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Managerial Incentives and Corporate Investment and Financing Decisions

ANUP AGRAWAL and GERSHON N. MANDELKER*

ABSTRACT

This paper examines the relationship between common stock and option holdings of managers and the choice of investment and financing decisions by firms. The authors find support for the hypothesis of a positive relationship between the security holdings of managers and the changes in firm variance and in financial leverage. This conclusion is based on samples of acquiring and divesting firms. The findings are consistent with the hypothesis that executive security holdings have a role in reducing agency problems.

MANAGERIAL INCENTIVE PROBLEMS THAT arise in a corporation due to the separation of ownership and control have troubled economists for some time (e.g., Smith [14], Berle and Means [4], and, more recently, Jensen and Meckling [10] and Harris and Raviv [8]). Fama and Jensen [7] argue that the prevalent choice of the corporate form suggests that there exist mechanisms that reduce agency problems. Two types of such devices have been identified: competitive market mechanisms and direct contractual provisions. It has been argued that market mechanisms such as the threat of takeover provided by the market for corporate control (Manne [11]), and “ex-post settling up” by managerial labor markets (Fama [6]) discipline managers and induce them to pursue the interests of shareholders. Fama argues that the discipline induced by capital and labor markets will be sufficient to eliminate incentive problems under a variety of conditions. On the other hand, the existence of elaborate (and costly) contracts between managers and shareholders suggests that management compensation schemes also have an important role in aligning the interests of managers with those of shareholders.

The theoretical arguments of Jensen and Meckling [10] and Haugen and Senbet [9] and the empirical evidence of Amihud and Lev [1], Walkling and Long [16], and Benston [3], among others, suggest that managers’ holdings of common stock and stock options have an important effect on managerial incentives.¹ This implies that investment and financing decisions of firms may be influenced by the security holdings of their managers.

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¹ For example, Benston finds that changes in the value of managers’ stockholdings are larger than their annual employment income.

In this study, we empirically investigate two related issues. First, we examine the relationship between a manager's holdings of common stock and options and the characteristics of the investment decisions made by the firm—specifically, changes in the variability of returns on the firm's assets. Second, we study the relation between a manager's security holdings and the firm's financing decisions. These issues have not been addressed by previous studies.

We examine three types of investment decisions: acquisitions by mergers, acquisitions by tender offers, and divestitures by sell-offs. Acquisitions and sell-offs are particularly suited for this study since these are typically large transactions between two publicly traded corporations and hence have considerable impact on the firms. An examination of these three types of investment decisions and the concomitant financing provides more specific evidence on the issues addressed and allows for a comparison between these decisions.

The remainder of this paper is organized as follows. Section I contains a discussion of the economic hypotheses. Section II discusses the details of management compensation, empirical methodology, and data sources. Section III presents the empirical findings, and Section IV provides a summary.

I. Issues and Hypotheses

The total wealth, W , of a manager may be classified into three main types of assets: his or her common stock and option holdings, W_s , if any, in the firm that employs him or her; his or her human capital, W_h , which equals the present value of the stream of future earnings from employment; and holdings of other assets unrelated to the firm, W_o . The stock and option holdings in the firm are valued in the capital markets, and their value is directly affected by changes in the characteristics of the firm's cash flows. Changes in the firm's cash flows may also affect the stream of the manager's employment income and thus his or her human capital.² Managerial incentive problems arise, in part, because corporate investment and financing decisions by managers are influenced by their personal wealth considerations.

A. Manager's Incentives Regarding Selection of Risky Projects

It has been argued that the manager has an incentive to select investment projects that reduce the variability of the firm's earnings stream, *ceteris paribus*, due to the overinvestment of his or her human capital in a single firm and the consequent underdiversification of his or her personal wealth portfolio. Amihud and Lev [1] argue that, to the extent that the manager's employment income is tied to changes in firm value, an increase in the variance of returns on the firm's total assets, σ_V^2 , increases the variance and reduces the certainty equivalent of the stream of his or her employment income. The manager obviously dislikes such decreases in his or her human capital, W_h , and therefore has an incentive to reduce σ_V^2 .

² Suppose the firm performs poorly. This may have several effects on the manager's future employment income. First, his or her remuneration in the current job falls, as the evidence in Murphy [13] suggests. Second, his or her potential wages in alternative employment decrease, as Amihud and Lev [1] argue. Third, in the extreme case, if the firm liquidates, his or her firm-specific human capital is lost.

