Taking Stock: Equity-Based Compensation and the Evolution of Managerial Ownership

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ABSTRACT

We investigate the impact of stock-based compensation on managerial ownership. We find that equity compensation succeeds in increasing incentives of lower-ownership managers, but higher-ownership managers negate much of its impact by selling previously owned shares. When executives exercise options to acquire stock, nearly all of the shares are sold. Our results illuminate dynamic aspects of managerial ownership arising from divergent goals of boards of directors, who use equity compensation for incentives, and managers, who respond by selling shares for diversification. The findings cast doubt on the frequent and important theoretical assumption that managers cannot hedge the risks of these awards.

WE INVESTIGATE THE IMPACT OF STOCK-BASED COMPENSATION, including options and restricted stock, on the ownership of U.S. executives. Equity-based pay spread at explosive rates in the United States during the 1990s. Morgenson (1998) reports that in 1997, the 200 largest U.S. companies had reserved more than 13 percent of their common shares for compensation awards to managers, up from less than seven percent eight years earlier. Institutional investors and shareholder activists have tolerated and even encouraged this diversion of equity to executives, believing that managerial ownership may reduce agency problems. Boards' compensation committees routinely cite the goal of increasing managerial ownership as the rationale for equity-based pay.[1]

Although boards state that they intend stock options and other awards to boost the ownership of managers, executives are not likely to have the same goal. Modern portfolio theory predicts that managers receiving additional stock in their firms should sell these shares or, equivalently, sell other shares

* The authors are from New York University. We appreciate helpful comments and assistance from Michael Lemmon, Henri Servaes, Abbie Smith, René Stulz, Robert Whitelaw, Marc Zenner, an anonymous referee, and seminar participants at the American Compensation Association academic research conference, the American Finance Association annual meetings, Case Western Reserve University, the University of Chicago, the London Business School, the University of North Carolina, the University of Pennsylvania, Purdue University, Rice University, the University of Virginia, and Virginia Polytechnic Institute.

[1] For representative examples from well-known firms, see the proxy statements filed by Minnesota Mining and Manufacturing Co. in 1997, which state that "the company's stock option plan . . . is designed to increase ownership of the company's stock," and by Procter & Gamble Co. in 1995, in which the firm's description of its compensation policy refers to "the company's desire to increase management's stock ownership."

they already own, to diversify away the unsystematic risk associated with concentrating wealth in a single asset. This risk is higher for managers than for ordinary investors because executives already have human capital value correlated with firm performance. Whether stock compensation leads to higher managerial ownership therefore appears to be an empirical question related to the strength of managers' diversification impulses.

We study year-to-year changes in stock and option ownership in 1993, 1994, and 1995 for 8,516 top managers in 1,646 companies of all sizes, a total of 18,558 person-year observations. We observe inflows of equity to managers' portfolios from new options, new restricted shares, and option exercises, and we compare these with outflows of equity from sales of stock.

Our findings depend crucially on managers' prior ownership. We segment our data into subsamples based on whether an executive owns as many shares as those awarded in new grants of stock options or restricted stock. Executives with low prior ownership exhibit stronger incentives after receiving new options and restricted stock, as we find no evidence of offsetting sales of stock during years with new option awards, and modest evidence of selling after restricted stock awards. For higher-ownership executives, we find active selling during years with new option awards, and in some models, strong evidence of selling after receipt of restricted stock. These sales effectively neutralize much of the incentive impact of high-ownership managers' stock-based pay. For executives who exercise stock options, we find near-total selling of the shares acquired regardless of prior ownership, though this disposal of shares may partly be necessary to raise funds for taxes and to pay the option exercise price.

The data imply that once managers reach a certain ownership level, they actively rebalance their portfolios when boards award equity compensation. We cannot know whether boards expect or condone these sales. Prior research has often overlooked this dynamic aspect of managerial ownership, either treating ownership as exogenous or as a choice variable under the control of the board. Instead, we find that ownership changes endogenously as a function of executive pay and prior ownership. Our findings may interest audiences concerned with managerial incentives, including investors, boards of directors, compensation consultants, and financial analysts. For financial theorists who model the value to executives of stock options and related compensation, our findings call into question the frequent and important assumption that managers cannot hedge the risks of these awards.

The paper proceeds as follows. Section I develops hypotheses. Section II describes our data. Section III presents analysis and discussion of the results. Section IV contains conclusions.

I. Hypotheses

Influential principal-agent models, beginning with Jensen and Meckling (1976) and Holmström (1979), often tout the benefits of managerial ownership or suggest "sharing rules" under which stockholders commit to paying

managers some fraction of a firm's returns. Stock options, restricted stock, and a variety of related instruments have been used by most major U.S. firms for this purpose. However, large stock compensation makes managers' wealth underdiversified. This effect is compounded for senior executives, since their human capital value already depends on firm performance, and since they may already have large investments in company stock. Bryant (1997) cites statistics indicating that top executives hold more than one-third of their net worth in their own firm's stock. We study this divergence of interests between managers, who for risk-reduction reasons should not want to hold large amounts of company stock, and shareholders, whose representatives, the board of directors, award stock compensation to managers to heighten the wealth consequences of their performance. We recognize that other considerations influence both the award and liquidation of stock-based pay; an important example is Miller and Scholes's (1982) illustration of the possibility for firms and executives to realize joint tax savings from arrangements such as stock options.

