tailed tests.

Table 4 (*Continued*)

(4c) Estimation of the *BONUS SHARE* Equation

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value
INTERCEPT	12.6780	0.0001	12.5766	0.0001	12.4967	0.0001	12.0267	0.0001
SILICON VALLEY					−1.1701	0.2455	−1.2751	0.6622
IT-SILICON VALLEY							−0.1517	0.9613
IT			−0.4471	0.3799	−0.1113	0.8344		
IT-HARDWARE							0.6875	0.2741
IT-SOFTWARE							−1.8252	0.0757
IT-TELECOM							−1.6615	0.1739
RETURN	0.0927	0.0001	0.0961	0.0001	0.0968	0.0001	0.1036	0.0001
$RETURN_{t-1}$	0.0114	0.0023	0.0119	0.0014	0.0113	0.0021	0.0101	0.0099
$BONUS\ SHARE_{t-1}$	0.4844	0.0001	0.4833	0.0001	0.4835	0.0001	0.4850	0.0001
OPTION SHARE	−0.1280	0.0001	−0.1283	0.0001	−0.1327	0.0001	−0.1117	0.0001
Volatility	−7.5196	0.0001	−7.0435	0.0001	−6.5888	0.0001	−6.6720	0.0001
Stock held/total pay	−0.0126	0.0016	−0.0126	0.0015	−0.0126	0.0015	−0.0127	0.0016
Stock held/firm equity	0.0110	0.1854	0.0106	0.2012	0.0102	0.2167	0.0124	0.1386
Options held/total pay	0.0615	0.1540	0.0596	0.1671	0.0668	0.1206	0.0629	0.1479
Options held/firm equity	−0.0323	0.2897	−0.0322	0.2934	−0.0325	0.2899	−0.0418	0.1815
Million dollar rule	2.2678	0.0001	2.2692	0.0001	2.3209	0.0001	1.9734	0.0004
Million dollar rule 93	2.8722	0.0001	2.8634	0.0001	2.9507	0.0001	2.7570	0.0001
Regulated non-IT	−2.3756	0.0032	−2.3739	0.0032	−2.3431	0.0035	−2.1932	0.0066
Regulated IT	−0.7336	0.6088	−0.3191	0.8312	−0.6273	0.6758	0.8615	0.6426

pensation is negative and nearly equal in magnitude to the positive coefficient on the current compensation, supporting a specification that relates performance to the change in compensation.

The lagged value of *RETURN* is included in the *BONUS SHARE* and *OPTION SHARE* equations to capture the influence of past performance on current compensation, as in the multi-period agency model (Rogerson 1985). Also, there may be a timing lag between measurement of performance and compensation (option grants in 1996 may be based on 1995 performance).

5. Estimation Results

Identification of the model and of every equation in the model is checked using rank and order conditions (Judge et al. 1988). The model is estimated using three-stage least squares (Zellner and Theil 1962). The three-stage least squares estimator is used instead of the two-stage least squares estimator because the three-stage least squares model is asymptotically more efficient than the two-stage least squares estimator if the equation disturbances are correlated.[12] To address potential dependence between employees from the same firm, we average the observations for the five named executives for each firm during a year.[13] The ExecuComp data includes 8,291 firm-years between 1992 and 1996. After eliminating 856 observations with missing compensation data, 1,724 observations to provide lagged values, 2,453 observations with miss-

[12] Cross-equation correlations of the disturbances are −0.28 for *TOTAL PAY* and *OPTION SHARE*, −0.23 for *RETURN* and *OPTION SHARE*, and between −0.20 and 0.10 for all other pairs in Model 1. These correlations are not high enough to cause large differences between three-stage and two-stage least squares estimation (Mikhail 1975). In fact, estimation results are very similar between three-stage and two-stage estimation for our sample data.

[13] Averaging across the executives for a firm also reduces empirical problems associated with employee turnover. The main results are robust to estimating the model with individual observations for each executive.