If the manager owns common stock and stock options in the firm, his or her incentives with respect to a reduction in σ_V^2 are not obvious. In such a case, there are two further effects on the manager's personal welfare. First, if the firm has risky debt, we know from the option-pricing models (Black and Scholes [5]) that the value of common stock increases when σ_V^2 goes up. Thus, the value of the manager's common stock and stock option holdings, W_s , increases. Second, an increase in σ_V^2 also increases the variance of common stock returns, σ_S^2 . The effect of an increase in σ_S^2 on the variance of the manager's total personal wealth portfolio, σ_W^2 , is not obvious. It depends, among other things, on the correlation of returns on his or her stock and option holdings with those on the remainder of his or her total wealth portfolio and on the relative weight of the former in the latter. (See the Appendix for an elaboration.)³

In summary, when a manager owns common stock and stock options in the firm, a variance-increasing investment by the firm can have three effects on his or her personal welfare: the value of his or her common stock and option holdings in the firm W_s , increases; the value of his or her human capital decreases; and the variability of his or her total wealth, σ_W^2 , changes. If there is sufficient spanning in the capital markets, the effect on personal portfolio variance can be diversified away. When a manager has large stock and option holdings in the firm, the first effect is likely to dominate. Thus, large stock and option holdings by a manager induce him or her to select variance-increasing corporate investments.

However, as pointed out by Haugen and Senbet [9], such a risk-shifting incentive of managers increases agency problems between bondholders and stockholders. They show that, under certain conditions, countervailing contracts such as a put option provided to bondholders (e.g., a convertibility option on a bond) can reduce a manager's risk-shifting incentive in the presence of executive stock options. Thus, it is not clear that a manager necessarily has an incentive to reduce the firm's risk, as was implied by Amihud and Lev [1]. The manager's incentive with respect to changes in the firm's variance is then an empirical issue.

B. Manager's Incentives with Respect to the Financial Leverage of the Firm

An investment decision such as an acquisition or a sell-off usually results in a change in the capital structure of the firm. In the case of an acquisition, such a change is a result not only of the financing instrument used to purchase the firm, but also of the capital structure of the acquired entity. In the case of a sell-off of a division, such a change is a function of the form of payment, while, in the case of a sell-off of a subsidiary, it is also a function of the capital structure of the subsidiary.

A reduction in the firm's financial leverage has three potential effects on the manager's personal welfare. First, a reduction in the firm's debt-equity ratio,

³ As pointed out by the referee, the true agency problem arises when the shift in risk is also associated with a value shift. Under certain conditions, this shift benefits managers and stockholders even when a negative-NPV project is adopted; see Barnea, Haugen, and Senbet [2]. In the discussion, we assume *ceteris paribus*, i.e., investment in zero-NPV projects, and thus ignore the value-shift effect.

caused, for example, by an issue of additional equity by an acquiring firm to finance a merger by exchange of stock, reduces the probability of bankruptcy of the firm. To the extent that the manager's future employment income is tied to the continued survival of the firm, a reduction in financial leverage increases the value of the human capital of the manager.⁴ Second, a reduction in leverage also increases the value of existing risky debt because bondholders now get greater protection on their claims. If the financing decision has no effect on the total value of the firm, then the value of old equity, as well as that of executive stock options, is reduced. This causes a decrease in the value of common stock and option holdings, W_s , of the manager. Third, a reduction in financial leverage also reduces the variance of stock returns, σ_S^2 . This may change the variance of the total wealth portfolio, σ_W^2 , of the manager, as discussed above. (See Section I, Subsection A.)

In summary, a reduction in financial leverage has three effects on the personal welfare of the manager who holds common stock and options in the firm: W_h increases, W_s decreases, and σ_W^2 may change. The incentive of a manager with respect to changes in the firm's financial leverage is then an empirical issue.

II. Methodology and Data

A. The Sample

We examine three types of investment decisions: acquisitions by mergers, acquisitions by tender offers, and sell-offs. An initial sample of all firms that were acquired during 1974 to 1982 is taken from the CRSP files. Names of the corresponding acquiring firms and the announcement dates are identified from the *Wall Street Journal* (WSJ) newspaper and Index. The announcement date is defined as the trading day preceding the first WSJ publication date of the intention to acquire. We include acquisitions in which the market value of equity of the target is ten percent or more of the acquiring firm. The market value of equity of each firm is computed for the day following the announcement date. We require that acquiring firms have available stock return data for days -120 to +120 around announcement date and for seventy days after completion date. This left us with a sample of 205 acquiring firms. Out of these, we were able to obtain data on management compensation, stock and option holdings, and long-term debt for 153 firms.

