Share Repurchase Policies and CEO Compensations: An Empirical Examination

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Abstract

I examined how share repurchase activities are associated with complicated managerial compensation plans. The empirical evidence in this study suggests that managerial equity based compensation incentives to increase the amount of share repurchases at companies with potentially the most severe agency problems. That is to say, the amount of share repurchases is greater for those firms that are with longer listing history, higher executive power measured by CEO's tenure and the amount of cash compensation, and fewer investment opportunities. My results show that the complexity of managerial compensation contracts plays an important role in explaining the share repurchase decisions.

1. Introduction

Stock repurchases have been an important payout mechanism in recent years. In the last several years, both the amount of repurchases and the number of firms that repurchase have grown significantly (Fama and French (2001) and Allen and Michaely (2003)). A widely accepted explanation behind the payout decision is the signaling hypothesis. In addition, managers may decide to repurchase shares if 1) they are intended to be used in a merger; 2) to mitigate the dilution of the ownership for companies with employee stock compensation plans; 3) to manipulate Earnings Per Share (EPS) - especially for smaller, less profitable companies; 4) to serve the clientele with preferences for tax sheltering; 5) managers believe that company is undervalued.

It is obvious that share repurchase decisions are largely managerial decisions. Evidence in Brav et al (2005) shows that share repurchases are preferred by managers because repurchases are more flexible and can be adopted to achieve various managerial goals. While traditional theories of signaling and free cash flow hypotheses cannot fully explain the surge of share repurchase activities in the past several years from the real world, the managerial motive to repurchase shares becomes an interesting topic to explore. In this paper, I investigate the association between share repurchases and CEO characteristics under the influence of managerial entrenchment.

As in the free-cash-flow literature, the managerial entrenchment approach assumes that there is shareholder-manager conflict because managers can derive private benefits from managing the firm, for example, engaging in empire-building activities and etc. On the other hand, the entrenchment literature explicitly takes into account the costs of removing entrenched managers: a take-over or bankruptcy may be the only feasible way to remove the

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I am grateful to Praveen Kumar for his inspiring suggestion and advice. I would like to thank two anonymous referees for the suggestions that greatly improved this paper. I also thank participants at the 2006 Academy of Finance Annual Conference held in Chicago, IL for their helpful suggestions. All remaining errors are my own responsibility.

incumbent managers. The manager chooses imposing payout or capital structure policies to maximize his or her own utility (e.g., tenure, other private benefits, etc.) subject to avoiding a take-over or bankruptcy.[1] Consider, for example, Zwiebel's (1996) managerial entrenchment model. This model does not assume that managers can be made to pay out cash involuntarily. Rather, entrenched managers seek to avoid the possibility of an involuntary replacement (through a take-over or bankruptcy) by restraining their non-productive use of capital. The dynamically consistent way to do this is to pay out cash and set appropriate levels of debt voluntarily. The manager's optimal choice of payout and debt policy will depend on the type of investment projects available. In equilibrium, there is self-selection in terms of choice of payout and debt policy: managers with good projects (the more productive managers) choose a lower payout policy since they do not need "self-restraining" devices to avoid involuntary replacement as much as less productive managers. Hence there is an explicit relationship between managerial motives and a firm's repurchase decisions.

Most of the empirical literature on a firm's payout policies studies the effect of ordinary dividend payment. Brav et al. (2005) find maintaining the existing dividend level is in line with investment decisions while share repurchases are used to pay out the residual cash flow after investment spending. Therefore the decision of paying dividend is different from the decision of buying back common shares.

Few studies have examined directly the unambiguous refutable predictions of the entrenchment hypothesis with respect to share repurchases until now. I seek to fill this gap by investigating how equity incentives are related to the decision of share repurchases. This study tests both the amount and the likelihood of share repurchases that can be explained by the CEO characteristics while controlling for measures of free cash flow (Lambert et al. (1989) and Fenn and Liang (2001)). Moreover, this study extends the empirical framework to allow for the role of executive incentive compensation. Complex executive compensation contracts (including stock options, director shares, restricted stock awards and etc.) reduce the non-value-maximizing consequences of managerial entrenchment (Lewellen et al. (1987), Hall and Liebman (1998), and Zhou (2001)). I therefore extend the set of refutable predictions to include a positive relationship between repurchases and equity-based managerial incentives.