Table 4 ***(Continued)***

(4d) Estimation of the *OPTION SHARE* Equation

	Model 1		Model 2		Model 3		Model 4	
INTERCEPT	44.6618	0.0001	45.3465	0.0001	46.0900	0.0001	43.7437	0.0001
SILICON VALLEY					3.6654	0.0169	1.4198	0.7385
IT-SILICON VALLEY							3.5614	0.4307
IT			2.3522	0.0016	1.9505	0.0121		
IT-HARDWARE							0.6993	0.4446
IT-SOFTWARE							3.9639	0.0076
IT-TELECOM							6.0075	0.0006
RETURN	0.1066	0.0001	0.0959	0.0001	0.0934	0.0001	0.0909	0.0001
$RETURN_{t-1}$	0.0157	0.0036	0.0143	0.0085	0.0123	0.0217	0.0133	0.0186
BONUS SHARE	−0.3684	0.0001	−0.3683	0.0001	−0.3714	0.0001	−0.3553	0.0001
$OPTION\ SHARE_{t-1}$	0.1595	0.0001	0.1524	0.0001	0.1446	0.0001	0.1615	0.0001
Sales growth	0.0683	0.0001	0.0681	0.0001	0.0686	0.0001	0.0693	0.0001
Book to market	−5.7503	0.0001	−5.7757	0.0001	−5.8099	0.0001	−5.3720	0.0001
Dividend payout	−0.0006	0.3912	−0.0006	0.3892	−0.0006	0.3975	−0.0006	0.3796
Industry turnover	0.0363	0.7963	0.0131	0.9262	0.0173	0.9026	0.0814	0.5601
Age	−0.3899	0.0001	−0.3919	0.0001	−0.3926	0.0001	−0.3711	0.0001
Volatility	5.5617	0.0290	4.3051	0.0967	3.2614	0.2111	3.5220	0.1764
Stock held/total pay	−0.0085	0.1537	−0.0084	0.1569	−0.0087	0.1437	−0.0084	0.1558
Stock held/firm equity	−0.0575	0.0001	−0.0564	0.0001	−0.0547	0.0001	−0.0550	0.0001
Options held/total pay	−0.4983	0.0001	−0.4859	0.0001	−0.4746	0.0001	−0.4629	0.0001
Options held/firm equity	0.5005	0.0001	0.4979	0.0001	0.5056	0.0001	0.5126	0.0001
Million dollar rule	14.3339	0.0001	14.3846	0.0001	14.4486	0.0001	14.2116	0.0001
Million dollar rule 93	10.8920	0.0001	10.9765	0.0001	11.0656	0.0001	10.5725	0.0001
State tax rate	−0.0419	0.5769	−0.0732	0.3349	−0.1216	0.1255	−0.1278	0.1022
Debt to assets	−4.1952	0.0097	−3.7872	0.0206	−3.6648	0.0246	−4.4416	0.0065
Times interest earned	0.0013	0.1026	0.0013	0.0964	0.0013	0.0895	0.0012	0.1102
Regulated non-IT	−3.2436	0.0064	−3.1790	0.0077	−3.3381	0.0051	−3.2040	0.0068
Regulated IT	1.1797	0.5717	−0.8919	0.6846	−0.5564	0.8007	−4.4772	0.0944

ing values for any of the exogenous variables, and 37 observations identified as outliers, we estimate our basic model with 3,258 observations, of which 605 are for IT firms.

Model Specification Checks. Belsley et al.'s (1980) diagnostic indicates that the data do not exhibit high multicollinearity. We identified influential observations using recommended cutoffs for leverage points, studentized residuals, the DFFITS measure, and standard influences of observations on the covariance of estimates (Belsley et al. 1980, Krasker et al. 1983). No observation exceeded three or more of the four cutoffs. We excluded 37 observations under the stringent condition that an observation is considered influential if any one cutoff is exceeded.

Results of Estimation. We estimate four versions of the model. First, we estimate the model as presented in §4 (Model 1). Second, we include an intercept dummy for the IT industry (*IT*) in each of the four equations (Model 2). The purpose of this variation is to evaluate whether performance and other economic factors were effective in explaining the differences in compensation practices between IT and non-IT firms. Third, we include an additional dummy for the *Silicon Valley* region (Model 3).[14] Our motivation for including a separate dummy for the 128 Silicon Valley observations is based on articles in the popular press

[14] After removing 39 outliers, Model 3 is estimated with 3,256 observations (603 IT and 128 Silicon Valley).

that describe a unique Silicon Valley culture powered by stock options: "The cry in the Valley is that options are part of the culture" (Lowenstein 1997). Finally, we include an additional dummy for 112 IT observations in Silicon Valley (*IT-SILICON VALLEY*) and replace the IT dummy with three separate dummies for 355 *IT-HARDWARE*, 109 *IT-SOFTWARE*, and 127 *IT-TELECOM* observations (Model 4).[15] Our purpose here is to evaluate whether IT effects, if any, are attributable to specific segments.