The preliminary list of divesting firms in selloffs has been collected from the FTC "Annual Statistical Reports on Mergers and Acquisitions" and from the "Mergers and Acquisitions" journal. We have identified 294 firms for which the purchase consideration was disclosed. We eliminate divesting firms for which the announcement date cannot be ascertained from WSJ, those that are not listed on the NYSE or AMEX, and those for which the stock return data for the required period are not available. We also eliminate firms for which the value of the sold-off unit is less than ten percent of the equity value of the divesting firm.

⁴ Bankruptcy of the firm not only increases the probability of the loss of the current job of the manager, but also generates adverse information about his or her managerial abilities that can reduce his or her income in alternative employment.

The remaining sample consists of ninety-five divesting firms. We are able to obtain data on management compensation and wealth and on long-term debt for fifty-six of these firms. Thus, our total sample consists of 209 firms.

B. Managers' Security Holdings and Compensation

The primary sources of data on managers' compensation and their holdings of common stock and options in their firms are the proxy statements filed by firms with the Securities and Exchange Commission. The following items are collected for each sample firm for the year prior to an investment announcement: (a) salary plus bonus; (b) securities, properties, and benefits; (c) aggregate of contingent forms of remuneration excluding stock options; (d) number of stock options granted and their exercise prices; (e) number of shares of stock held by the executive and his or her immediate family members; and (f) number of stock options held and their weighted-average exercise price. These data are collected separately for the highest ranked executive, the second-highest ranked executive, and the group defined in proxy statements as "all officers and directors" of each sample firm.

The stockholdings of managers are valued using the average of the stock prices at the end of each of the three months prior to an investment announcement. This procedure is adopted because we are interested in valuing managers' stockholdings at the time they make the investment decision. The valuation of executive stock options presents a more complex problem. Executive stock options have many features that distinguish them from typical exchange-traded call options.⁵ At present, no valuation formula that takes into account all of these features is available. However, Smith and Zimmerman [15] have derived a lower bound value on such an option. This lower bound equals the higher of zero or the current stock price minus the present value of the exercise price minus the present value of the stream of dividends to be paid by the stock. We use this lower bound to value these options.⁶ The valuation formula for this lower bound is

$$\max[0, S - (X + D)B],$$

where

$$D = \sum_{t=1}^T d_t (1 + r)^{T-t},$$

T = ten years for options granted and five years for options held,

d_t = dividend per share declared in year t (we assume a constant payout over the life of the option and define d as the dividend declared in the year prior to the investment announcement),

⁵ Some of these features are nontransferability, expiration on leaving the firm, restrictions on the timing of exercise, etc. In addition, stock options that are unaccompanied by stock appreciation rights—SAR's—constrain the executive to hold the stock obtained upon option exercise for a certain number of years.

⁶ This lower bound obviously undervalues the options. However, we find that managerial holding of options is relatively very small. The mean value of option holdings by the CEO in our sample is \$0.3 million, while that of stockholdings is \$7.0 million dollars. Hence, we do not believe this undervaluation to cause a serious bias.

r = risk-free rate (the constant maturity market yield on twenty-year government bonds is used),

X = exercise price of the stock option,

S = stock price on the date of the option grant ($S = X$ in most cases),

$B = 1/(1 + r)^T$.

We construct three measures of managers' relative security holdings. The first measure, $R1$, is the ratio of the dollar value of common stock and options held to total annual compensation.⁷ This ratio represents the equivalent of the number of years of total annual compensation that a manager has as an investment in the common stock and options of the firm. We can also interpret $R1$ as the value of a manager's stock and option holdings normalized by a measure that can be assumed to be positively correlated with the value of his or her human capital. The second measure, $R2$, is the ratio of the dollar value of common stock and options held to annual salary plus bonus. Thus, $R2$ merely uses a different variable to normalize the managers' security holdings. The third measure, $R3$, is the proportion of total stock outstanding that is owned by senior managers. These measures are designed to overcome the problems in comparing security holdings across managers with differing levels of total wealth. They also overcome the problem of comparing undeinflated dollar amounts at different points in calendar time.