Managerial stock options can help to align the incentives of managers and shareholders. Fenn and Liang (2001) find that management stock options are related to the composition of payouts. They document a strong negative connection between dividends and management stock options; and a positive relationship between repurchases and management stock options. In a recent research, De Jong et al. (2003) investigate the payout decisions between dividends and share repurchases using a sample of non-financial Canadian firms. They find that firms with managerial option plans are less likely to pay dividends. However, few extant studies investigate the complexity of the executive compensation plans. In this study, I examine the association between stock repurchase activities and CEO compensation policies explicitly. The purpose of this study is to test the following hypothesis:

[1] Notice that the agency or the free-cash-flow approach assumes that shareholders can make the managers choose payout or capital structure policies that reduce the agency costs (for example, large payouts or high leverage).

There is a definite association between a CEO's compensation plan and a firm's share repurchase decision because of the potential equity dilution effect. In short, equity-based managerial compensation incentives to increase the amount of share repurchases at companies with potentially the most entrenched managers, that is, firms with longer listing history, higher executive power, and fewer investment opportunities or high free cash flows need to motivate their managers more through equity-based incentive payment.

There are several primary findings in this research. By incorporating multipart managerial compensation variables in the analysis, this research shows that the richness of executive compensation plans is an important factor in the process of repurchase decisions – both qualitatively and quantitatively. In my analysis, management stock options are an important factor in deciding whether to repurchase common stocks. However, the effect of stock options is insignificant in the determination of size (or amount) of stock repurchases. It appears that the significantly positive effect between repurchases and executive stock options in existing literature is due to the latent variable problem.

In addition, this study develops and demonstrates considerable empirical support for a perspective on share repurchases that integrates the influence of firm age, value of tangible asset, and heterogeneous management compensation. I also find that firm size, leverage, and investment opportunity related variables significantly impact the share repurchase decision. This analysis thus adds to the empirical literature that generally focuses on the signaling aspects of share repurchases (e.g., Vermalaen (1981) and Dann et al. (1991)), and identifies new links between firm characteristics and share repurchases, a matter of increasing interest (e.g., Jagannathan et al. (2000)). Finally, comparing the likelihood of repurchases and the amount of repurchases, I find that the entrenchment model is considerably more successful in explaining the amount of repurchases relative to the likelihood of whether to buy back shares.

2. Sample and Data Description

To investigate the relationship between share repurchases and a CEO's compensation plan, I use data from Standard & Poor's Compustat and Execucomp databases. Compustat is my source for share repurchases, and firm characteristics, while Execucomp is the source for managerial compensation variables.

2.1 Sample Selection

The primary data source is the 2001 Standard & Poor ExecuComp database. This database contains records of over 2,040 firms in various S&P indices, covering the period from 1992 to 2000. For each firm in the database, I take the annual compensation records for the CEO, and also obtain the firm's financial records from the Compustat file. The share prices are from the CRSP file. I then eliminate annual observations that are in regulated industries (SIC code 4990 through 4999 and 6000 through 6999). This procedure yields 9,677 firm-year records from 1992 through 2000. I refer to this as the full sample. Deleting observations with missing value from the proxy statements yields a final sample of slightly over 7,610 firm-year records. Most of my analyses are run on the restricted sample, but I use the full sample to study differences between repurchase and non-repurchase firms with respect to firm-specific characteristics that are available from Compustat and CRSP.

2.2 Empirical Estimation and Proxy Variables

As we noted above, the theoretical managerial entrenchment models predict a negative relation between the amount (or size) of share repurchases and the strength of the managerial productivity, conditional on the firm making a repurchase decision. Therefore, I estimate the following empirical specification:

$$Y^* = \alpha + \beta' X + \varepsilon \tag{1}$$

$$\frac{R}{P} = \begin{cases} Y^* & \text{if} \quad Y^* > 0 \\ 0 & \text{if} \quad Y^* \leq 0 \end{cases} \tag{2}$$

In this model, R/P is the repurchase yield, defined as the dollar amount of repurchase of common shares divided by the market value of equity. To avoid the potential look-ahead bias, I take the repurchase in period t and divide it by the average market capitalization of the beginning and ending share prices (P) of that period.