Our hypothesis tests attempt to distinguish between two paradigms of how executives might behave after receiving stock compensation. If a manager shares the board's goal of tying his wealth more closely to firm value, he will not adjust his other holdings of stock in the company. Our null hypotheses, predicting zero change in ownership, are based on this type of behavior. We recognize that these null hypotheses may be statistical "straw men" since it is unlikely that managers are totally unconcerned with diversification. Our alternative hypotheses are derived from the behavior of a manager who follows modern portfolio theory after receiving equity compensation. This executive will sell the award itself if permitted or, equivalently, sell other shares in the company that he already owns. A manager's portfolio decisions will also be influenced by private information about the firm's prospects, and by his awareness that investors may interpret managerial selling or retention of shares as signals of inside information. However, we expect such knowledge to be evenly distributed between optimistic and pessimistic over our comprehensive sample of thousands of companies and not to bias our results.

A. Stock Options

Hedging the risk imparted by a stock option award is complicated because managers may not sell their options to others and the options usually do not become exercisable for several years (most executive options have 10-year lives, are granted at-the-money, and gradually "vest" to become exercisable over three or four years). However, a suitable hedging strategy would involve selling other shares of stock that the manager already owns. To hedge the risk perfectly, the manager would sell a number of shares equal to the number of options awarded, multiplied by the change in option value per unit change in stock price. This rate of change, called the "delta" or "hedge ratio" when used with the Black–Scholes (1973) valuation model, always

falls between zero and one, implying that a manager seeking to hedge the risk of an option award will sell some shares but fewer than the number of options awarded. Numerous authors, beginning with Jensen and Murphy (1990), estimate hedge ratios for typical executive stock options near 0.6. However, most of these estimates ignore the complicated income tax questions associated with executive stock options; these tax problems and also transaction costs make prediction of real-world selling behavior problematic. We therefore test the null hypothesis that managers sell zero shares during years in which they receive options; the alternative hypothesis is that managers sell some stock, but less than 100 percent of the number of shares placed under option.

Optimal hedging for a manager holding options requires ongoing portfolio adjustments over the options' life, as hedge ratios change due to both movement in the underlying stock price and the passage of time. Exercising stock options triggers a further need for managers to sell shares in order to reduce risk, since the hedge ratio increases permanently to one when an option is converted to stock (this effect may have negligible importance if the options were deep in-the-money). Further, executives may need to sell shares in order to pay the exercise price or income taxes. We therefore test the null hypothesis that upon exercising options, managers retain all shares acquired; the alternative hypothesis is that a significant number of shares are sold.

B. Restricted Stock

When a manager receives restricted stock, he obtains shares whose sale is usually barred for three to five years. Although little research has considered the value to managers of these awards, it is plain that their sensitivity to firm value exceeds that of stock options and is likely near one. We test the null hypothesis that managers sell zero shares when receiving restricted stock. The alternative hypothesis is that managers sell approximately 100 percent of the number of new restricted shares, since one would expect a manager following portfolio theory to liquidate almost all of the new position for diversification. We might expect managers to sell shares of stock in years in which restricted shares become vested with their restrictions lapsing, certainly for tax reasons (this event usually triggers a tax obligation) but possibly also for risk reduction. Unfortunately, we do not have data for these events and cannot pursue this analysis.

C. Importance of Prior Stock Ownership

A necessary condition for most of our alternative hypotheses to hold is that a manager already owns stock in his firm before he receives options or restricted shares; otherwise, he would not have a way of selling shares. For executives newly hired from outside or young managers who have been rapidly promoted, stock ownership may be low or nonexistent. Boards may also

pressure lower-ownership managers to acquire some minimum stake in the firm. We therefore expect the intensity of each selling effect to be reduced for managers with low ownership, both because a manager cannot sell shares without already owning some, and also because the desire for diversification should be greatest among managers who already own many shares.

II. Data Description

Standard and Poor's Corporation's ExecuComp serves as our data source. ExecuComp includes annual data from proxy statements for the five highest paid executives in three cohorts of firms: the S&P 500, the S&P MidCap 400, and the S&P SmallCap 600. S&P adds and drops some firms from ExecuComp each year; the release that we use has 1,646 companies providing useable data.

The database includes compensation data for the four years 1992 to 1995. We calculate stock ownership changes by taking first differences and therefore lose one year of data. Allowing for yearly changes in sample composition and the identity of firms' top executives, we have a total of 18,558 annual observations for 8,516 executives. Since our goal is to study whether managers respond to stock compensation awards by selling previously held shares, we narrow our sample to 14,642 observations by excluding managers who do not receive a stock option or restricted stock award or who do not exercise options during the year. Unfortunately, S&P reports few characteristics of executives except for the job title; such variables as age and years of tenure which might be interesting for our research are missing for a large majority of individuals.

