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ABSTRACT

A longstanding puzzle in corporate finance is the rise of stock repurchases as a means of distributing earnings to shareholders. While most attempts to explain repurchase behavior focus on the incentives of firms, this paper focuses on the incentives of the agents who run firms, as determined by those agents' compensation packages. The increased use of repurchases coincided with an increasing reliance on stock options to compensate top managers, and stock options encourage managers to choose repurchases over conventional dividend payments because repurchases, unlike dividends, do not dilute the per-share value of the stock. Consistent with the stock option hypothesis, I find that firms which rely heavily on stock-option-based compensation are significantly more likely to repurchase their stock than firms which rely less heavily on stock options to compensate their top executives. I find no such relationship between repurchases and restricted stock, an alternative form of stock-based compensation that, unlike stock options, is not diluted by dividend payments. These findings have implications for the study of other puzzles concerning firms' payout behavior, and for the study of the effects of executive compensation packages on managerial incentives.

Christine Jolls
Harvard Law School
Harvard University
Griswold 504
Cambridge, MA 02138
and NBER
jolls@law.harvard.edu

1 Introduction

One of the most dramatic changes in corporate finance over the past twenty years has been the growth of stock repurchases as a means of distributing earnings to shareholders. Repurchasing firms use cash to buy back shares of their own stock, thereby transferring earnings to shareholders by a means other than a conventional dividend. Repurchases have risen substantially since the late 1970s, averaging 25.6 percent of total cash distributions in 1992-1996, compared to 7.1 percent over 1975-1979. Like much about firms' payout policies – such as why they choose to pay dividends – the causes of this increase in repurchase activity have proven elusive (see *Brookings Papers* 1987; Bagwell and Shoven 1988).

This paper attempts to shed light on the repurchase phenomenon by looking at the decision to repurchase stock from the perspective of the agents making that decision – the managers who run large firms. Because ownership and control are divided between shareholders and managers in such firms, shareholders may find it in their interest to use incentive compensation to align managers' financial interests with their own. Modern forms of stock-based compensation – especially the modern stock option, now used by most firms – began to appear with increasing frequency in the late 1970s, as companies recognized the shortcomings of traditional forms of performance-based pay (McLaughlin 1991, 9-10; Bok 1993, 44). But stock-option-based compensation may affect more than managerial incentives to maximize shareholder returns. Stock options may have the additional effect of encouraging managers to choose repurchases over dividends. The reason is that repurchases, unlike dividends, do not dilute the per-share value of the firm; the outflow of earnings is matched by a proportionate reduction in the number of outstanding shares. As a consequence, stock

options, which give holders the right to purchase stock at pre-specified prices, are worth more after a repurchase than after a dividend. (To illustrate: if a firm worth $100 has 10 shares outstanding and distributes $10 by paying a dividend of $1 per share, its shares will be worth $9 each after the distribution (ignoring signaling and other effects). If the $10 is instead used to repurchase one share of stock, then the firm's remaining 9 shares will be worth $10 each, just as before the distribution.)

The attractiveness of the repurchase route stems from the fact that executives who hold stock options do not (except in very rare cases) share in the dividends paid by the firm. For an executive holding actual stock in the firm, the preference for repurchases would not arise, since the executive would receive the dividend paid on the stock. Likewise, the preference for repurchases would not arise if either the number of stock options held by the executive or the exercise price associated with those options were adjusted in response to the repurchase decision. However, such adjustments are not made.

Several authors have noted that stock options held by executives reduce the attractiveness of dividends to these individuals (Lambert, Lanen and Larcker 1989; Buyniski 1991, 291; Defusco, Zorn and Johnson 1991). However, the implications of stock options for managers' decisions about repurchases have not been explored previously. (In a recent paper written after the first draft of this paper had circulated, Fenn and Liang (1997) examine the effect of *employee* stock options (as opposed to options held by top executives) on repurchase behavior. My findings on the explanatory power of employee stock options, in contrast to executive stock options, are discussed below.) The magnitude of repurchase distributions suggests that the implications of executive stock option holdings may be significant: the average dollar amount at stake for an executive in a typical repurchase decision is approximately $350,000.

This paper provides an empirical test of the hypothesis that stock options held by top executives encourage these individuals to choose repurchases over dividends. Stock option data made available by the 1992 SEC disclosure requirements enable precise measurement of the number of outstanding options held by top executives. Using this data, I test the basic prediction of my model of the repurchase decision: that firms managed by executives with large numbers of stock options will be more likely to repurchase their stock than otherwise similarly situated firms. The results provide substantial support for the stock option hypothesis. Controlling for other factors, repurchases are significantly more likely when executives have many stock options than when they have few. The data also suggest that the relationship between repurchases and stock options is not a reflection of a more general link between repurchases and executive pay. I find, for example, that there is a negative relationship between repurchases and restricted stock – an alternative form of stock-based compensation that (unlike stock options) accrues dividends and thus does not generate a preference for repurchases over dividends. The data further suggest that the relationship between repurchases and stock options is not due to the need to repurchase shares in order to fund option programs; I find that executive options, and not employee options generally, play a role in explaining repurchase behavior. The magnitude of the stock option effect suggests that increased use of executive stock options since the late 1970s may have played a significant role in the increase in repurchase activity since that time.

Other factors – including taxes – also favor repurchases over dividends, but these factors are harder to link up with the upsurge in repurchases over the past two decades. Tax considerations have for decades made repurchases more attractive than dividends, but the main increase in repurchase activity occurred relatively recently. Similarly, while a significant frac-

tion of the repurchase activity in the mid- to late 1980s may well have been related to hostile takeovers (see Denis 1990; Bagwell 1991), repurchase distributions remained more than twice as high in 1991-1993, after the hostile takeover market slowed down, than they were over 1979-1983, before hostile takeovers heated up. (Acquisitions, meanwhile, were roughly fifty percent higher in 1979-1983 than in 1991-1993.) A fair question is whether the quietness in the hostile takeover market during the early 1990s reflected the success of takeover defense strategies, including repurchases; but the reemergence of hostile takeovers more recently suggests that target firms have not mastered the secret of avoiding hostile takeover threats. Thus, both taxes and takeovers seem to leave room for additional explanations of the upsurge in repurchase activity over the last two decades.

In linking repurchases to the use of stock options in executive compensation packages, this paper draws on the insights of agency theory to illuminate repurchase behavior. From an agency perspective, it is unsurprising that firms' payout decisions apparently depend not only on the effects of the alternatives on shareholders, but also on the implications for those making the payout decisions. My findings suggest that other puzzles about firms' payout policies – such as the motivation for paying dividends – may also be explained in part by the existence or consequences of the agency relationship between shareholders and managers. My findings also point to the importance of distinguishing between different forms of incentive-oriented pay. While the empirical literature on incentive pay typically – and perhaps often appropriately – treats such pay as a monolithic category (see, for example, Jensen and Murphy 1990a; Jensen and Murphy 1990b; Garen 1994), there are certain situations, such as the one considered in this paper, in which it is important to distinguish between stock options and other types of performance-based compensation.

The remainder of the paper is organized as follows. Section 2 describes my model of the repurchase decision. Section 3 discusses the sample of firms used in the empirical analysis. Section 4 reports my empirical results, and section 5 discusses alternative explanations for my findings. Finally, section 6 concludes.