I also construct logit models based on the above specification to test the likelihood of share repurchases. In the logit models, the dependent variables are defined as 1 if a repurchase yield is greater than 0, or 0 otherwise.

To derive the amount of a repurchase, I adopt the methodology outlined in Allen and Michaely (2003). I first take the purchase of common and preferred stock (Compustat annual item 115) and then adjust this quantity by net changes of preferred stock redemption value (Compustat annual item 56) from year t-1 to year t.[2]

CEO's compensation variables are derived from ExecuComp. The level of managerial entrenchment is inversely related to the effectiveness of internal corporate governance mechanisms and the potency of external takeover threats. The effectiveness of the internal mechanisms is measured through CEO-specific variables that are reflective of the CEO's power. Exhibit 1 gives an in-depth and accurate definition and the predicted sign of proxy variables used in both Tobit and logit analyses.

In this research, a firm's characteristics are also considered. First, I use the net tangible asset. This variable is introduced to control for differential structure of firms with different asset. The measure is calculated as net book value of property, plant and equipment divided by the book value of asset.

The second variable is firm age. Empirically, positive payout firms tend to be older or more mature firms (e.g., Fama and French (2001)). The age of a firm is calculated as the

[2] My methodology here is similar to that used by Jagannathan, Stephens and Weisbach (2000) and Grullon and Michaely (2002). In my study, some observations for the net changes of preferred stock redemption value are negative. Those observations are treated as missing values.

difference between the recording year in the ExecuComp database and the share listing date of the firm. The listing date is obtained through CRSP monthly file.

There is a potential look-ahead bias if we use regressors obtained from the end of the repurchase payout period, rather than the beginning of this period. In general, using end-of- the-period values are likely to overstate the explanatory power of the model. To control for this effect, all regressors are taken to be the beginning-of-the-year values. Thus, for stock variables (such as share holdings and the value of stock options held) are taken to be the values at the end of the previous year, while flow variables (such as cash salary and bonus) are those from the previous year. Also, the repurchase-yield measures for a given year are taken to be the cash payments paid in the year divided by the average of the closing prices at the beginning and end of that year. In my study, measurements of share repurchases are remarkably robust to various combinations of choices regarding the construction and timing of payments and the share prices.

3. Empirical Results

Since share repurchase is mainly a managerial decision, the propensity of repurchase has an important implication: managers need to decide whether or not to make a repurchase first. Conditional on choosing to buy back shares, managers then decide the amount of repurchase. Thus the strength of the managerial productivity is negatively related both to the likelihood of making a repurchase and the amount of the payout, conditional on making share repurchase. To address this sequential process, to test the robustness of the models and to examine the effect of different components of CEO's compensation, I estimate two separate models for Tobit and logit regressions.

The primary empirical results are reported in Table 1. I report both coefficients of the regressions, and model performance in general. For both Tobit and logit regressions, the results are very consistent. Turning first to the repurchase-yield regressions, I find that the results are strongly supportive of the theoretical predictions. Conditional on the making the decision to repurchase shares, the repurchase yield is significantly and positively associated with equity-based managerial compensation and length of service in the firm, and significantly and negatively associated with the CEO power proxies related to compensation, and the amount of a firm's tangible assets. I continue to find evidence of a non-linear impact of service length: CEOs with exceptionally long tenure tend to repurchase less, ceteris paribus.

However, there are a few interesting differences between the Tobit regressions and the Logit regressions for the repurchase decision. Note that the value of executive stock options has a significant (positive) influence on the likelihood of share repurchases. This result has some intuitive appeal: one would expect that while the basic repurchase decision may be largely driven by the overall quality of the firm's economic prospects (good versus bad), the amount of share repurchases would also depend on how good these prospects are. To the extent that executive stock options are an indicator of how well the firm performed, they would be expected to be significant in the repurchase-yield regressions.

Looking at Tobit regressions, I find that the executive stock option is insignificant when comparing to other incentive compensation variables. This is an interesting result in light of the existing research mentioned earlier, it shows that researchers need to incorporate the complex effects of compensation contracts when studying the managerial incentive problems (e.g., Kole (1997)).