Stock ownership is defined in the database as shares held directly, including restricted shares but excluding options (whether exercisable or unexercisable). This definition differs from the SEC's requirement that companies report beneficial ownership including options exercisable within 60 days; we verify from a subsample of proxy statements that S&P indeed subtracted all options from executives' ownership totals when tabulating the data. Following this convention, stock ownership should rise one-for-one during years in which executives receive restricted stock or exercise options, and should exhibit zero change when executives receive new options.

ExecuComp's compensation data for our executives include stock options awarded during the year, options held at the end of the year, and the dollar value of restricted stock awarded during the year. We estimate the number of new restricted shares by dividing this award value by the year-end stock price. We exclude from our analysis "reload" options (about three percent of the option awards in ExecuComp). Reloads are given by some companies when an executive exercises unexpired options and pays the exercise price by surrendering shares of company stock; including reloads in the sample could bias our results since they create a mechanical relation among option awards, option exercises, and stock ownership changes. All share quantities

are adjusted for stock splits so that variables are stated in common 1996 units. ExecuComp provides financial statement data and stock performance information that we use.

We calculate changes in stock ownership by subtracting year-end share ownership from the prior year's. A slight timing problem arises because companies report stock ownership (though not option or restricted stock ownership) as of the date of the proxy statement, usually in mid-March for a company whose fiscal year ends in December. Therefore, we calculate year-to-year differences in stock ownership based on dates approximately 10 weeks after fiscal year-end. We do not expect this to create serious bias, since the flow of compensation awards in our sample does not vary greatly from year to year, and since executives may wait several weeks before selling shares in response to compensation. We test the importance of this timing problem later in the paper by repeating our analysis on a three-year cumulative basis for which the 10-week timing incongruence should be less important, and our results exhibit virtually no change.

Table I reports descriptive statistics for our sample. Panel A indicates that within our universe of more than 18,000 person-year observations, more than two-thirds of executives receive option awards in a given year, and approximately one-third exercise options. Restricted stock awards occur during slightly more than one-sixth of our executive-years. We narrow our sample to those managers who either receive new options or restricted shares or who exercise options during the year. Data in Panel B show that among this group, ownership appears low. Mean stock ownership, including restricted shares but excluding options, is about 384,390 shares, or 0.75 percent of the company's equity, but median values are far smaller at 32,170 shares, or 0.06 percent. Though mean option ownership lies well below mean stock ownership, median option holdings are more than twice as large as median stock ownership (78,740 compared to 32,170 shares), and the median annual option award (22,120 shares) is close in size to median total stock ownership. These data indicate that options have substantial importance in providing incentives for most top managers. Similar data for restricted shares indicate they have far less importance as incentives than either options or direct ownership, as the median restricted stock holding is zero and the mean is a relatively modest 14,520 shares.[2]

Annual changes in stock ownership for our executives are close to zero: A mean of −6,340 shares and a median of +640. These small annual changes seem surprising, since a large majority of the executives in our panel receive stock-based compensation almost every year, typically involving tens of thousands of new shares. Panel B also presents information about average option award sizes, option exercises, and restricted stock awards. The lower half of

[2] The mean overall stock ownership total of 384,340 shares includes an indeterminate number of restricted shares. Under SEC reporting rules, total ownership and restricted share ownership are reported as of different dates, so our mean restricted share ownership of 14,520 should not be understood as an exact computation of the restricted subset of the mean overall ownership.

Table I

Sample Description

Descriptive statistics about executive compensation and share ownership for a panel of 8,516 executives in 1,646 firms between 1993 and 1995. The sample includes a total of 18,558 person-year observations and is drawn from Standard and Poor's ExecuComp database. The subsample in Panel B includes the 14,642 executives receiving stock option or restricted stock awards or exercising options during the year. Panel A lists the fraction of person-year observations during which executives receive new stock option awards, exercise previously awarded options, and receive restricted stock awards. Panel B presents descriptive statistics about those awards on an annual basis, as well as cumulative three-year totals for those executives who appear every year of the sample. Panel C presents a comparison for CEOs and all other executives.

Panel A: Sample Frequencies

Number of observations	18,558
Percentage of all executives with	
New options awarded	67.9%
Options exercised	34.4
Restricted shares awarded	17.2

Panel B: Descriptive Statistics

	Number of Shares (thousands)			Number of Shares / Shares Outstanding		
Variable	Mean	Median	STD	Mean	Median	STD
Shares owned	384.39	32.17	3029.46	0.75%	0.06%	2.87%
Options inventory	188.34	78.74	432.00	0.42%	0.18%	0.79%
Restricted shares owned	14.52	0.00	185.07	0.02%	0.00%	0.08%
Annual changes, obs. = 14,642						
Change in shares owned	−6.34	0.64	476.02	−0.00%	0.00%	0.75%
New options awarded	57.25	22.12	140.60	0.13%	0.05%	0.33%
Options exercised	23.16	0.00	105.36	0.05%	0.00%	0.18%
Restricted shares awarded	3.56	0.00	21.60	0.01%	0.00%	0.07%
Salary + bonus (thousands $)	579	405	789			
Three-year changes, obs. = 3,364						
Change in shares owned	−5.01	4.85	870.35	0.03%	0.01%	1.51%
New options awarded	168.98	75.00	317.27	0.34%	0.15%	0.63%
Options exercised	67.15	10.40	250.87	0.12%	0.02%	0.35%
Restricted shares awarded	10.64	0.00	43.22	0.02%	0.00%	0.15%