We begin by discussing the results for Model 1.[16] Results for the *LN(TOTAL PAY)* equation are reported in Table 4a. The coefficient of 0.5030 on $LN(TOTAL\ PAY)_{t-1}$ is significantly less than one ($p = 0.0001$), indicating that pay responses to performance shocks are not persistent over time. A 1% increase in *BONUS SHARE* is associated with a 1.48% increase in *TOTAL PAY* and a 1% increase in *OPTION SHARE* is associated with a 2.40% increase in *TOTAL PAY*.[17] The significantly greater coefficient ($p = 0.0001$ for test of differences) for *OPTION SHARE*, relative to *BONUS SHARE*, confirms our expectation that total pay is more sensitive to option share than to bonus share because of the continuing risk associated with options.

As expected, *LN(TOTAL PAY)* increases with *ln(sales)*. Coefficients on some of the other exogenous variables must be interpreted carefully because they may be indirectly related to *LN(TOTAL PAY)* through the endogenous compensation share variables. For example, *LN(TOTAL PAY)* increases directly with executive *age* but *OPTION SHARE* decreases with *age* (see Table 4d). When evaluated at the mean *age* of 52 for the sample, the complete effect of *age* on *LN(TOTAL PAY)* is negative. Similarly, *LN(TOTAL PAY)* increases directly with the *regulated non-IT* dummy, but both *BONUS SHARE* and *OPTION SHARE* decrease significantly with it. The complete effect of *regulated non-IT* on *LN(TOTAL PAY)* is negative.

With respect to executives' holdings, *LN(TOTAL PAY)* increases directly with *stock held/firm equity*, consistent with the entrenchment hypothesis, and decreases directly with *options held/total pay*, consistent with the convergence of interests hypothesis. The significantly positive coefficient on *stock held/firm equity* (combined with a significantly negative coefficient on *stock held/firm equity* in the *OPTION SHARE* equation) indicates that managers with larger shareholdings (as a percentage of the firm) receive more fixed pay and fewer stock options. The significantly negative coefficient on *options held/total pay* (combined with the significantly negative coefficient on *options held/total pay* in the *OPTION SHARE* equation) suggests that option holdings do reduce managers' mobility and enable firms to retain executives at lower total compensation levels.

Results for the *RETURN* equation are presented in Table 4b. The significantly positive coefficient on $LN(TOTAL\ PAY)_t$ and significantly negative coefficient on $LN(TOTAL\ PAY)_{t-1}$ of equal magnitude ($p = 0.0001$ for comparison) indicate that stock returns are influenced by the change in total pay. The significantly positive coefficients on the *BONUS SHARE* and *OPTION SHARE* variables indicate that stock returns are also influenced by the extent of incentive pay. The higher coefficient on *BONUS SHARE* of 0.4924 relative to the coefficient on *OPTION SHARE* of 0.3928 ($p = 0.0001$ for test of differences) suggests that current performance is more closely tied to bonus pay than option pay.[18] The significantly positive coefficient on *ROA* and significantly negative coefficient on ROA_{t-1} reflect a positive relation between stock returns and the change in return on assets. Consistent with convergence of interests, the coefficients on *stock held/total pay* and *options held/total pay* are significantly positive in the *RETURN* equation. Interestingly, *options held/total pay* have a much greater effect on

[15] After eliminating 53 outliers, Model 4 is estimated with 3,242 observations (591 IT and 124 Silicon Valley). Of the 124 Silicon Valley, 12 are non-IT. Of the 591 IT, 355 are hardware, 127 are software and 109 are telecom.

[16] All the *p*-values reported in the tables are for two-sided tests. Because the economic factors are included as control variables, we are not testing specific directional hypotheses.

[17] In footnote 6, algebraic predictions of the sensitivity of total pay to bonus share of 1.25% and to option share of 1.43% were made, based on the mean levels of bonus share and option share. The coefficient value of 2.40% for the option share is significantly greater than 1.43%.