2 A Model of the Repurchase Decision

2.1 Framework

A firm with N_0 shares outstanding and stock price p_0 chooses an amount $d \geq 0$ by which to increase its dividend and an amount $r \geq 0$ of stock to repurchase at price p_r. I focus on dividend increases, rather than the simple decision to pay a dividend, because firms appear to be very reluctant to eliminate or cut existing dividends (see Marsh and Merton 1987: 5-6). The total amount distributed by the firm is at most L.

The choices of d and r are made by the firm's top managers, who hold q_T stock options with exercise prices p_q, $q = 1, ..., q_T$. The distributions occur in period 1. In period 2 the managers exercise their stock options and realize an aggregate gain of $\sum_{q=1}^{q_T} \max\langle p_1 - p_q, 0\rangle$, where p_1 is the price of the firm's stock at the end of period 1 (after the dividend and repurchase distributions). I assume that $p_1 - p_q$ is nonnegative for all q, based on the frequency with which "out-of-the-money" options ($p_1 < p_q$) are repriced in managers' favor. (In my sample, virtually all of the executives had option packages with positive values.)

Managers choose distribution levels d and r to maximize the value of their objective function. Following Stein (1989), I model the managerial objective function as a weighted average of shareholder-value and manager-value components. Specifically, I assume that

managers maximize a weighted average of (i) their estimate of the value of the dividend and repurchase distributions to shareholders; (ii) the firm's market value after the distributions; and (iii) the value of the managers' stock options (given $p_1 \geq p_q$):

$$\Pi = \lambda_1 \underbrace{(\pi_d d + \pi_r r)}_{(i)} + \lambda_2 \underbrace{[N_0 p_0 + \Phi_d d + \Phi_r r - d - r]}_{(ii)} + (1 - \lambda_1 - \lambda_2) \underbrace{\sum_{q=1}^{qT} (p_1 - p_q)}_{(iii)}, \qquad (1)$$

where:

π_d = managers' estimate of value to shareholders of amounts distributed via dividends,
π_r = managers' estimate of value to shareholders of amounts distributed via repurchases,
Φ_d = percent increase in the firm's value associated with distribution of one percent of its initial value in a dividend increase,
Φ_r = percent increase in the firm's value associated with repurchase of one percent of its outstanding stock,
λ_1, λ_2 = decision weights.

Managers look to their estimate of the value of dividend and repurchase distributions to shareholders, rather than to the actual values of those distributions, because the actual values depend on the individual tax situations of shareholders – something about which managers will generally have no information.[1]

2.2 Derivation of the optimal decision rule

Because the actual act of repurchasing shares (following the announcement of the repurchase) conveys no new information, the repurchase price should equal p_1 (the post-distribution price). p_1 in turn is given by the total market value of the firm after the

[1]The model reflected in (1) does not attempt to capture the complexities of hostile takeover threats as a factor in repurchase decisions. As noted earlier, Denis (1990) and Bagwell (1991) link repurchases to such threats. However, in the period I study (the early 1990s), hostile takeovers were relatively rare. While my model does not embrace the takeover factor, I discuss this factor from an empirical perspective in section 5.4 below.

repurchase and dividend distributions divided by the number of shares outstanding after those distributions:

$$p_1 = \frac{N_0 p_0 + \Phi_d d + \Phi_r r - d - r}{N_0 - (r/p_1)}. \tag{2}$$

Solving (2) for p_1, substituting in the objective function in (1), and differentiating with respect to d and r:

$$\frac{\partial \Pi}{\partial d} = \lambda_1 \pi_d + \lambda_2(\Phi_d - 1) + (1 - \lambda_1 - \lambda_2) q_T \left(\frac{\Phi_d - 1}{N_0}\right); \tag{3}$$

$$\frac{\partial \Pi}{\partial r} = \lambda_1 \pi_r + \lambda_2(\Phi_r - 1) + (1 - \lambda_1 - \lambda_2) q_T \left(\frac{\Phi_r}{N_0}\right). \tag{4}$$

The derivatives in (3) and (4) reflect the marginal benefits from dividend and repurchase distributions respectively. Because the derivatives do not vary with d and r, the solution to the problem of maximizing (1) subject to $d \geq 0$, $r \geq 0$, and $d + r \leq L$ takes the following very simple form:

$$\left\{ \begin{array}{cl} d = L, r = 0 \text{ (“dividend”)} & \text{if } \partial\Pi/\partial d > \partial\Pi/\partial r \text{ and } \partial\Pi/\partial d \geq 0 \\ d = 0, r = L \text{ (“repurchase”)} & \text{if } \partial\Pi/\partial r > \partial\Pi/\partial d \text{ and } \partial\Pi/\partial r \geq 0 \\ d = 0, r = 0 \text{ (“neither”)} & \text{if } \partial\Pi/\partial d < 0 \text{ and } \partial\Pi/\partial r < 0 \\ d = z, r = L - z \text{ (“both”)} & \text{otherwise} \end{array} \right\}, \tag{5}$$

where $0 \leq z \leq L$. Rewriting (5) in regression form:

$$\left\{ \begin{array}{cl} \text{dividend increase} & \text{if } \delta_0 x + \epsilon_0 > \delta_j x + \epsilon_j, j \neq 0 \\ \text{repurchase} & \text{if } \delta_1 x + \epsilon_1 > \delta_j x + \epsilon_j, j \neq 1 \\ \text{neither} & \text{if } \delta_2 x + \epsilon_2 > \delta_j x + \epsilon_j, j \neq 2 \\ \text{both} & \text{if } \delta_3 x + \epsilon_3 > \delta_j x + \epsilon_j, j \neq 3 \end{array} \right\}, \tag{6}$$

where $\delta_0 x = \partial\Pi/\partial d$, $\delta_1 x = \partial\Pi/\partial r$, $\delta_2 = 0$, and $\delta_3 = \mu\delta_0 + (1 - \mu)\delta_1$ for weights μ

and $(1-\mu)$. With the disturbance terms ϵ_j independently and identically distributed with extreme value distribution $\Pr(\epsilon_j \leq \epsilon) = exp\{exp\{\epsilon\}\}$, (6) gives rise to the standard multinomial logit model, where the probability of alternative j, $j = 0,1,2,3$, is $P_j = exp\{\delta_j' x\} / \sum_{k=0}^{3} exp\{\delta_k' x\}$.[2]

2.3 Explanatory variables

The values of $\delta_0 x$ and $\delta_1 x$ in the above regression model depend on the values of λ_1, λ_2, π_d, π_r, Φ_d, Φ_r, and q_T/N_0 from the derivatives in (3) and (4). Within this set, λ_1 and λ_2 are parameters to be estimated, and the remainder depend on characteristics of the firm. The variable q_T/N_0 is straightforward to compute; it is simply the number of options held by top executives divided by the total number of shares outstanding. Since 1992, this information has been publicly available on proxy statements.