Panel C: CEOs versus Other Executives

	Non-CEO			CEO		
Variable (000)	Mean	Median	STD	Mean	Median	STD
No. of observations		9,927			3,221	
Shares owned	161.49	21.62	1093.68	1145.45	148.94	5973.92
Change in shares owned	−2.92	0.52	199.14	−18.02	1.50	929.99
New options awarded	40.52	18.83	92.75	114.36	50.00	231.71
Options exercised	17.85	0.00	60.39	41.28	0.00	190.10
Restricted shares awarded	2.60	0.00	14.78	6.84	0.00	36.06
Salary + bonus	465.87	349.24	438.58	949.75	700.00	1363.75

the table shows this information on a cumulative three-year basis for the 3,364 qualifying executives who appear in all three years of the study with the same firm. Finally, Panel C presents data comparing the stock ownership and compensation data for CEOs and all other executives.

Before proceeding to our analysis, we note that our estimates of managerial selling are likely underinclusive. In recent years derivative securities dealers have developed many ways for managers to realize value from their equity holdings without "selling" their shares in a legal sense that would lead to reporting in our data set. These methods include equity swaps (Bolster, Chance, and Rich (1996)), put options, "collars" and related strategies (Bettis, Bizjak, and Lemmon (1999)), and secured borrowing using the stock as collateral (O'Brian (1997)). Ip (1997) states that an official of a firm that tracks insider pseudoselling "believes the level of insider disclosure of such derivative transactions is far below the actual level of insider activity." Though tax avoidance is a major motive for this activity, and evasion of disclosure requirements may also be important, market professionals cite portfolio diversification as a key goal of many executives. O'Brian (1997) quotes a vice president of Merrill Lynch as saying, "All their (executives') wealth is tied up in one thing, generally their company's stock. We need to provide them with liquidity."

III. Analysis

We test for whether managers adjust stock ownership in response to compensation awards by estimating ordinary least squares regressions of changes in shares owned against the number of shares obtained from various forms of compensation. We include in all regressions the firm's stock return during the prior year, since we expect managers concerned about diversification to be much more likely to sell shares after the company's stock price increases.

A. Ownership Changes in Response to Compensation Awards

The main results of our study appear in Table II, which is divided into two panels based on executives' ability to enter into transactions that might offset the ownership impact of new stock compensation. In Panel A, we estimate regressions for the subsample of managers who previously own at least as many shares as the number received from new compensation; for example, in the first column, which studies ownership changes after option awards, we restrict the sample to those executives who already own at least as many shares as the number of new options awarded.[3] Panel B presents regressions

[3] In calculating ownership, we are constrained by the format of our data source to use the sum of unconditionally owned plus restricted shares; the presence of these restricted shares means that our condition for segmenting the data will not be unambiguously satisfied for all executives in Panel A. We saw no advantage in the alternative of subtracting out our data source's variable for the number of restricted shares, since that variable is measured several months earlier than total ownership, and a nontrivial fraction of restricted shares will "vest" and become unconditionally owned between these two dates.

Table II

Annual Change in Shares Owned and Stock-Based Compensation

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 14,642 person-year observations between 1993 and 1995 for executives who either exercised options or received options or restricted stock. The dependent variable is the increase in the number of shares held by the executive. Independent variables are the number of stock options awarded, the number of shares acquired from the exercise of previously awarded options, and the number of shares of restricted stock awarded along with the company's stock return during the year. The first column of the table indicates the null hypothesis for each regression coefficient. Heteroskedastic-consistent t-statistics appear below each variable in parentheses.

Dependent Variable		Annual Change in the Number of Shares			
Panel A: Executives with Greater Share Ownership than the Number of New Shares Awarded, and All Option Exercise Events					
Intercept (000)		5.405	1.784	−20.670	3.129[a]
		(0.49)	(0.46)	(1.26)	(0.40)
Annual number of new options awarded	$H_0 = 0$	−0.684[b]			−0.679[b]
		(2.48)			(2.49)
Annual number of options exercised	$H_0 = 1$		−0.132[d]		−0.128[d]
			(0.90)		(0.76)
Annual number of restricted shares	$H_0 = 1$			0.056[d]	0.532
				(0.23)	(1.60)
Stock return during the year		4.698	−0.983	77.890[b]	2.675
		(0.26)	(0.08)	(2.00)	(0.17)
No. of observations		6,566	6,325	2,769	8,227
Adjusted R^2		0.0161	0.0002	0.0026	0.0157
Panel B: All Other Executives					
Intercept (000)		9.986[a]		20.520[a]	9.314[a]
		(3.53)		(5.26)	(3.39)
Annual number of new options awarded	$H_0 = 0$	0.069[a]			0.052[b]
		(2.75)			(2.00)
Annual number of options exercised	$H_0 = 1$				0.103[d]
					(1.54)
Annual number of restricted shares	$H_0 = 1$			0.328[a,d]	0.346[a,d]
				(3.36)	(3.65)
Stock return during the year		10.056[c]		−5.798	8.106
		(1.76)		(0.67)	(1.41)
No. of observations		5,893		415	6,165
Adjusted R^2		0.0036		0.1009	0.0061

[a,b,c] denote significant differences from zero at the 1, 5, and 10 percent levels, respectively.
[d,e,f] denote significant differences from one at the 1, 5, and 10 percent levels, respectively, if $H_0 = 1$.

for the remaining executives who lack sufficient shares to offset completely the ownership impact of a new award. Results for option exercises are presented in Panel A only, since an executive with even zero prior ownership could immediately sell all the shares acquired from exercising an option.