C. Estimation of Firm Variance and Debt-Equity Ratio

We need to measure changes in σ_V^2 after an investment decision because of its potential impact on the welfare of the manager. (See Section I, Subsection A.) The variance of returns for the overall firm, σ_V^2 , cannot be calculated directly because these returns are unobservable. We use two surrogates for firm return variance. It follows from Merton [12, equation 3b] that, if all the debt securities issued by a firm are riskless, σ_V equals σ_V' , defined as follows:

$$\sigma_V' = \sigma_S \times (S/V),$$

where

σ_S = standard deviation of common stock returns,

$V = S + D$,

S = common stock value,

D = debt plus preferred stock value.

If the firm has risky debt outstanding, σ_V' underestimates σ_V . However, if a firm has any debt outstanding, σ_S overestimates σ_V . Thus, we have two surrogates for σ_V : σ_V' , which underestimates it, and σ_S , which overestimates it. We classify a firm in the σ_V increase (decrease) group if both σ_S and σ_V' increase (decrease) following an investment. Since we are interested in measuring only the direction, not the magnitude, of change in σ_V , this procedure should not cause a serious

⁷ Total annual compensation consists of salary and bonus plus securities, properties, and benefits plus aggregate of contingent forms of remuneration.

problem.⁸ Indeed, the direction of change in σ_V indicated by both measures, σ_V and σ_S , turns out to be the same for over seventy-nine percent of the sample.

Variance of stock returns before the investment announcement is measured over the 60-day preannouncement period (Ann - 120 to Ann - 61). Variance after the investment is computed by using the returns over the 60 days after the completion of the investment (Cmp + 11 to Cmp + 70).⁹ We use this latter period since we assume that, if variance changes as a result of the investment, the change will have occurred by the latter period.

The leverage ratio for each firm is measured as [book value of long-term debt + preferred stock]/[book value of long-term debt + preferred stock + market value of equity]. Although market value of debt would be preferable, this is not available for most of the sample as many firms have privately placed debt outstanding. The debt-equity ratio before the investment announcement is computed by using data for the year prior to this date. The debt-equity ratio after the investment is measured by using data for the year after the completion of the investment. It is expected that, by the latter time, firms will have stabilized their debt-equity ratio. Book values of debt and preferred stock are obtained from the COMPUSTAT Annual Industrial files and Moody's Industrial Manuals.

III. Empirical Results

A. Managers' Security Holdings and Changes in the Riskiness of the Firm

We first investigate whether there is a relationship between the security holdings of managers and their incentives to make risk-shifting investments. We identify the group of firms with a variance that increases subsequent to the investment announcement and another group with a variance that decreases.¹⁰ Table I shows the measures of relative security holdings of managers of the two groups of firms and the *t*-statistics for the differences among them.¹¹

The three measures used are *R1*, *R2*, and *R3*, as defined in Section II, Subsection B. Each of these measures is shown separately in the table for (a) the highest ranked manager (usually the Chief Executive Officer or the Chairman of the Board), (b) the group of the two highest ranked managers, and (c) the group of "all officers and directors". Results are shown for the combined sample and

⁸ Notice that an increase in *D/V* does not necessarily lead a firm to be classified in the σ_V increase group. An increase in *D/V* leads to an increase in σ_S , but, since *S/V* is decreased simultaneously, the direction of change in σ_V is not clear.

⁹ Investment completion date, Cmp, is defined as the stockholder approval date in case of a merger or a sell-off and the date the requisite number of shares are reported to be tendered in case of a tender offer.

¹⁰ A firm must experience an increase in σ_S as well as in σ_V in order for it to be included in the variance-increase group; see Section II, Subsection C.

¹¹ The test used is the Mean-Comparison Test for two independent samples with different variances. Note that we do not make any distributional assumptions about the population. The test is based on the Central-Limit Theorem that the distribution of sample means is approximately normal for large sample sizes from finite-variance populations, which themselves may not be normally distributed.