The remainder of the components listed above require further discussion. Managers' estimates of the value to shareholders of amounts distributed via dividend increases and repurchases – given by π_d and π_r – could be set equal to a common constant, based on managers' inability to determine what the tax consequences of a dividend versus a repurchase distribution would be for the firm's various shareholders. A less restrictive approach, however, is to allow these variables to depend on the proportion of tax-exempt shareholders in the firm, something that managers are likely to have good information about. If a firm

[2]An alternative formulation of the model presented here would have managers first choosing whether to make a distribution and then, if they opted to do so, then choosing the degree to which each mode of distribution (dividend increase and repurchase) would be used. This formulation would yield a nested logit model rather than a multinomial logit model. Specification checks of the multinomial logit model, however, suggest that it is correctly specified (see section 4.3 below).

has many tax-exempt shareholders, then the average advantage conferred by a repurchase (which typically results in taxation only on the difference between the repurchase price and shareholders' bases, rather than on the whole distribution (Bagwell and Shoven 1988)) will be less significant. I use the proportion of shares held by institutional investors to measure the proportion held by tax-exempt shareholders.[3]

The effect of dividend and repurchase distributions on firm value, measured by Φ_d and Φ_r, is likely to depend on several characteristics of the firm. First, distributions should be more likely to have a positive effect on firm value when the firm's future earnings are strong. Distributions are less costly for firms with strong future cash flows. For this reason, dividends and repurchases are means of signaling good future earnings prospects (see, for example, Ofer and Siegel 1987; Bartov 1991; Dann, Masulis and Mayers 1991). Dividends and repurchases need not have equal signaling power; dividends may have greater power because they are more costly tax-wise (Bernheim and Wantz 1995). The greater cost of dividends may mean that future earnings have a greater influence on the relationship between dividends and firm value than on the relationship between repurchases and firm value.

The effect of dividend and repurchase distributions on firm value may also be influenced by the relative value of funds in managers' and shareholders' hands. Jensen (1986) argues that managers often use corporate funds to make negative net present value investments. If this is correct, then distributions should have a greater (positive) effect on firm value when the firm has a low value of Tobin's q (the ratio of market value to book value) than when it has a high q. The existing evidence here is mixed (see Lang and Litzenberger 1989; Howe,

[3]Not all institutional investors are tax-exempt. However, I am not aware of any data source that distinguishes between taxable and tax-exempt institutional investors on a firm-by-firm basis.

He and Kao 1992).

A final variable that may affect the relationship between dividend and repurchase distributions and firm value is the firm's debt-equity ratio. Distributions reduce the outstanding equity of the firm and thus increase the debt-equity ratio. This increase will enhance firm value if the initial debt-equity ratio was below the optimum for the firm and will reduce firm value if the initial ratio was above the optimum. However, the difference between the pre-distribution ratio and the optimum is not generally observable. Thus, following Bagwell and Shoven (1988), I include the pre-distribution debt-equity ratio as an explanatory variable.

The ultimate vector of explanatory variables is obtained by substituting for π_d, π_r, Φ_d, Φ_r, and q_T/N_0 in (3) and (4). The explanatory variables are as follows:

expression	*explanatory variables*
π_d, π_r	proportion of shares held by institutional investors
Φ_d, Φ_r	future operating income as a percent of assets Tobin's q debt-equity ratio
q_T/N_0	average executive options as a percent of shares outstanding

I use the average level of executive options outstanding, rather than the total number of options held by top executives, in computing q_T/N_0, since the total number of options will reflect the number of executives covered by the proxy statement reporting requirements as well as the intensity of stock option use (which is the variable of interest). Table 1 gives definitions and data sources for each of these explanatory variables, as well as for additional variables included in alternative specifications of the basic model.

3 Sample

Under a new SEC rule enacted in 1992, all firms covered by SEC disclosure requirements whose 1992 fiscal years ended between December 31, 1992, and May 31, 1993, were required to report 1992 fiscal-year-end stock option holdings on their 1993 proxy statements. The vast majority of firms have December 31 fiscal year-ends, so 1992 fiscal-year-end option information is available for a large proportion of all firms. Proxy statements for firms with fiscal-year-end assets less than $25 million are generally not available in public databases, so I do not include such firms in my sample. The sample also does not include foreign firms and firms with fewer than 500 shareholders of record because such firms are not required to file proxy statements with the SEC. Firms for which information on total assets and shareholders of record at 1992 fiscal year-end was not available from the Compustat database were treated as not meeting the size criteria. The total number of firms in the sample is 2539.

Within this sample, I am interested in the dividend-increase and repurchase behavior of firms during their 1993 fiscal years (based on 1992 fiscal-year-end option levels). Of the firms in the sample, 97 announced dividend increases during their 1993 fiscal years, 53 announced repurchases, and 27 announced both dividend increases and repurchases, all as reported by the *Wall Street Journal*. I limited the repurchase category to repurchases open to shareholders at large; negotiated repurchases involving a single substantial shareholder were excluded. I also excluded repurchases with the stated goal of buying out small shareholders or acquiring shares for pension plan or similar purposes. Because the value of my dependent variable turns only on whether the firm undertook a repurchase (and not on the magnitude of the repurchase activity undertaken), the common practice of repurchasing fewer shares

than the number indicated in the announcement does not affect my analysis.

The size of the initial sample made it impracticable to obtain stock option and other compensation information – which I compiled manually from individual proxy statements – for every firm in the sample. My approach was therefore to obtain stock option and other compensation information for all of the dividend-increase, repurchase, and dividend-increase-and-repurchase firms in the sample, and for a random subsample of 300 of the firms that announced neither a dividend increase nor a repurchase, and then to use a choice-based estimation procedure (described below). Firms that announced neither a dividend increase nor a repurchase are referred to as "retention" firms.

For the firms in this sample, the proxy databases on Lexis/Nexis and Laser D SEC yielded proxy statements for 96 of the 97 dividend-increase firms, all of the repurchase firms, 263 of the 300 retention firms, and all of the dividend-increase-and-repurchase firms. Of these, Compustat lacked necessary information for seven of the dividend-increase firms, eight of the repurchase firms, 50 of the retention firms, and two of the dividend-increase-and-repurchase firms. Of the remaining firms, Standard and Poor's lacked institutional investor data (needed for the institutional shareholding variable) for three of the dividend-increase firms, one of the repurchase firms, 43 of the retention firms, and one of the dividend-increase-and-repurchase firms. My ultimate sample thus consists of 86 dividend-increase firms, 44 repurchase firms, 170 retention firms, and 24 dividend-increase-and-repurchase firms. The total number of firms in the sample is 324. Summary statistics are contained in table 2.

The difference in the availability of data for firms with dividend-increase or repurchase activity and firms in the retention category is largely a function of the difference in firm size between the two categories. As the market-value statistics in table 2 indicate, the average

firm in the retention category (based on firms for which data is available) is substantially smaller than the average firm in the other categories. (The retention average is closest to the repurchase average, but the standard deviation of the retention average is much larger, and, consistent with this difference, approximately 25 percent of the firms in the retention category have market values less than $100 million, compared to only 11 percent of the firms in the repurchase category.) Because the unavailability of data for many firms in the retention category thus seems likely to reflect a size-based truncation effect, I include market value as an explanatory variable in one of the alternative specifications discussed below.

4 Results

The basic empirical relationship between stock options and repurchases can be seen in table 2. Row 5 shows the average level of executive stock options at firms in the dividend-increase, repurchase, retention, and dividend-increase-and-repurchase categories. The level of options is over twice as high at firms in the repurchase category as at firms in the dividend-increase category. This finding provides preliminary support for the stock option hypothesis, which predicts that managers with large stock option holdings will be more favorably inclined toward repurchases than managers with small stock option holdings.

Another interesting feature of table 2 is that the level of stock options at firms in the retention category – like the level of options at repurchase firms – is much higher than the level of options at dividend-increase firms. This finding provides further support for the stock option hypothesis. This is so because the basis for the preference for repurchases under that hypothesis – that, unlike dividend increases, they do not dilute the value of outstanding

options – applies to retention as well; retention also does not dilute option values.