Sample sizes reported in Table II indicate that a majority of top managers do own enough shares to engage in selling that would hedge away the risks imposed by new compensation awards. Of the 12,459 managers receiving

new stock option awards, 6,566 (more than 53 percent) already own more shares than the number of new options awarded,[4] and 2,769 of 3,184 managers receiving restricted stock awards (87 percent) already own more than the number of new restricted shares. Though this pattern of ownership applies less often to middle managers and lower-level employees, it indicates that many top executives have substantial flexibility to adjust ownership after they receive new stock compensation.

The first column of Table II (both panels) presents estimates for how ownership changes during years in which executives receive new options. Since options do not count toward ownership in our data set until they are exercised and converted to stock, our null hypothesis is that zero ownership change occurs during these years. A positive value for the dependent variable, the change in shares owned, indicates rising ownership, and a negative value indicates selling to reduce ownership. We test the significance of all OLS estimates with White (1980) standard errors robust to serial correlation and heteroskedasticity.

In Panel A, the coefficient estimate for managers who own more shares than the number of options awarded is -0.684, implying that for every 1,000 new options awarded, an executive sells 684 shares of stock. This result, in line with our alternative hypothesis that executives respond to option awards by selling shares, has a magnitude close to the approximate option hedge ratio of about 0.6. For lower-ownership managers, results in Panel B show a positive and significant estimate of 0.069, implying that their ownership rises slightly in years with new option awards. We do not have a clear explanation for this increase. One possibility is that these managers often receive restricted stock during the same years—a conjecture consistent with the slight movement of the coefficient toward zero in the rightmost column after restricted stock awards are included in the regression. For stock option awards, therefore, we conclude that substantial hedging takes place among higher-ownership managers to offset the options' impact, but that the awards succeed in raising the incentive exposure of lower-ownership managers.

We next examine the impact of option exercises on stock ownership, studying in Panel A of Table II the full cohort of 6,325 person-year observations during which executives exercise options to acquire stock. Our null hypothesis is that managers retain these shares, implying a coefficient of one. As shown in the second column of Panel A, the estimate is instead below zero: -0.132, which is significantly different from the null hypothesis below the 1 percent level but not significantly different from zero. This estimate implies that executives retain approximately none of the shares acquired on the exercise of options. Although striking, the result is not surprising given other research (e.g., Huddart and Lang (1996)) suggesting that most option

[4] Even more managers would fall into this category if we assumed that the quantity of shares needed to hedge an option award equaled the number of options awarded multiplied by the hedge ratio of approximately 0.60.

exercises occur long before expiration. The extreme pattern of early exercises is puzzling, but one would not expect managers to exercise options early without also wanting to divest the underlying stock.

Managers' heavy selling of shares acquired from exercising options can be explained partly through tax and liquidity effects; executives probably sell some stock to finance the exercise price and to meet income tax liabilities triggered by the exercise. However, since the exercise price is only a portion of the value of the stock acquired, and since taxes are calculated only as a fraction of the stock value above the exercise price, these effects do not require selling anywhere near 100 percent of the shares acquired. Moreover, executives can sometimes defer tax liability by holding the stock acquired by exercising options (Scholes and Wolfson (1992)).

Information effects may present a more plausible explanation for selling after option exercises, as many executives may exercise options and liquidate their positions because they believe the stock is overvalued. However, it seems unlikely that *all* option exercises are triggered for this reason, since many exercises take place due to information-neutral events such as retirements, job changes, and option expirations. Carpenter and Remmers (1998), in a comprehensive study of managerial option exercises from 1991 to 1995, fail to find evidence of abnormal company stock performance following exercises. Moreover, top executives should be reluctant to sell large amounts of stock under any conditions since investors may interpret the dispositions as negative signals about the firms' prospects.