Table I
Mean Security Holdings of Senior Managers of Firms for Which
the Postinvestment Variance Increases, Var+, and of Those for
Which It Decreases, Var-

	Acquiring Firms		Divesting Firms		Total Sample	
	Var+	Var-	Var+	Var-	Var+	Var-
Top Manager						
R1	28.69 (1.40)†	5.51	20.67 (1.11)	8.37	26.10 (1.71)*	6.02
R2	33.04 (1.39)†	8.36	27.89 (1.27)	9.56	31.35 (1.79)*	8.51
R3	0.02 (0.51)	0.01	0.03 (1.79)*	0.01	0.03 (1.19)	0.02
Two Top Managers						
R1	18.20 (1.32)†	4.18	10.42 (0.41)	7.59	16.56 (2.65)*	4.43
R2	21.51 (1.32)†	6.48	12.57 (0.49)	8.99	19.95 (1.68)*	6.51
R3	0.03 (0.49)	0.02	0.03 (1.25)	0.01	0.03 (0.93)	0.02
All Officers and Directors						
R1	13.88 (1.89)*	5.24	9.93 (1.14)	6.18	12.61 (2.19)*	5.42
R2	12.36 (1.02)	7.65	12.88 (1.14)	8.07	12.57 (1.43)†	7.73
R3	0.06 (0.69)	0.05	0.15 (2.62)*	0.05	0.09 (2.02)*	0.05

The two numbers in each group are the mean ratios for the variance increase (Var+) and decrease (Var-) groups, respectively. Shown in parentheses below the first number is the *t*-statistic for the difference between the two means. A firm is classified in the variance-increase group if both σ_e^2 and $\sigma_v'^2$ increase after the investment and in the variance-decrease group if both measures decrease.

The results are similar for acquiring firms in mergers and tender offers. Therefore, the two have been combined to increase the sample size. The group of "all officers and directors" includes the two highest ranked executives. R1 = Value of stock plus options held divided by total annual compensation. R2 = Value of stock plus options held divided by annual salary plus bonus. R3 = Stock owned divided by total stock outstanding.

* Statistically significant at the five percent level in a one-tailed test.

† Statistically significant at the ten percent level in a one-tailed test.

also separately for acquiring and divesting firms.¹² The two numbers under each column are the mean ratios for the group of firms with σ_v^2 that increased and decreased, respectively, after the investment.

In Table I, the relative stock and option holdings of managers of the group of firms that select investments resulting in variance increases are considerably higher than for the variance-decreasing group of firms. For the combined sample,

¹² The results are similar for acquiring firms in mergers and in tender offers, and, hence, these are shown together to increase the sample size.

the mean ratio of stock plus option holdings to total annual compensation ($R1$) for the top managers of the first group is 26.10, while, for the second group, it is 6.02. For the two top managers, the ratios are 16.56 and 4.43 for the two groups, respectively. Similarly, for the group of "all officers and directors", the ratios are 12.61 and 5.42 for the two groups, respectively. All the differences are statistically significant at the five percent level. Similar results obtain when we use $R2$, the ratio of the dollar value of stock plus options held to annual salary plus bonus. The fraction of stock owned ($R3$) by managers of the first group is also larger than that of the second group although only some of the differences are statistically significant. The results for the subsamples of acquiring and divesting firms are similar to the combined sample results.¹³

Overall, the evidence tends to support the hypothesis that executives' security holdings induce them to make investment decisions that are in the interest of shareholders. This is consistent with evidence provided by Amihud and Lev [1]. They report that firms with managers who have smaller stockholdings engage in conglomerate mergers, which are presumably risk reducing, more often than firms with managers who have larger stockholdings.

Haugen and Senbet [9] point out that executive security holdings, while mitigating agency problems between managers and shareholders, increase agency problems between the latter and bondholders due to the risk-shifting incentives of managers. They show that, under certain conditions, a countervailing contract such as a put option provided to bondholders (e.g., in the form of a conversion option on the bond) can resolve such risk-shifting incentives of managers. In order to investigate the use of such countervailing contracts, we analyze the use of convertible debt and preferred stock by the firms in our sample.

We have obtained data on convertible debt and preferred stock on 171 firms from COMPUSTAT. Table II presents three different measures of the relative use of these complex securities by variance-increasing and variance-decreasing groups of firms. The first measure shows that the percentage of firms in the two samples that use convertibles is sixty-five and fifty-nine, respectively. Thus, this measure does not seem to be significantly different for the two groups of firms. The second measure is the ratio of the book value of convertible securities to market value of equity. The means of this ratio for the variance-increasing and variance-decreasing groups of firms are .10 and .08, respectively. The difference is not statistically significant. The third measure is the ratio of the book value of convertibles to market value of equity plus book value of long-term debt and preferred stock. The mean of this ratio for each of the groups is .04. Thus, the firms in our sample that have made variance-increasing investments do not seem to make greater use of convertible securities than those that have made variance-decreasing investments.¹⁴

Since our criteria for inclusion of firms in the two groups do not require that for each variance-increasing firm in group 1 there should be a firm in group 2

¹³ The t -statistics are smaller for the subsample tests, possibly due to smaller sample sizes.