[18] Explicit ties between bonuses and accounting returns may partially explain the sharper relation between *BONUS SHARE* and *RETURN*.

performance than *stock held/total pay* even though the numerators of both variables are valued using the closing stock price. In fact, *options held/total pay* apparently has a much greater effect on performance than the *OPTION SHARE* of current compensation.[19] Consistent with entrenchment, the coefficients on *stock held/firm equity* and *options held/firm equity* are significantly negative. The significantly positive coefficient on *per capita option grant* suggests that wider use of options throughout the organization positively affects performance.

Empirical results for the *BONUS SHARE* and *OPTION SHARE* equations are presented in Tables 4c and 4d. In both equations, the coefficients on *RETURN* and $RETURN_{t-1}$ are significantly positive, with lagged performance having a much smaller direct effect on current incentive pay. The significantly positive coefficients on the lagged values of *BONUS SHARE* in the bonus equation and *OPTION SHARE* in the option equation indicate some persistence over time in incentive pay with greater persistence in bonus pay ($p = 0.0001$ for test of differences). The coefficient on the current *OPTION SHARE* is significantly negative in the bonus share equation and the coefficient on the current *BONUS SHARE* is significantly negative in the option share equation, indicating substitution between bonuses and option awards. Both coefficients are significantly greater than -1 ($p = 0.0001$), indicating less than perfect substitution.

The *BONUS SHARE* is negatively and significantly related to *volatility*, consistent with incentive pay decreasing as the precision of the performance measure decreases. The *OPTION SHARE* is positively and significantly related to *volatility*, which may be due to an alternative role for *volatility* as a measure of innovation or a mechanical relation between the Black-Scholes value of options and *volatility*. Both the *BONUS SHARE* and the *OPTION SHARE* decrease with *stock held/total pay*, consistent with less incentive pay as ownership increases relative to total pay (as a proxy for manager wealth). The coefficient on *options held/total pay* in the option share equation is significantly negative consistent with decreasing use of options as the manager's portfolio of options increases. However, the coefficient on *options held/firm equity* is significantly positive, reflecting cross-sectional differences in firms' propensity to grant options.

The coefficients on the *million dollar rule* dummy variables are significantly positive in both the *BONUS SHARE* and *OPTION SHARE* equations. The magnitudes of the coefficients are much larger in the *OPTION SHARE* equation, suggesting a greater emphasis on stock options in situations where the million dollar rule applies. Stock options generally qualify as incentive compensation under the Section 162(m) rules, whereas bonus pay must be tied to specific performance criteria (stock returns or accounting returns) on an ex ante basis to qualify. The significantly positive coefficients on the *million dollar rule 93* variables are consistent with an anticipatory effect in 1993. As expected, the coefficients on the *regulated non-IT* dummy are significantly negative in both the *BONUS SHARE* and *OPTION SHARE* equations. The lack of significance on the *regulated IT* dummy variables indicates that the use of incentive compensation in regulated IT industries is not significantly different from other IT industries.

Model 2 includes a separate *IT* dummy variable. This enables us to directly evaluate the effectiveness of the empirical proxies in explaining the greater use of stock options by IT firms. For the observations used in our estimation, the mean value of *OPTION SHARE* is 35.98% for IT firms and 27.60% for non-IT firms.[20] Of the difference in means of 8.38%, approximately 6.03% is explained by performance and other economic factors, and the remaining 2.35% (the value of the *IT* dummy variable) is an unexplained *IT* effect. Thus, while performance and other economic factors explain a large portion of the difference in option share

[19] Both *options held/total pay* and *OPTION SHARE* are deflated by current compensation. The numerator of *options held/total pay* is measured using the market price of the stock whereas the numerator of *OPTION SHARE* is measured using the Black-Scholes value of the options. Use of the market price of the stock effectively causes the value of *options held/total pay* to be overstated and, consequently, the coefficient on *options held/total pay* to be understated.

[20] The sample used in the estimation is a subset of the full data set used to provide the information in Table 2.