A further possibility is that firms expect managers to sell all shares awarded under stock option plans, notwithstanding rhetoric about managerial ownership like that quoted in footnote 1. The widespread sponsorship of "cashless" option exercises by companies tends to support this conjecture, as does the frequent availability of cash-based "stock appreciation rights" as a substitute for options. If true, this would raise the issue of why companies do not simply pay managers in cash via bonus plans, such as phantom stock, that are linked to stock appreciation. Corporate liquidity constraints, accounting considerations (Matsunaga (1995)), and the possibility of joint tax savings between the manager and firm (Miller and Scholes (1982)) might explain some of the use of options, and firms might also use option plans as an indirect method of selling equity without the negative signals of seasoned equity offerings.[5]

We investigate restricted stock awards in regressions shown in the third column of Table II (both panels). In Panel A, we study the 2,769 managers receiving restricted stock who already own more shares than the number awarded. Within this group, substantial selling takes place during the award year, to a far greater degree than the sales contemporaneous with stock option awards. Since restricted shares count toward executives' total ownership, the null hypothesis is that stock holdings will rise by one for every

[5] We thank Diane Denis for this conjecture. Asquith and Mullins (1986) document the negative stock price effects of seasoned equity offerings.

restricted share awarded. The estimate for this coefficient is far below one, 0.056, significantly different from one at the 1 percent level but not significantly different from zero. This estimate implies that the typical executive sells shares equal to more than 94 percent of the restricted shares awarded. For the much smaller group of 415 managers who own less than the number of new shares awarded, results in Panel B still indicate sales of stock, albeit on a smaller scale. The coefficient estimate of 0.328, significantly different at the 1 percent level from both zero and one, implies that these managers sell approximately two shares of stock for every three restricted shares awarded.

In the rightmost column of Table II (both panels) we present estimates for regressions including all the key explanatory variables; for executives to be included in Panel A, they must own more shares than the sum of new options plus new restricted shares. The sign, magnitude, and significance of all coefficients remain similar when all variables enter the model, with one exception: The estimate for restricted stock in Panel A climbs from +0.056 to +0.532, and it is no longer statistically different from either zero or one. The change in the coefficient, which occurs when the sample is expanded to include some 5,400 additional observations in which zero restricted stock is awarded but some stock option activity takes place, again suggests collinearity exists among option awards, option exercises, and restricted stock awards.

In summary, we find different responses by low- and high-ownership managers who receive stock options and restricted stock. Low-ownership managers exhibit increased incentives, as they engage in little or no selling of stock. High-ownership managers, in contrast, sell substantial shares after receiving stock compensation, largely neutralizing the incentive change created by the new awards. As discussed in the sections below, our estimates associated with option awards and exercises appear robust to a wide variety of alternative models, while estimates associated with restricted stock awards do not exhibit as much consistency.

B. Three-Year Cumulative Analysis

In Table III we repeat the one-year analysis from Table II using cumulative three-year totals for stock compensation and ownership changes. This estimation has two purposes. First, the three-year analysis, covering 156 weeks, should greatly reduce any bias due to the discrepancy of approximately 10 weeks between the intervals in which compensation events and stock ownership changes are measured. Second, the analysis is free by construction of serial correlation of executives' annual observations. Three-year results in Table III are similar to Table II's analysis based on annual data, including estimates that imply little retention of shares acquired from exercising options and erratic estimates for ownership changes following awards of restricted stock. However, we find more dramatic evidence of selling by high-ownership managers after new option awards, as the estimate in Panel A lies near −1.0.

Table III

Change in Shares Owned and Stock-Based Compensation—Three-Year Total

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 3,364 executives who either exercised options or received options or restricted stock between 1993 and 1995. The dependent variable is the increase in the number of shares held by the executive. Independent variables are the number of stock options awarded, the number of shares acquired from the exercise of previously awarded options, and the number of shares of restricted stock awarded along with the company's stock return during the three-year period. The first column of the table indicates the null hypothesis for each regression coefficient. Heteroskedastic-consistent t-statistics appear below each variable in parentheses.

Dependent Variable		Three-Year Change in the Number of Shares		
Panel A: Executives with Greater Share Ownership than the Number of New Shares Awarded, and All Option Exercise Events				
Intercept (000)		16.731	41.653[c]	6.671
		(0.55)	(1.89)	(0.54)
Number of options awarded, 3-year total	$H_0 = 0$	−0.954[a]		
		(2.96)		
Number of options exercised, 3-year total	$H_0 = 1$		−0.119[d]	
			(0.68)	
Number of restricted shares, 3-year total	$H_0 = 1$			−0.327[f]
				(0.47)
Stock return during the 3-year period		−25.483	−36.251[a]	18.360
		(1.20)	(3.24)	(0.86)
Observations		1,053	2,080	797
Adjusted R^2		0.0560	0.0060	0.0000
Panel B: All Other Executives				
Intercept (000)			30.831[b]	41.324[a]
			(2.21)	(2.66)
Number of options awarded, 3-year total	$H_0 = 0$		0.154[c]	
			(1.75)	
Number of restricted shares, 3-year total	$H_0 = 1$			0.396[a,d]
				(3.06)
Stock return during the 3-year period			−12.499[c]	27.514
			(1.72)	(0.99)
Observations			2,010	264
Adjusted R^2			0.0123	0.0082

[a,b,c] denote significant differences from zero at the 1, 5, and 10 percent levels, respectively.
[d,e,f] denote significant differences from one at the 1, 5, and 10 percent levels, respectively, if $H_0 = 1$.