4.1 Regression results: stock options

The relationships suggested by the means in table 2 are confirmed by regression results. To facilitate interpretation of the results, I renormalize the model developed above so that the benchmark choice – whose coefficients are normalized to zero – is the dividend-increase alternative, rather than the retention alternative (the benchmark in the original model). The coefficients for the other choices then reflect the effects of the explanatory variables on those choices relative to their effects on the dividend-increase alternative. The renormalized regression model is given by:

$$\left\{ \begin{array}{cc} \text{dividend increase} & \text{if } \beta_0 x + \epsilon_0 > \beta_j x + \epsilon_j, j \neq 0 \\ \text{repurchase} & \text{if } \beta_1 x + \epsilon_1 > \beta_j x + \epsilon_j, j \neq 1 \\ \text{neither} & \text{if } \beta_2 x + \epsilon_2 > \beta_j x + \epsilon_j, j \neq 2 \\ \text{both} & \text{if } \beta_3 x + \epsilon_3 > \beta_j x + \epsilon_j, j \neq 3 \end{array} \right\},$$

where $\beta_0 = 0$, $\beta_1 = \delta_1 - \delta_0$, $\beta_2 = -\delta_0$, and $\beta_3 = (1-\mu)(\delta_1 - \delta_0)$.

As noted above, the sample of firms I use is choice-based. Amemiya and Vuong (1987) show that in that case the likelihood function to be maximized is $\prod_{i=1}^{N} P_{j_i} Q_{j_i}^{-1} H_{j_i}$, where N is the number of observations in the sample; P_{j_i} is the probability of the alternative j chosen by i ($P_{j_i} = exp\{\delta_j' x_i\} / \sum_{k=0}^{3} exp\{\delta_k' x_i\}$); Q_{j_i} is the probability across the population of the alternative j chosen by i; and H_{j_i} is the probability in sample of the alternative j chosen by i. Manski and McFadden (1981) show that consistent estimates of the coefficient vectors β_j are obtained by maximizing:

$$\sum_{i=1}^{N} \ln\left(\frac{P_{j_i} Q_{j_i}^{-1} H_{j_i}}{\sum_{j=0}^{J-1} P_{j_i} Q_{j_i}^{-1} H_{j_i}}\right).$$

The upper panel of table 3 reports coefficient estimates both with and without the interaction terms in the model ($\Phi_d(q_T/N_0)$ and $\Phi_r(q_T/N_0)$). The interaction terms reflect the fact that the effect of executive stock options on repurchase behavior in the model depends not only on the number of options held by managers (the direct effect), but also on the price of the firm's stock after the dividend and repurchase distributions (since this is the price at which options are exercised). However, as comparison of the maximized log likelihoods for the regressions with and without the interaction terms reveals, those terms contribute very little to the explanatory power of the model. Including the interaction terms also has relatively little effect on the estimated coefficients for the other explanatory variables (apart from (not surprisingly) the options variable), and, in addition, all but one of the estimated coefficients on the interaction terms are statistically indistinguishable from zero. Therefore, to aid in interpreting the effect of the executive options variable, I focus on specifications without the interaction terms.

Column 4 in the upper panel of table 3 gives the effects of the explanatory variables on repurchases relative to their effects on the dividend-increase choice. Columns 5 and 6 give the effects of the explanatory variables on the retention and dividend-increase-and-repurchase alternatives, again relative to the dividend-increase option. As column 4 indicates, executive stock options have a positive and statistically significant effect on repurchases, consistent with the raw correlation in these variables discussed above. (All tests of statistical significance are two-tailed tests at the five percent level.) Likewise, executive options have a positive and

statistically significant effect on retention, and the estimated coefficient is close in magnitude to the estimated coefficient on the options variable in the repurchase equation, suggesting that the same economic effect underlies the options-retention relationship as underlies the options-repurchase one. All of these findings are consistent with the stock option hypothesis.

Is the stock option hypothesis behaviorally plausible? That is, how likely is it from a behavioral perspective that decisions about repurchases versus dividend increases may be influenced by option holdings? A calculation of the amount that the average executive in a firm that did a repurchase in 1993 had at stake in the choice between a repurchase and a dividend increase suggests that a behavioral effect is plausible. If the average executive in such a firm had chosen instead to distribute the same amount via a dividend increase, the executive's stock option portfolio would have been worth $345,000 less as a result of the dilution caused by the dividend distribution. It bears noting that this mean value of the amount at stake in the choice between a repurchase and a dividend increase significantly exceeds its median, indicating that a few high-option, high-repurchase firms are pulling up the average; but even the median value of the amount-at-stake variable is $74,000, not a trivial sum for most executives.

Converting the coefficient estimates in the upper panel of table 3 into estimated marginal effects allows us to understand the economic magnitude of the effect of executive stock options on repurchases. The bottom panel of table 3 reports estimated marginal effects for the model. The estimated effect of a one unit increase (approximately one standard deviation) in the options variable on the probability of a repurchase is 0.256. Meanwhile, the estimated effect of a one unit increase in the options variable on the probability of the dividend-increase-and-repurchase alternative is -0.087; the net effect on the probability of observing a repurchase

is thus 0.169. This figure implies that if the average number of stock options held by top executives increases 50 percent from its mean value of 116,060 (see column 6 of table 2) while the number of outstanding shares remains constant at the mean value (23,305,221) implied by the mean of the options variable,[4] then the probability of observing a repurchase increases by approximately four percentage points (0.169 * (174,090*100/23,305,221 - 0.498) = 0.042). This represents a 131 percent increase over the proportion of firms (80/2539, or .032) engaging in repurchases in the original sample.

The magnitude of the stock option effect implies that the increase in the use of modern executive stock options since the late 1970s may have played a significant role in the increase in repurchase activity since that time. For instance, if the average value of the options variable in the 1993 sample represents a doubling of the 1979 figure, then the corresponding increase in the proportion of repurchasing firms would be 0.042 (0.169 * (0.498 - 0.249)). This is larger than the actual proportion (0.032) of repurchasing firms in the 1993 sample. Of course, many factors other than stock options undoubtedly changed over the 1979-1993 period; for instance, debt-equity ratios, which my results suggest are negatively related to repurchases (see below), rose significantly over that period. Without an explicitly longitudinal analysis, it is not possible to ascertain the exact magnitude of the stock option effect on repurchase behavior over time. Nevertheless, my results suggest the possibility that increased use of stock options beginning in the late 1970s has been a substantial factor in the rise in repurchase activity since that time.

[4]The mean value of shares outstanding implied by the mean of the options variable is the value s defined by $116{,}060/s = .498/100$ (where .498 is the mean of the options variable).

4.2 Regression results: other variables

Table 3 reveals that the proportion of shares held by institutional investors has a positive and statistically significant effect on repurchase and dividend-increase-and-repurchase behavior, relative to its effect on the benchmark alternative of a dividend increase. It has no significant effect on retention behavior relative to that benchmark. This pattern of results is largely consistent with the managerial empire-building theory, which suggests that retention of earnings reflects an agency problem between managers, who want to keep funds within the firm, and shareholders, who want funds distributed. The presence of institutional investors may mitigate this agency problem, due to these investors' greater control over managers. Greater distribution of funds may thus occur with higher concentrations of institutional investors. The fact that distributions occur through the repurchase and dividend-increase-and-repurchase routes rather than through the pure dividend-increase route may reflect a higher degree of "savvy" – and thus a greater propensity to rely at least in part on the repurchase mode of distributing earnings – among firms with high proportions of institutional investors. It is also possible that these firms have some institutional investors who are not tax-exempt, and that these investors successfully lobby managers for repurchases instead of (or at least in addition to) dividend increases.