¹⁴ We also examined whether there are cross-sectional differences in the callability of bonds. We found that almost all the publicly traded bonds are callable, and there are no discernible differences between the two subsamples.

Table II
 Use of Convertible Debt and Convertible Preferred
 Stock by Variance-Increasing, Var+, and Variance-
 Decreasing, Var-, Firms

	Var+ Group	Var- Group	t- Statistic
Percentage of Firms Having Convertible Securities	65%	59%	
<i>CV/EQ</i>			
Mean	.10	.08	.56
First Quartile	.00	.00	
Median	.03	.00	
Third Quartile	.12	.06	
Maximum	.81	1.08	
<i>CV/(EQ+D)</i>			
Mean	.04	.04	.23
First Quartile	.00	.00	
Median	.02	.00	
Third Quartile	.06	.03	
Maximum	.24	.42	

The data are for the year prior to the investment announcement.
 The *t*-statistic relates to the difference between the two means.

CV = Book value of convertible debt and convertible preferred stock. *EQ* = Market value of equity. *D* = Book value of long-term debt and preferred stock.

that makes a variance-reducing decision *at the same time*, it is possible that the results could be biased due to market-wide changes in variance. To control for this possibility, we have repeated the above test, redefining a variance increase to be greater than a corresponding increase in the variance of the market return over the same period and vice versa for variance decrease. This reduces the number of firms included in each sample, but the results are similar and hence are not reported here. These results are also consistent with the hypothesis that executive security holdings help in reducing agency problems between managers and shareholders.

Another possible story that has the potential for explaining our findings in Table I is that the positive relationship between managerial security holdings and variance changes is spurious and is driven by systematic industry factors. In order to test for this possibility, we examine our sample for industry concentrations. Table III presents the number and percentage of firms by one- and two-digit SIC industry codes in the variance-increasing and variance-decreasing samples. As can be seen from the table, the distribution of the two samples across various industries does not seem very different. There does not seem to be a significant difference in industry concentrations across the two samples. Thus, we are unable to detect a systematic industry effect in our sample that would render the findings in Table I spurious.¹⁵

¹⁵ The analyses in Tables II and III were generated by ideas suggested to us by the referee.

Table III
Distribution of Firms by Industry in Variance-Increasing, Var+,
and Variance-Decreasing, Var-, Samples

Industry (1- or 2-Digit SIC Code)	Var+		Var-	
	No. of Firms	Percentage of Sample	No. of Firms	Percentage of Sample
Mining and Construction (1)	7	11	7	9
Manufacturing (2 and 3):				
Food (20)	4	7	3	4
Chemicals (28)	4	7	10	12
Primary Metals (33)	6	10	7	9
Electrical/Electronic Machinery (36)	5	8	6	7
Other Machinery (35)	3	5	9	11
Transport Equipment (37)	2	3	4	5
Miscellaneous Manufacturing ^a	14	23	11	13
Utilities and Transport (4)	5	8	4	5
Wholesale and Retail Trade (5)	3	5	8	10
Finance, Insurance, and Real Estate (6)	5	8	7	9
Other Industries	3	5	5	6
	61	100	81	100

^a This group is composed of firms classified in ten different two-digit SIC-code industries, none of which comprises more than two firms in each sample.

B. Managers' Security Holdings and Changes in the Financial Leverage of the Firm

We now examine whether there is a relationship between a manager's security holdings and changes in the debt-equity ratio of a firm following an acquisition or a sell-off. We identify firms for which the debt-equity ratio increased after the investment announcement and those for which it decreased. Table IV shows the measures of managers' relative security holdings for the two groups of firms. As in the previous table, results are shown for the combined sample and also separately for the subsamples of acquiring and divesting firms.