Table 5 Explained Difference in Mean Values of *OPTION SHARE*

	IT	Non-IT	Difference
RETURN	2.4481	1.5132	0.9349
$RETURN_{t-1}$	0.5123	0.2224	0.2899
BONUS SHARE	−6.9725	−7.0822	0.1097
$OPTION\ SHARE_{t-1}$	4.5232	3.5836	0.9396
Sales growth	1.4692	0.9872	0.4820
Book to market	−2.3478	−2.8761	0.5283
Dividend payout	−0.0139	−0.0254	0.0115
Industry turnover	0.1008	0.0970	0.0038
Age	−20.2057	−20.7497	0.5441
Volatility	1.7081	1.3598	0.3484
Stock held/total pay	−0.0825	−0.1213	0.0388
Stock held/firm equity	−0.4914	−0.7013	0.2099
Options held/total pay	−2.5451	−2.2024	−0.3428
Options held/firm equity	3.5242	2.9107	0.6134
Million dollar rule	6.9377	5.8962	1.0414
Million dollar rule 93	1.0592	0.9934	0.0659
State tax rate	−0.4792	−0.3923	−0.0869
Debt to assets	−0.5518	−0.7903	0.2385
Times interest earned	0.0546	0.0405	0.0141
Regulated non-IT		−0.2272	0.2272
Regulated IT	−0.0746		−0.0746
Explained difference (sum of above)			6.1372
Unexplained IT effect (*IT* dummy variable)			2.3522
Sum of explained difference and IT effect			8.4894

The mean values of *OPTION SHARE* for IT and non-IT firms in the sample are 35.9777 and 27.6033 (difference = 8.3744). The IT and non-IT amounts above are the estimated coefficients from Model 2 multiplied by the mean values of the variables for IT and non-IT firms.

between IT and non-IT firms, a significant residual amount remains. Table 5 provides an approximate breakdown of the explained difference by economic variable.[21] To obtain this approximate breakdown, the estimated coefficients from Model 2 are multiplied by the mean value of each variable for IT firms and non-IT firms. The economic variables having the largest influence on the difference in the *OPTION SHARE* between IT and non-IT firms are *million dollar rule*, $OPTION\ SHARE_{t-1}$, *RETURN*, *options held/firm equity*, *age*, *book to market*, and *sales growth*.

[21] The explained difference in the table of 6.13% is slightly higher than the explained difference of 6.03% obtained by subtracting the value of the *IT* dummy variable from the actual difference in the mean values of *OPTION SHARE* for IT and non-IT firms. This reflects the approximate nature of the analysis.

An interesting question is whether IT executives are overpaid relative to non-IT executives. In the *LN(TOTAL PAY)* equation of Model 2, the coefficient on the *IT* dummy variable is significantly negative with magnitude of −0.0657 (p = 0.0010). When considered jointly with the significantly positive coefficient on the *IT* dummy variable in the *OPTION SHARE* equation, the complete unexplained *IT* effect on *LN(TOTAL PAY)* is a negligible 0.78%. This indicates that, after considering the influence of incentive pay and other economic factors on total compensation, IT executives are not overpaid relative to executives in other industries.[22]

Model 3 includes a separate *Silicon Valley* dummy variable in addition to the *IT* dummy variable. In the *OPTION SHARE* equation (Table 4d), we see a significant *Silicon Valley* effect in addition to the IT effect, indicating that IT firms in Silicon Valley use relatively more option compensation than other IT firms. Model 4 provides a finer gradation of the IT industry dummies.[23] The results for the *OPTION SHARE* equation indicate that differences between IT firms and non-IT firms are primarily a result of greater use of options in software and telecom firms.

Simultaneity. Our general model includes simultaneous relations between compensation and performance as described in Figure 1. The estimation results clearly support simultaneity along the following dimensions: reciprocal relations between firm performance (*RETURN*) and specific components of incentive compensation (*BONUS SHARE* and *OPTION SHARE*), reciprocal relations between performance and total compensation (*TOTAL PAY*), and substitution between bonus and option pay. To assess the importance of recognizing reciprocal relations between pay and performance and substitution between bonus share and option share, we removed the cross-

[22] Our interpretation requires that the coefficient on the lagged value of *LN(TOTAL PAY)* be less than one in the *TOTAL PAY* equation. If the coefficient were equal to one, a differential amount added to the pay of IT executives in period $t-1$ would not be detected by the coefficients on the dummy variables.