The estimated coefficient on the operating income variable in table 3 is negative and statistically significant in the retention equation and is not statistically significant in the other equations, implying that firms with low next-period earnings are less likely to engage in repurchase and dividend distributions, as opposed to retaining earnings, than firms with high earnings. These findings are precisely what would be predicted by the signaling effect

described above. The estimated coefficient on q is not significantly different from zero in any of the equations, perhaps due to the difficulty of measuring it accurately. Finally, the debt-equity ratio has a negative and statistically significant effect on repurchase behavior, no significant effect on retention behavior, and a positive and statistically significant effect on dividend-increase-and-repurchase behavior.

Table 4 indicates the degree to which the overall model succeeds in predicting firms' choices between the four alternatives. The model predicts 83 of the 86 dividend-increase choices, 15 of the 44 repurchase choices, 3 of the 170 retention choices, and 4 of the 24 dividend-increase-and-repurchase choices. Obviously, the predictions are more accurate for some alternatives than for others. In terms of overall predictive ability, the model predicts dividend increases for proportionally more of the dividend-increase firms than firms choosing other options (83/86 as opposed to 28/44, 32/170, and 20/24); predicts repurchases for proportionally more repurchase firms than firms choosing other options (15/44 versus 1/86, 33/170, and 0/24); predicts retention for proportionally more retention firms than firms choosing other options (3/170 versus zero for all other options); and predicts the dividend-increase-and-repurchase alternative for proportionally more dividend-increase-and-repurchase firms than firms choosing other options (4/24 versus 2/86, 1/44, and 2/170). Thus, the model appears to have some overall predictive power, though in absolute terms it predicts the dividend-increase and repurchase choices much more accurately than the retention and dividend-increase-and-repurchase choices.

4.3 Specification check

An underlying assumption of the multinomial logit model is that the choice alternatives (dividend increase, repurchase, etc.) are independent of one another. This assumption may be tested by omitting various subsets of the four choice possibilities in the original specification and examining whether the omissions produce changes in the estimated coefficients for the remaining choices (Hausman and McFadden 1984). Performing this test, I find that none of the estimated coefficients in the reduced models differs from its counterpart estimate in the original model by less than twice the standard error in the alternative specification. These results suggest that the independence-of-alternatives assumption is satisfied.

5 Alternative explanations for options-repurchase link

The results described above suggest that executive stock options play an important role in repurchase decisions, as predicted by the stock option hypothesis. However, there are several possible alternative explanations for this finding. The present section describes the alternative explanations and discusses evidence that supports the stock option hypothesis relative to each alternative explanation. The alternative explanations are (1) that the relationship between stock options and repurchases exists because of firms' need to repurchase shares in order to fund their stock option programs; (2) that the relationship between stock options and repurchases is simply a species of a more general link between repurchases and executive pay (or at least incentive pay); (3) that the relationship between stock options and repurchases results from shareholders' explicit use of option levels to encourage or discourage repurchases for some independent reason; and (4) that the relationship between stock options

and repurchases reflects an underlying connection between options and an omitted explanatory variable not linked to an explicit attempt by shareholders to encourage or discourage repurchases. These explanations are considered in turn.

5.1 Use of repurchases to fund stock option plans

One alternative explanation for the observed relationship between stock options and repurchases is that firms whose executives hold large numbers of options may find it necessary or desirable to repurchase shares in order to fund their option programs. Once a recipient of options decides to exercise those options, the firm must have shares on hand to distribute if the option holder so desires. (Option holders often simply take the cash value of the option, equal to the difference between the market price and the exercise price. In this case options create no need to repurchase shares.) The option-funding hypothesis for repurchases generates a clear prediction about the effect of total outstanding options at the firm versus options held by top executives: the former, not the latter, should be the better predictor of repurchase behavior. Under the stock option hypothesis, in contrast, the relevant variable is the number of options held by the repurchase decision makers – the executives of the firm.

Unfortunately, proxy statements do not report the total number of outstanding options at the firm; they report only the number of outstanding options held by top executives. Information on option grants in the preceding year, however, is reported on both a firm-wide and an executive-only basis. The number of options granted in the preceding year is obviously an imperfect measure of the underlying variable of interest, which is the total number of outstanding options. However, as the first three columns of table 5 reveal, using

the average number of options granted to top executives in the preceding year, instead of the average number of options outstanding in those executives' hands at the end of the year, does not alter the earlier conclusion that executive options have a positive and statistically significant effect on repurchases. Adding the total-option-grants variable to this regression then allows us to measure the role of total employee options compared to the role of executive options. The last three columns of table 5 show that while executive options continue to have a positive and significantly significant effect on repurchases in the expanded regression, total employee options have a statistically insignificant effect on repurchases, with a negative point estimate. This finding indicates that it is executive stock options, rather than employee stock options more generally, that influence repurchase decisions.[5]

5.2 General link between repurchases and executive pay

A second alternative to the stock option hypothesis for explaining the observed relationship between executive stock options and repurchases is that repurchase behavior is correlated with executive pay generally (or with the incentive-oriented component of such pay). Firms with highly-paid executives might be "savvy" firms that are more likely to engage in repurchases. To test for this possibility, I examine whether forms of compensation other than stock options affect repurchases in the way that stock options do.

Restricted stock – stock that vests if certain performance targets are met – provides a particularly good control for stock options because it is similar to stock options in that both

[5]Fenn and Liang (1997) find that employee stock options have a positive effect on repurchases. However, their model does not include a variable for executive stock options. If I use just employee options in my model, then I find a positive effect on repurchases. But the results in table 5 suggest that this is because employee options are proxying for executive options (as Fenn and Liang hypothesize).

forms of compensation reward managers on the basis of the stock price, but it differs from options in precisely the respect that is critical to the stock option hypothesis. Restricted stock, unlike options, gives the holder the right to share in dividend payments that accrue before the vesting of the stock (Crystal 1991). Thus, in contrast to stock options, restricted stock should create no preference for repurchases relative to dividend increases based on a desire to avoid dilution. Therefore, the restricted stock variable should pick up any underlying effect of stock-based compensation on repurchase behavior, apart from the effect underlying the stock option hypothesis.

Columns 1 through 3 of table 6 report the results of a model incorporating restricted stock and non-stock-based compensation as explanatory variables, and table 7 reports the results of a model incorporating these variables plus several additional explanatory variables discussed in more detail in section 5.4 below. The estimated coefficients on the options variable in the repurchase and retention equations are positive and statistically significant in both models, just as in the original model. The estimated coefficients on the restricted stock and non-stock-based compensation variables are negative in both the repurchase and retention equations in both of the models, and they are statistically significant in the second model, which contains a fuller set of explanatory variables. (The estimated coefficient on non-stock-based compensation in the retention equation is also statistically significant in the first model.) The fact that restricted stock has a negative effect on repurchases (relative to the benchmark alternative of a dividend increase), while options have a positive effect, provides strong support for the conclusion that positive effect of options on repurchases is not merely a reflection of a more general relationship between repurchases and stock-based compensation. Similarly, the fact that non-stock-based compensation has a negative effect

on repurchases suggests that the options effect is not a species of a more general relationship between repurchases and the level of executive pay.

5.3 Explicit use of options to encourage/discourage repurchases

Another possible explanation for the relationship between stock options and repurchases is that shareholders may be using stock options as an explicit means of encouraging or discouraging repurchases relative to dividend increases based on the independent desirability of each of these strategies. On this view, the desirability of repurchases relative to dividend increases is not a result of the stock options themselves, but of some underlying third factor that leads shareholders to award high or low levels of stock options in order to encourage or discourage repurchases. In a sense, this is a form of reverse-causality argument: instead of high levels of options producing a high incidence of repurchases, high repurchases (resulting from some independent factor) prompt high levels of options. Obviously, the level of stock options cannot properly be taken as exogenous in this scenario.