An examination of Table IV reveals that the top manager, as well as his or her second-in-command in the group of firms that experience an increase (decrease) in their debt-equity ratios, has a considerably large (small) holding of stocks and options in his or her firm. For the combined sample, the mean *R1* for the top managers of the two groups of firms is 19.69 and 4.53, respectively. For the two top managers, these numbers are 11.11 and 3.42, respectively. A similar pattern is revealed by *R2* and *R3*. The differences between the two groups of firms are statistically significant. For the group of "all officers and directors", the differences between the two groups are in the same direction although they are statistically not significant. The results for the subsamples of acquiring and divesting firms are similar to those for the combined sample. Overall, the evidence favors the hypothesis that executive security holdings tend to reduce agency problems between managers and shareholders with respect to the firm's financing decision. Previous empirical findings document a reduction in stockholders'

Table IV
Mean Security Holdings of Senior Managers of Firms for Which the
Postinvestment Debt-Equity Ratio Increases and of Those for Which It
Decreases

	Acquiring Firms		Divesting Firms		Total Sample	
	(D/V)+	(D/V)–	(D/V)+	(D/V)–	(D/V)+	(D/V)–
Top Manager						
R1	20.04 (3.75)*	4.42	18.72 (2.11)*	4.43	19.69 (4.20)*	4.53
R2	24.58 (3.90)*	6.16	20.96 (1.95)*	6.96	23.80 (4.13)*	6.63
R3	0.04 (3.67)*	0.01	0.05 (2.09)*	0.02	0.04 (3.63)*	0.01
Two Top Managers						
R1	10.85 (3.55)*	3.48	12.81 (1.95)*	3.22	11.11 (4.09)*	3.42
R2	14.58 (3.93)*	4.72	15.43 (2.09)*	4.62	14.64 (4.45)*	4.71
R3	0.05 (3.16)*	0.02	0.06 (1.85)*	0.02	0.05 (3.04)*	0.02
All Officers and Directors						
R1	8.20 (0.50)	6.48	7.71 (0.26)	6.97	8.11 (0.69)	6.70
R2	9.24 (0.19)	8.39	9.35 (0.02)	9.28	9.26 (0.19)	8.78
R3	0.08 (1.65)*	0.05	0.12 (0.01)	0.12	0.09 (–0.01)	0.09

The two numbers in each group are the mean ratios for the debt-equity ratio increase ((D/V)+) and decrease ((D/V)–) groups, respectively. Shown in parentheses below the first number is the *t*-statistic to measure the significance of the difference between the two means.

See second paragraph of Table I footnotes.

wealth when there is a reduction in leverage via exchange offers, etc. Our evidence is consistent with these findings in that it suggests that managers with low stockholdings are more likely to reduce leverage than those with large stockholdings since the interests of the former are less aligned with those of the shareholders.

We next examine whether there is a relationship between the security holdings of managers and changes in σ_V^2 and in debt-equity ratio following an investment-financing decision. We identify firms in our sample for which both the variance and the debt-equity ratio increase and another group for which both decrease. Table V shows the relative security holdings of managers of the two groups. For the combined sample, the table shows that the ratios *R1* and *R2* are substantially larger for the highest ranked officer and for the two highest officers of the former group of firms than the latter, and the differences are significant at the five percent level. The mean *R1* for the top managers of the first group of firms is 10.76, while it is only 3.16 for top managers of the second group. The corresponding numbers for the two top managers are 7.32 and 2.85, respectively. While *R3* is also larger for managers of the group of firms that experience an increase in both σ_V^2 and debt-equity ratio than those that experience a decrease in both, the

Table V
Mean Security Holdings of Senior Managers of Firms for Which
the Postinvestment Variance and Debt-Equity Ratio Increase,
INC, and of Those for Which They Decrease, DEC

	Acquiring Firms		Divesting Firms		Total Sample	
	INC	DEC	INC	DEC	INC	DEC
Top Manager						
R1	9.23 (1.09)	4.29	16.18 (0.99)	2.31	10.76 (1.65)*	3.16
R2	10.87 (1.08)	5.70	16.95 (0.98)	2.89	12.24 (1.71)*	4.09
R3	0.01 (-0.39)	0.01	0.02 (1.25)	0.00	0.02 (1.03)	0.01
Two Top Managers						
R1	5.78 (1.19)	3.69	12.79 (0.94)	2.23	7.32 (1.64)*	2.85
R2	7.31 (1.14)	4.85	13.51 (0.95)	2.69	8.70 (1.74)*	3.62
R3	0.02 (-0.16)	0.02	0.03 (1.00)	0.01	0.02 (0.87)	0.01
All Officers and Directors						
R1	11.69 (2.31)*	2.86	8.59 (0.24)	7.20	11.01 (1.59)†	5.34
R2	8.14 (2.23)*	3.66	9.39 (0.13)	8.55	8.43 (0.72)	6.45
R3	0.05 (0.74)	0.03	0.07 (0.53)	0.05	0.05 (0.43)	0.04

The two numbers in each group are the mean ratios for the group of firms for which both variance and debt-equity ratio increase (INC) and for which both decrease (DEC), respectively. Shown in parentheses below the first number is the *t*-statistic to measure the significance of the difference between the two means.