C. High and Low Ownership Executives

Our results suggest that executives sell previously acquired shares of stock soon after receiving new options or restricted stock, but that this behavior occurs only if a manager already owns sufficient shares. We study further the importance of executives' prior holdings by investigating the subsample of man-

Table IV

Small Relative to Large Stock Ownership

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 14,642 person-year observations between 1993 and 1995 for executives who either exercised options or received options or restricted stock. Results are presented here only for the subsamples of executives with greater share ownership than the number of new shares awarded, and all option exercise events. The models and analysis are identical to those presented in Table II, except that independent variables are interacted with indicators for whether the executive has high or low stock ownership. High and low stock ownership executives are divided according to the sample median dollar value of equity ownership, measured by stock price times the sum of shares and options owned. The first column of the table indicates the null hypothesis for each regression coefficient. Heteroskedastic-consistent *t*-statistics appear below each variable in parentheses.

Dependent Variable		Change in the Number of Shares		
Intercept (000)		−3.729	−2.349	−24.938
		(0.33)	(0.59)	(1.44)
Options awarded to low ownership executives	$H_0 = 0$	0.106		
		(0.43)		
Options awarded to high ownership executives	$H_0 = 0$	−0.655[b]		
		(2.35)		
Options exercised by low ownership executives	$H_0 = 1$		0.185[d]	
			(1.28)	
Options exercised by high ownership executives	$H_0 = 1$		−0.088[d]	
			(0.55)	
Restricted shares awarded to low ownership executives	$H_0 = 1$			1.104[a]
				(3.11)
Restricted shares awarded to high ownership executives	$H_0 = 1$			−0.006[d]
				(0.02)
Stock return during the year		9.924	0.266	81.885[b]
		(0.53)	(0.20)	(2.06)
Observations		6,486	6,220	2,725
Adjusted R^2		0.0150	0.0007	0.0032

[a,b,c] denote significant differences from zero at the 1, 5, and 10 percent levels, respectively.
[d,e,f] denote significant differences from one at the 1, 5, and 10 percent levels, respectively, if $H_0 = 1$.

agers who already own more shares than the number of new options or new restricted shares. Within this group, we segment the observations into "high ownership" and "low ownership" partitions demarcated by the median dollar value of executives' total equity holdings (shares plus options owned times the stock price, measured at the start of the year[6]). We interact indicator variables for these high and low subsamples with the explanatory variables for the regressions in Table II, decomposing each variable into two new ones. Results from reestimating the regressions on this basis appear in Table IV.

[6] Related variations of the definition of this variable do not affect the results meaningfully.

Considerable evidence in Table IV supports the conjecture that prior executive stock ownership influences managers' responses to new compensation. Selling of shares after option and restricted stock awards appears far more vigorous when managers belong to the high ownership half of this subsample; indeed, our results for these two variables appear to be driven entirely by managers in the upper ownership range. The dichotomous behavior between low and high ownership executives extends to the exercise of stock options, albeit less dramatically. We find low ownership executives retaining about 18.5 percent of the shares they acquire on exercise, whereas high ownership managers sell approximately all shares acquired. Further analysis, based on finer segmentation of ownership ranges, confirms that the tendency to sell shares after compensation awards grows in magnitude as ownership increases. For example, we analyze selling in the aftermath of option awards across ownership quartiles. Coefficient estimates across these quartiles indicate a monotonic pattern of greater selling as ownership rises: +0.06, +0.03, −0.17, −0.62 (the latter two coefficients are significant at the 5 percent level).

D. Robustness Tests

We explore whether our results exhibit heterogeneity among classes of executives and firm sizes. Table V presents estimates fitted over various subsamples of observations. We divide the table into two panels using the same ownership criteria introduced for Table II. The first two columns show estimates for CEOs and all other executives, and the final three columns show estimates for firms in the S&P 500, S&P MidCap 400, and S&P SmallCap 600. Although a few estimates lack significance or diverge from the overall pattern, the results show no systematic differences across the five subsamples. We again observe that higher-ownership managers appear to sell shares after receiving options, and lower-ownership managers exhibit mildly positive though insignificant ownership changes after option awards. Managers in all groups retain few shares acquired from exercising options and tend to sell shares when they receive restricted stock, though coefficient estimates for this latter variable vary considerably.

Further robustness tests also support our results; associated estimations are not reproduced in order to save space. We repeat the analysis in Table II after transforming the dependent and explanatory variables into (i) percentage ownership of the firm's equity, and (ii) the dollar value of equity. Coefficient estimates exhibit only minor changes. We also augment the basic model from Table II with three additional control variables: The executive's percentage ownership of the firm, the stock price at the start of the year, and the log of the market value of equity (a measure of firm size). Our estimates for managerial selling after stock option awards and exercises change immaterially after adding these controls, though the significance level of the coefficient on the option award variable for higher-ownership managers drops to the 12 percent level. However, we no longer find evidence

Table V

Various Subsamples

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 14,642 person-year observations between 1993 and 1995 for executives who either exercised options or received options or restricted stock. The regression model is identical to that in Table II. This table presents regression estimates over five subsamples. The left two columns present estimates for CEOs compared to all other executives. The right three columns present estimates for executives from large, mid-sized, and small firms as defined by Standard & Poor's. The first column of the table indicates the null hypothesis for each regression coefficient. Heteroskedastic-consistent t-statistics appear below each variable in parentheses.