The difficulty with this approach, however, is that if shareholders were in fact aware of, and acting upon, the incentive effects of options on repurchase and dividend-increase decisions, then it is unclear why they would not simply provide for dividend-accruing options – as opposed to foregoing options altogether – when they wanted to discourage repurchases relative to dividend increases. That is, if a significant factor in the choice of a level of stock options were the effect of the choice on repurchase and dividend-increase decisions, then one would expect to see pro-repurchase and pro-dividend-increase firms distinguishing themselves not exclusively by the number of options they award, but also (and perhaps even only) by the

structure of the option plan – non-dividend-accruing versus dividend-accruing. Constructing a dividend-accruing option plan would be quite simple; there is ready precedent in the form of restricted stock (which, as noted above, accrues dividends and thus creates no need for managers to rely on the repurchase route to avoid diluting option values); and, moreover, several high-dividend-paying firms, such as NYNEX and a number of electric utilities, already have stock option plans that provide for dividend accrual (Buyniski 1991, 291).[6] In light of the ease with which the negative incentive effects of options on dividend increases could be avoided if shareholders were consciously aware of, and in the practice of acting upon, them, it seems implausible that the variation in option levels across firms reflects underlying variation in shareholders' preferences for repurchases and dividend increases, as posited by the view attributing the options-repurchase relationship to such underlying variation.

5.4 Other omitted variable problems

It remains possible that the options variable is picking up the effect of a third factor that is correlated with both stock options and repurchase behavior but is not linked to an explicit effort by shareholders to encourage repurchases or dividend increases. Cross-sectional results such as those reported here cannot rule out categorically the possibility that the effect of stock options reflects an unobserved firm effect of some sort, and even a panel analysis would leave open the possibility that an omitted factor (such as takeover threats) was driving the relationship between options and repurchases. On the takeover point, there is no strong reason to suspect that options would be positively correlated with takeover threats (although

[6]Spot checks of firms in my sample detected none that had dividend-accruing options. Thus, such options are not sufficiently widespread (or at least were not so in 1993) to undermine the stock option hypothesis of repurchase behavior.

we know that repurchases may be correlated with such threats); indeed, if the proponents of incentive compensation are right, then firms with high levels of options should be well-run organizations that are, for that reason, *less* vulnerable to hostile takeovers than other firms. Moreover, since restricted stock has the opposite effect on repurchases, one would have to explain why takeover threats would be correlated with options but not restricted stock – an alternative form of stock-based, incentive-oriented pay.

With regard to factors other than takeover threats, the model is robust to the addition of explanatory variables including the trend in the firm's stock price, the firm's market value, and a series of industry dummy variables (see tables 6 and 7). The trend in the firm's stock price is meant to capture the possible role of stock undervaluation in repurchase decisions (see Ikenberry, Lakonishok, and Vermaelen 1995). If a firm's stock price is depressed, then executives of the firm might tend both to be holding a large number of outstanding stock options (because exercising options has been unprofitable due to the low stock price) and to want to do a repurchase to "correct" the market's undervaluation of the firm's stock. On this view, the options variable might be picking up an underlying stock undervaluation effect. It is difficult to test the stock undervaluation hypothesis because there is no obvious way to measure stock undervaluation, but, as a proxy for this variable, I include the percent increase in the firm's stock price between the end of fiscal 1991 and the end of fiscal 1992. The theory here is that a firm whose stock price increased significantly over this period is less likely than an otherwise similarly situated firm to have substantial stock undervaluation at the end of fiscal 1992. Although the price-trend variable is obviously only a rough proxy for stock undervaluation, including it should tend to decrease the estimated coefficient on the options variable if the stock undervaluation hypothesis is correct, as long as the price-trend

variable is correlated at least to some degree with undervaluation. This is so because the options variable should no longer pick up the entire undervaluation effect.

Results of models with the price-trend variable are reported in columns 4 through 6 of table 6 and in table 7. The estimated coefficient on the price-trend variable in the repurchase equation is negative in each model and is significantly different from zero in the model reported in table 6, consistent with the stock undervaluation hypothesis. (Firms with declining stock prices are more likely to repurchase their stock, relative to the benchmark alternative of a dividend increase.) However, the estimated coefficients on the options variable in the repurchase equations in tables 6 and 7 are still positive and statistically significant, and, in terms of magnitude, the coefficient is actually larger by about 20 percent in table 6 than in the original model, and is less than one standard deviation less in table 7 than in the original model. These findings provide some support for the view that the options variable is not picking up a significant spurious stock undervaluation effect.

The model reported in table 7 includes, in addition to the restricted stock, non-stock-based compensation, and price-trend variables, the firm's market value and a series of industry dummy variables. Market value has no significant effect on repurchase and dividend-increase-and-repurchase behavior, but it has a negative and statistically significant effect on retention behavior. Thus, large firms are less likely than small ones to choose the retention option over the other three possibilities, consistent with the truncation effect discussed above (see section 3). Of the estimated coefficients on the industry dummy variables, only two are significantly different from zero. Notably, the public service sector dummy variable has a negative and statistically significant effect on repurchases, implying that firms in the public service sector (largely utilities and other regulated firms) are less likely than manufacturing

firms to engage in repurchases than dividend increases. This finding fits with stylized facts suggesting that utilities tend to pay high dividends.

6 Conclusion

This paper has offered a new explanation for the dramatic increase in stock repurchases since the late 1970s. Managers holding stock options have substantial personal wealth at stake in the choice between repurchase and dividend distributions. My empirical results suggest that stock options factor importantly in firms' observed repurchase behavior. Controlling for other observable factors, firms in which managers have large stock option holdings are significantly more likely to choose the repurchase route than firms in which managers have small stock option holdings. None of obvious alternatives explanations for this finding appears to have strong support, and the stock option hypothesis – unlike other factors – seems to fit well with the observed pattern of repurchase activity over time.

My findings suggest the importance of considering agency issues in analyzing firms' payout decisions. The agency approach may be useful in studying, for example, the question of why and under what circumstances firms pay dividends. Such an approach would contrast with the usual focus on factors such as taxes and the desire to signal strong future earnings. My findings also suggest the usefulness of disaggregating different forms of incentive pay in studying agency issues. Although all forms of incentive pay are in principle designed with the goal of creating incentives for managers to maximize shareholder value, different forms of incentive pay may in fact produce sharply different results.