A firm is classified in the increase group if σ_s^2 , $\sigma_v'^2$, and the debt-equity ratio all increase after the investment and in the decrease group if all three measures decrease.

See second paragraph of Table I footnotes.

differences are not statistically significant. For the group of “all officers and directors”, all three ratios are larger for the former group of firms, but only the difference in *R1* is significant at the ten percent level. The results for the subsamples of acquiring and divesting firms are similar although the *t*-statistics are smaller, possibly due to smaller sample sizes. Overall, the data seem to support the hypothesis that executives’ security holdings induce them to make investment-financing decisions that are consistent with shareholders’ interests.

IV. Summary and Conclusions

In this study, we test hypotheses concerning two related issues. First, we examine the relationship between a manager’s holdings of common stock and options and the characteristics of the investment decisions made by the firm—specifically, changes in the variability of returns on the firm’s assets. Second, we study the

relation between a manager's security holdings and the firm's financing decisions, i.e., changes in debt-equity ratio.

We find that the common stock and options holdings of managers of firms for which the return variance increases upon an investment announcement are larger than for firms for which it decreases. The differences between the mean $R1$ (stock plus option holdings divided by total annual compensation) of the top managers of the two groups are large and statistically significant. We do not find any significant differences in the use of countervailing contracts, such as convertible securities, by the two groups of firms. These findings are consistent with the hypothesis that there is a relationship between security holdings of managers and investment decisions of their firms; i.e., the ratio $R1$ is higher (lower) for managers of firms with decisions that result in a σ_V^2 increase (decrease).

Second, we find that the security holdings of managers of firms with a debt-equity ratio that increases are larger than those for which this ratio decreases. In the combined sample, the mean $R1$ for the top managers of the two groups is 19.7 and 4.5, respectively, and the difference is statistically significant. Thus, when firms make financing decisions, executive security holdings seem to have a role in reducing agency problems.

Overall, our findings are consistent with the hypothesis that executive holdings of common stock and options in the firm have a role in reducing managerial incentive problems. This evidence does not preclude, of course, a role for other provisions of compensation contracts, as well as for competitive market forces, in reducing agency problems. The evidence does not rule out other hypotheses for the observed existence of large executive holdings of securities in their firms, such as signalling or sorting. The relative importance of these various economic factors is an interesting issue for future research.

Appendix

The effect of an increase in the variance of common stock returns on the variance of returns on the manager's personal portfolio is as follows. Let W be the total wealth of a manager, of which W_s is invested in common stock of the firm and $W_o = (W - W_s)$ in all other assets. Let σ_W^2 , σ_S^2 , and σ_o^2 denote the variance of returns on W , W_s , and W_o , respectively. Let ρ_{So} denote the correlation coefficient between the returns on W_s and those on W_o . Assume that ρ_{So} is a constant. Then we can write the variance of the total wealth of the manager as

$$\sigma_W^2 = x_s^2 \sigma_S^2 + 2x_s x_o \rho_{So} \sigma_o + x_o^2 \sigma_o^2,$$

where $x_s = W_s/W$ and $x_o = W_o/W$. The partial derivative of σ_W^2 with respect to σ_S^2 can be written as

$$\begin{aligned} \delta \sigma_W^2 / \delta \sigma_S^2 &= x_s^2 + x_s x_o \rho_{So} (\sigma_o / \sigma_S) \\ &\quad + 2x_s x_o \rho_{So} \sigma_S (\delta \sigma_o / \delta \sigma_S^2) + 2x_o^2 \sigma_o (\delta \sigma_o / \delta \sigma_S^2) \\ &= x_s^2 + x_s x_o \rho_{So} (\sigma_o / \sigma_S) \\ &\quad + 2x_o (\delta \sigma_o / \delta \sigma_S^2) (x_s \rho_{So} \sigma_S + x_o \sigma_o). \end{aligned}$$

Therefore, the sign of the partial derivative depends on the signs of ρ_{S_0} and $(\delta\sigma_0/\delta\sigma_S^2)$, as well as on the relative magnitudes of the various terms.

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