Dependent Variable		Annual Change in the Number of Shares				
Subsample		Non-CEOs	CEOs	S&P 500	Mid-cap	Low-cap
Panel A: Executives with Greater Share Ownership Than the Number of New Shares Awarded, and All Option Exercise Events						
Intercept (000)		1.623	2.122	−20.023	9.396	−1.978
		(0.46)	(0.09)	(1.22)	(0.73)	(0.28)
Annual number of new options awarded	$H_0 = 0$	−0.552[a]	−0.747[c]	−0.338	−0.765[c]	−0.450[c]
		(5.01)	(1.77)	(1.42)	(1.77)	(1.79)
Annual number of options exercised	$H_0 = 1$	−0.042[d]	−0.158[d]	−0.237[d]	−0.117[d]	0.187[d]
		(0.66)	(0.64)	(0.72)	(0.41)	(1.15)
Annual number of restricted shares	$H_0 = 1$	0.080[d]	0.891	0.405	0.326[f]	0.931[b]
		(0.31)	(1.51)	(0.41)	(0.93)	(1.99)
Stock return during the year		−1.735	10.311	110.975	−36.225	−28.458[a]
		(0.19)	(0.23)	(1.59)	(0.82)	(3.26)
Observations		5,909	2,318	2,928	2,115	2,623
Adjusted R^2		0.0245	0.0125	0.0054	0.0244	0.0312
Panel B: All Other Executives						
Intercept (000)		5.415[a]	45.078[b]	6.576[a]	7.760	11.307[a]
		(8.09)	(2.43)	(2.91)	(1.04)	(3.54)
Annual number of new options awarded	$H_0 = 0$	0.004	0.029	0.042	0.108	0.007
		(0.37)	(0.59)	(1.51)	(1.16)	(0.16)
Annual number of options exercised	$H_0 = 1$	0.123[a,d]	0.059[d]	0.035[d]	−0.004[d]	0.179[d]
		(3.28)	(0.30)	(0.61)	(0.05)	(1.41)
Annual number of restricted shares	$H_0 = 1$	0.544[c]	0.230[c,d]	0.372[e]	0.385	0.457[f]
		(1.66)	(1.71)	(1.49)	(0.83)	(1.47)
Stock return during the year		0.604	55.811	15.512	22.378	6.823
		(0.43)	(1.38)	(1.51)	(1.02)	(1.24)
Observations		5,202	963	2,302	1,466	1,891
Adjusted R^2		0.0557	0.0000	0.0095	0.0023	0.0082

[a,b,c] denote significant differences from zero at the 1, 5, and 10 percent levels, respectively.
[d,e,f] denote significant differences from one at the 1, 5, and 10 percent levels, respectively, if $H_0 = 1$.

of managers selling shares after receiving restricted stock, as the coefficient in the third column, estimated at 0.056 in Table II, grows to an estimate near one. Among the additional variables, the executive's percentage owner-

ship appears to be a strong factor in predicting additional sales of stock because we obtain strongly negative and significant estimates for its coefficient in the higher-ownership subsample.

IV. Conclusions

We study how executives' stock ownership responds to awards of stock options and restricted stock, which are often touted by firms as instruments for increasing managers' performance incentives. Results indicate that managerial ownership evolves dynamically under the influence of two countervailing forces: boards' goals of increasing the incentive exposure of managers, and executives' desires to diversify their portfolios for risk reduction.

We find that when higher-ownership managers receive new options, they reduce the risk exposure created by the award by selling shares of stock they already own. Lower-ownership managers, in contrast, do not sell shares after receiving new options. When executives exercise options to acquire stock, nearly all of the shares are sold by the typical manager regardless of prior ownership. In some models, awards of restricted stock also lead to sales of previously owned shares, though regression estimates for this effect are erratic. Together, the results suggest that equity compensation succeeds in lifting the incentive levels of managers with low ownership. Higher-ownership managers, in contrast, appear to negate much of the impact of stock compensation by selling previously owned shares for diversification. The divergent results for low- and high-ownership executives imply that boards can use stock compensation to impose performance incentives only up to a threshold level; if boards want executives to have greater wealth exposure to the company's stock, they may need to place restrictions on managerial sales.

These results illuminate a tension between boards' incentive compensation strategies and executives' diversification goals, although we do recognize that numerous other forces also contribute to the complex process of determining managerial ownership. As suggested above, firms may acquiesce in large-scale managerial selling if shares are awarded as part of a tax-efficient compensation scheme that replaces more expensive cash compensation. Conversely, managers may retain shares and remain underdiversified if they fear that selling would send negative signals to investors. Further research might investigate such issues as how frequently boards of directors establish and enforce policies that require managers to maintain minimum ownership; how high these targets are, and whether they increase with a manager's service or position; what consequences, if any, are faced by managers who do not adhere to boards' ownership targets, or by companies whose boards do not establish such targets; and when is substantial selling by managers tacitly or overtly permitted by boards?[7]

[7] These topics have received some attention in the popular media; see *The Economist* (1999) and Bryant (1998).

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