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Table 1: Variables

variable	when measured	source
proportion of shares held by institutional investors	end of 1992 fiscal year	S & P's Security Owners' Stock Guide (shares held by institutional investors); Compustat (common shares outstanding).
operating income as a percent of assets	operating income: during fiscal 1993; assets: end of 1992 fiscal year	Compustat (operating income before depreciation and total assets).
Tobin's q	end of 1992 fiscal year	Compustat (market value, book value of common equity, and total assets).
debt-equity ratio	end of 1992 fiscal year	Compustat (total debt and market value).
average executive options as a percent of shares outstanding	end of 1992 fiscal year	Proxy statements (average number of exercisable and unexercisable options held by covered executives); Compustat (common shares outstanding).
average executive options granted as a percent of shares outstanding	during fiscal 1992	Proxy statements (average number of options granted to covered executives); Compustat (common shares outstanding).
all employee options granted as a percent of shares outstanding	during fiscal 1992	Proxy statements (total number of options granted to covered executives and proportion of options granted to covered executives); Compustat (common shares outstanding).
dollar value of restricted stock grants	during fiscal 1990, fiscal 1991, and fiscal 1992	Proxy statements (average restricted stock grant to covered executives).
dollar value of non-stock-based compensation	during fiscal 1992	Proxy statements (average salary, bonus, and other non-stock compensation paid to covered executives).
percent annual increase in stock price	from end of 1991 fiscal year to end of 1992 fiscal year	Compustat (stock prices).
market value of firm	end of 1992 fiscal year	Compustat (market value).
dummy variables: mining/construction sector (2-digit SIC between 10 and 17) public service sector (2-digit SIC between 40 and 49) wholesale/retail trade sector (2-digit SIC between 50 and 59) finance/insurance sector (2-digit SIC between 60 and 67) nonfinancial services sector (2-digit SIC between 70 and 89)	end of 1992 fiscal year	Proxy statements (SIC code, or primary SIC code if multiple codes listed).
number of options	end of 1992 fiscal year	Proxy statements (average number of exercisable and unexercisable options held by covered executives).

Notes: Tobin's q is given by the firm's market value minus the book value of its common equity, divided by its total assets. "Covered executives" are executives covered by the disclosure requirements applicable to proxy statements. Options covering multiple classes of common stock were aggregated. Restricted stock grants and non-stock-based compensation were prorated for executives employed during only part of the relevant period.

Table 2: Summary Statistics

variable	whole sample (N=324)	dividend increase firms (N=86)	repurch. firms (N=44)	retention firms (N=170)	dividend increase/ repurch. firms (N=24)	population (imputed)
	means and (in parenthesis) standard deviations					
proportion of shares held by institutional investors	0.437 (0.306)	0.429 (0.212)	0.517 (0.170)	0.405 (0.373)	0.542 (0.193)	0.410 (0.361)
operating income as a percent of assets (x 10^{-1})	1.262 (1.177)	1.396 (0.916)	1.314 (0.961)	1.078 (1.191)	1.994 (1.822)	1.105 (1.182)
Tobin's *q*	1.825 (1.282)	1.751 (1.032)	1.890 (1.179)	1.741 (1.200)	2.568 (2.304)	1.753 (1.205)
debt-equity ratio	0.912 (2.401)	0.929 (2.253)	0.369 (0.593)	0.887 (2.426)	2.023 (4.052)	0.890 (2.400)
average executive options as a percent of shares outstanding	0.395 (0.909)	0.194 (0.184)	0.440 (0.474)	0.515 (1.209)	0.183 (0.140)	0.498 (1.143)
average executive options granted as a percent of shares outstanding	0.076 (0.155)	0.036 (0.051)	0.132 (0.239)	0.086 (0.166)	0.043 (0.044)	0.085 (0.162)
all employee options granted as a percent of shares outstanding	1.133 (1.788)	0.821 (0.997)	1.627 (2.749)	1.127 (1.818)	1.391 (1.381)	1.128 (1.802)
dollar value of restricted stock grants (x 10^{-6})	0.275 (1.166)	0.506 (1.892)	0.118 (0.274)	0.137 (0.662)	0.719 (1.385)	0.157 (0.709)
dollar value of non-stock-based compensation (x 10^{-6})	0.689 (0.793)	0.941 (0.701)	0.667 (0.712)	0.471 (0.691)	1.376 (1.218)	0.502 (0.698)
percent annual increase in stock price	0.182 (0.426)	0.321 (0.452)	0.042 (0.245)	0.153 (0.452)	0.146 (0.237)	0.157 (0.446)
market value of firm (x 10^{-10})	0.353 (0.907)	0.638 (1.302)	0.220 (0.314)	0.166 (0.620)	0.898 (1.174)	0.193 (0.645)
dummy variable for firm in mining/ construction sector	0.031 (0.173)	0.023 (0.152)	0.023 (0.151)	0.041 (0.199)	0.000 (0.000)	0.040 (0.194)
dummy variable for firm in public service sector	0.142 (0.350)	0.186 (0.391)	0.023 (0.151)	0.159 (0.367)	0.083 (0.282)	0.156 (0.362)
dummy variable for firm in wholesale/retail trade sector	0.111 (0.315)	0.093 (0.292)	0.136 (0.347)	0.124 (0.330)	0.042 (0.204)	0.122 (0.328)
dummy variable for firm in finance/ insurance sector	0.207 (0.406)	0.326 (0.471)	0.205 (0.408)	0.124 (0.330)	0.375 (0.495)	0.136 (0.339)
dummy variable for firm in non-financial services sector	0.074 (0.262)	0.035 (0.185)	0.068 (0.255)	0.100 (0.301)	0.042 (0.204)	0.096 (0.294)
number of options (x 10^{-4})	13.550 (18.694)	15.853 (22.598)	12.710 (14.171)	11.277 (17.015)	22.932 (19.139)	11.606 (17.192)

Notes: Population values are weighted averages of the values from the sub-samples in columns 2 through 5, where the weights reflect the representation of the choices in the overall population.

Table 3: Results for Basic Model

	with interaction terms			without interaction terms		
	repurch. equation	retention equation	dividend increase/ repurch. equation	repurch. equation	retention equation	dividend increase/ repurch. equation
variable	coefficient estimates and (in parenthesis) standard errors					
[1] proportion of shares held by institutional investors	1.772 (0.776)	-0.770 (0.572)	2.165 (0.918)	1.433 (0.729)	-0.681 (0.551)	2.240 (0.896)
[2] operating income as a percent of assets (x 10^{-1})	-0.334 (0.284)	-0.323 (0.225)	0.209 (0.400)	-0.416 (0.223)	-0.415 (0.182)	0.245 (0.350)
[3] Tobin's *q*	0.318 (0.262)	0.201 (0.201)	0.272 (0.277)	0.131 (0.185)	0.164 (0.148)	0.229 (0.251)
[4] debt-equity ratio	-0.064 (0.307)	0.018 (0.083)	0.143 (0.083)	-0.713 (0.299)	-0.031 (0.065)	0.136 (0.063)
[5] average executive options as a percent of shares outstanding	4.149 (1.325)	2.841 (1.081)	-0.808 (2.599)	1.522 (0.528)	1.832 (0.511)	-0.421 (1.140)
[2] * [5]	-0.215 (0.443)	-0.334 (0.430)	0.203 (0.919)			
[3] * [5]	-0.690 (0.597)	-0.211 (0.473)	-0.176 (0.595)			
[4] * [5]	-2.811 (1.248)	-0.217 (0.214)	-0.015 (0.251)			
constant	-2.088 (0.658)	-2.141 (0.428)	-3.226 (0.797)	-1.127 (0.511)	-1.961 (0.357)	-3.308 (0.679)
variable	estimated marginal effects and (in parenthesis) standard errors					
proportion of shares held by institutional investors				0.255 (0.126)	-0.136 (0.053)	0.148 (0.096)
operating income as a percent of assets (x 10^{-1})				-0.076 (0.041)	-0.031 (0.015)	0.033 (0.097)
Tobin's *q*				0.016 (0.033)	0.010 (0.012)	0.013 (0.074)
debt-equity ratio				-0.145 (0.051)	0.018 (0.010)	0.028 (0.026)
average executive options as a percent of shares outstanding				0.256 (0.096)	0.142 (0.044)	-0.087 (0.020)
maximized log likelihood	-336.529			-340.349		

Notes: Choice-based sampling multinomial logit estimates. Dependent variable equals 1 if the firm chose the repurchase option, 2 if the firm chose the retention option, and 3 if the firm chose the dividend-increase-and-repurchase option. Coefficients measure the effects of the explanatory variables relative to their effects on the benchmark alternative of a dividend increase. Estimated marginal effects (in the bottom panel of the table) are computed at the imputed population means of the explanatory variables.