[23] Coefficients in Model 3 must be interpreted carefully. A specific firm may activate a number of dummy variables. For example, a software firm in Silicon Valley would activate Silicon Valley, Silicon Valley IT, and IT-Software.

Table 6 **Regression of *ln(per capita option grant)* on Economic Factors**

	Coeff.	*p*-value
INTERCEPT	1.4855	0.0001
SILICON VALLEY	0.2384	0.0051
IT	0.1472	0.0007
RETURN	0.0018	0.0001
$RETURN_{t-1}$	0.0018	0.0001
$ln(\text{per capita option grant})_{t-1}$	0.7650	0.0001
Sales growth	0.0010	0.0760
Book to market	−0.2380	0.0001
Volatility	0.7013	0.0001
Dividend payout	0.0000	0.8849
State tax rate	0.0014	0.7615
Times interest earned	0.0000	0.9162
Debt to assets	−0.2811	0.0063
Regulated non-IT	0.0535	0.4348
Regulated IT	0.0611	0.6138

OLS regression of *ln(per capita option grant)* on dummy variables for *Silicon Valley* firms and *IT* firms, *RETURN* and $RETURN_{t-1}$, $ln(\text{per capita option grant})_{t-1}$, and other economic factors. Adjusted r-squared = 0.72, *p*-values are for two-tailed tests.

equation links between bonus share and option share and estimated each of the equations individually.

When these simultaneous relations are ignored, the results are much different. For example, in the nonsimultaneous estimations, firm performance is not significantly related to the option share of total compensation and the option share is not significantly related to current firm performance. Clearly, recognizing the simultaneity of performance and pay and substitution between the pay components is critical.[24] Otherwise, distorted and biased estimates are obtained.

Per Capita Option Grants. Table 6 reports results of regressing *ln(per capita option grant)* on *RETURN*, the economic factors, dummy variables for Silicon Valley and IT, and the lagged value of *ln(per capita option grant)*. This is necessarily a partial analysis because we do not have data on other components of employee compensation. The results are similar to those for the *OPTION SHARE* equation. The coefficients on the economic factors (*sales growth, book to market, volatility,* and *debt to assets*) are all significant in directions that move with the characteristics of IT firms. After controlling for these factors, the Silicon Valley and IT dummies are significantly positive, suggesting that Silicon Valley and IT firms use options more extensively throughout their organizations.

[24] These issues are explored in greater depth in Anderson et al. (1998).

6. Conclusion

Our analysis indicates that executives at IT firms receive a greater portion of their total compensation in the form of stock options. This greater use of options is partially explained by differences in economic factors that influence the use of options in all firms, but after controlling for a variety of economic factors, significant differences in the use of options by IT firms remain. Thus, it is possible that systematic differences in the behavior of Silicon Valley and IT firms and executives cause a higher percentage of compensation to be paid as stock options. It is also possible that less risk-averse executives seek out these firms.

Concern has been expressed that IT firms overpay senior executives with excessive option awards. This allegedly excessive use of stock options is often linked to the debate about accounting rules which do not require a deduction from reported income for the fair value of options granted. Our analysis does not support the argument that IT firms overpay executives.

Articles in the business press suggest that the "options culture" extends to all levels of employees in the Silicon Valley and IT firms. We found that after controlling for economic factors, the per capita option grant was significantly greater for Silicon Valley and IT firms. We also found positive associations between performance and both per capita option grant and the proportion of option pay for executives.

Finally, while our focus was on understanding executive compensation practices in the IT industry, our analysis extends the cross-disciplinary literature on incentive compensation as well. We explicitly model and empirically document the significant interdependencies between total compensation, performance levels, and the form of compensation used. We show that while the share of bonus and options in total compensation is related to performance, the

change in total compensation and the extent of performance-based compensation simultaneously influence performance itself. Unlike previous studies that consider individual pay components separately and that ignore the simultaneous impact of pay on performance, we find a significant positive relation between the ex ante value of stock options (as a percentage of total compensation) and current firm performance. We also find that cash bonus payments and stock option awards are substitutes for each other. These findings imply that future research of incentive pay must explicitly recognize interrelations between the alternative forms of compensation and the reciprocal relations between pay and performance.[25]

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