Table 4: Predicted and Actual Choices

		predicted				
		dividend increase	repurch.	retention	dividend increase/ repurch.	total
actual	dividend increase	83	1	0	2	86
	repurch.	28	15	0	1	44
	retention	132	33	3	2	170
	dividend increase/repurch.	20	0	0	4	24
	total	263	49	3	9	324

Notes: Predictions are based on coefficient estimates in the upper-right-hand panel of table 3.

Table 5: Results for Models with Executive and Total Employee Option Grants

	executive option grants			executive and total employee option grants		
	repurch. equation	retention equation	dividend increase/ repurch. equation	repurch. equation	retention equation	dividend increase/ repurch. equation
variable	coefficient estimates and (in parenthesis) standard errors					
proportion of shares held by institutional investors	1.469 (0.606)	-0.158 (0.510)	0.736 (0.593)	1.520 (0.589)	-0.040 (0.512)	0.754 (0.568)
operating income as a percent of assets (x 10^{-1})	-0.266 (0.239)	-0.408 (0.180)	0.150 (0.304)	-0.264 (0.233)	-0.403 (0.176)	0.122 (0.288)
Tobin's *q*	0.111 (0.196)	0.179 (0.150)	0.290 (0.222)	0.104 (0.187)	0.174 (0.144)	0.316 (0.210)
debt-equity ratio	-0.587 (0.259)	-0.018 (0.062)	0.117 (0.061)	-0.608 (0.273)	-0.018 (0.060)	0.123 (0.060)
average executive options granted as a percent of shares outstanding	6.267 (1.873)	4.863 (1.802)	2.150 (3.362)	7.974 (2.830)	6.774 (2.686)	-1.046 (4.416)
all employee options granted as a percent of shares outstanding				-0.129 (0.157)	-0.157 (0.138)	0.175 (0.150)
constant	-1.368 (0.480)	-1.965 (0.329)	-2.674 (0.510)	-1.332 (0.465)	-1.961 (0.337)	-2.761 (0.510)
maximized log likelihood	-348.559			-346.151		

Notes: Choice-based sampling multinomial logit estimates. Dependent variable equals 1 if the firm chose the repurchase option, 2 if the firm chose the retention option, and 3 if the firm chose the dividend-increase-and-repurchase option. Coefficients measure the effects of the explanatory variables relative to their effects on the benchmark alternative of a dividend increase.

Table 6: Results for Models with Additional Compensation and Price-Trend Variables

	compensation variables			price-trend variable		
	repurch. equation	retention equation	dividend increase/ repurch. equation	repurch. equation	retention equation	dividend increase/ repurch. equation
variable	coefficient estimates and (in parenthesis) standard errors					
proportion of shares held by institutional investors	1.711 (0.558)	0.124 (0.530)	2.351 (0.892)	1.020 (0.711)	-0.922 (0.583)	1.961 (0.910)
operating income as a percent of assets ($\times 10^{-1}$)	-0.409 (0.213)	-0.389 (0.169)	0.321 (0.168)	-0.358 (0.220)	-0.402 (0.182)	0.251 (0.285)
Tobin's q	0.196 (0.183)	0.216 (0.142)	0.248 (0.147)	0.134 (0.188)	0.189 (0.148)	0.254 (0.216)
debt-equity ratio	-0.613 (0.296)	0.073 (0.073)	0.157 (0.073)	-0.740 (0.292)	-0.052 (0.063)	0.119 (0.063)
average executive options as a percent of shares outstanding	1.503 (0.538)	1.653 (0.512)	-0.640 (1.236)	1.756 (0.504)	2.071 (0.493)	-1.159 (1.105)
dollar value of restricted stock grants ($\times 10^{-6}$)	-0.483 (0.498)	-0.107 (0.192)	-0.063 (0.113)			
dollar value of non-stock-based compensation ($\times 10^{-6}$)	-0.255 (0.301)	-1.156 (0.282)	0.208 (0.185)			
percent annual increase in stock price				-2.094 (0.500)	-1.143 (0.311)	-0.916 (0.632)
constant	-1.131 (0.465)	-1.680 (0.366)	-3.714 (0.690)	-0.691 (0.508)	-1.688 (0.359)	-3.048 (0.675)
maximized log likelihood	-324.707			-331.405		

Notes: Choice-based sampling multinomial logit estimates. Dependent variable equals 1 if the firm chose the repurchase option, 2 if the firm chose the retention option, and 3 if the firm chose the dividend-increase-and-repurchase option. Coefficients measure the effects of the explanatory variables relative to their effects on the benchmark alternative of a dividend increase.

Table 7: Results for Model with Additional Compensation, Price-Trend, Size, and Industry Dummy Variables

variable	repurch. equation	retention equation	dividend increase/ repurch. equation		repurch. equation	retention equation	dividend increase/ repurch. equation
	coefficient estimates and (in parenthesis) standard errors						
proportion of shares held by institutional investors	1.392 (0.716)	-0.364 (0.502)	1.870 (0.849)	dummy variables:			
operating income as a percent of assets (x 10^{-1})	-0.866 (0.321)	-1.052 (0.290)	0.708 (0.421)	mining/construction	-0.865 (1.106)	-0.597 (0.754)	* * *
Tobin's *q*	0.461 (0.242)	0.429 (0.211)	0.061 (0.300)	public services	-2.493 (0.853)	-0.542 (0.386)	-0.613 (0.689)
debt-equity ratio	-0.652 (0.303)	0.056 (0.086)	0.112 (0.087)	wholesale/retail trade	-0.021 (0.541)	0.050 (0.445)	-0.642 (0.510)
average executive options as a percent of shares outstanding	1.119 (0.317)	1.334 (0.332)	-0.116 (0.910)	finance/insurance	-0.717 (0.558)	-2.008 (0.467)	0.953 (0.620)
dollar value of restricted stock grants (x 10^{-6})	-0.837 (0.398)	-0.543 (0.237)	0.138 (0.168)	nonfinancial services	-0.140 (0.690)	0.418 (0.558)	0.109 (1.092)
dollar value of non-stock-based compensation (x 10^{-6})	-2.214 (0.575)	-0.729 (0.374)	-1.121 (0.677)				
percent annual increase in stock price	-0.607 (0.516)	0.008 (0.191)	-0.119 (0.123)				
market value (x 10^{-10})	0.101 (0.257)	-0.703 (0.263)	0.288 (0.212)				
constant	0.181 (0.609)	-0.249 (0.473)	-3.838 (0.956)				
maximized log likelihood	-293.865						

Notes: Choice-based sampling multinomial logit estimates. Dependent variable equals 1 if the firm chose the repurchase option, 2 if the firm chose the retention option, and 3 if the firm chose the dividend-increase-and-repurchase option. Coefficients measure the effects of the explanatory variables relative to their effects on the benchmark alternative of a dividend increase. The omitted industry dummy variable is for firms in the manufacturing sector (2-digit SIC between 20 and 39). The number of dividend-increase-and-repurchase firms was insufficient to permit estimation of the mining/ construction sector coefficient in the dividend-increase-and-repurchase equation.