3.1 Size Effects

Some of the most influential variables for determining the repurchase decision and the repurchase-yield in the previous section are the length of CEO service, cash salary and bonus as a proportion of the CEO's total compensation, stock options exercised, and firm age. All of these variables are likely to be correlated with the quality of investment opportunity set or firm size. Firm size and age are positively correlated (e.g., Audretsch (1995)). In my sample, smaller firms are more likely to have a greater proportion of asset value in growth options; in addition, CEOs of small firms receive a significantly higher proportion of their compensation through equity-based compensation. I therefore examine whether the impact of the entrenchment-related variables on repurchase policy is really due to an underlying correlation between firm size and repurchase payout policy.

To test for size effects in repurchase decision, I enhance the specification of the basic repurchase decision and yield models to include firm size, defined as the market value of total assets. Table 2 reports the results of this analysis.

Tobit regressions in Table 2 make two major points. First, that the significance of the compensation variables in Table 1 is not a spurious finding due to a latent size effect. Both the significance and (algebraic) size of the coefficients for the various compensation related variables are unaffected even when I control for the firm size.

Second, firm size is positively and very significantly related to the likelihood of share repurchases, even after controlling for the age of the firm and the compensation related variables. The in-sample fit of the model in fact improves with the inclusion of size as an explanatory variable for the two logit models. These results imply that firm size is an important factor for managers when they try to make a decision of whether to buy back shares.

I turn now to the impact of firm size on the size of the repurchases. Results from Tobit models in Table 2 exhibit quite different effects about the firm size on the repurchase yield: the introduction of firm size does not improve the explanatory power of both tobit models. This result is quite interesting, it indicates that a firm's size has nothing to do with the amount of repurchases. This evidence shows that firm size has an influence on the propensity of share repurchases, but has no influence on the size of repurchases.

3.2 Leverage Effects

In previous sections, leverage related variables are absent in the basic repurchase models under managerial entrenchment. However, leverage should impact share repurchases for a variety of reasons according to theoretical literature (e.g., Zwiebel (1996)) and empirical evidence (e.g., Berger et al. (1997)). I examine the influence of firm leverage ratio in this section.

I expect leverage to have a negative impact on repurchases, other things held constant, for at least two reasons. There is a direct and restrictive impact of debt covenant restrictions on repurchase payouts. There may also be an indirect negative effect to the extent that debt related repurchases reduce firm liquidity and constrain (discretionary) payouts to shareholders. This prediction should hold even when there are endogenous debt effects, in which case my models should be interpreted as a structural probability model of share repurchases.

I test the hypothesis of a negative relation of leverage to repurchases by including firm leverage in the basic specification (cf. Table 1). Here I measure leverage through the debt-to-capitalization ratio using the market value of equity. But my results are unaffected when I use other measures such as the book value of debt-to-equity ratio.

Table 3 reports the leverage effect on the repurchase likelihood and repurchase-yield, respectively. I find that high leverage has a significantly negative relationship with the likelihood of repurchases. Furthermore, and conditional on a positive repurchase decision, leverage is significantly and negatively related to both repurchase yields. The analysis thus supports the hypothesis that leverage negatively affects repurchases, ceteris paribus. Note that the inclusion of leverage does not materially impact the role of the other independent variables, indicating that the role of the compensation variables in the repurchase regressions is not due to spurious correlation with leverage.

3.3 Investment Opportunity Effects

To test the impact of growth opportunities on the decision of share repurchases, I proxy the quality of the investment opportunity set in two ways. I use the market-to-book value ratio as a measure of portion of the market value of the firm comprised of growth options (Fama and French (1992) and Smith and Watts (1992)). However, market-to-book ratio may proxy for other issues. As an example, low market-to-book ratio may be interpreted as under-valued, out of favor firm, and hence low market-to-book ratio can be the incentive for share repurchase. To accommodate this potential problem, I also construct an investment opportunity factor using principal components introduced in Baber et al. (1996). I use principal components to extract the common growth-option factor from 4 underlying variables that are compiled from Compustat. These four variables are, 1) the firm's investment intensity from year t-2 to year t; 2) the geometric growth in the market value of assets from year t-2 to year t; 3) the market-to-book ratio of assets at the end of year t; and 4) the ratio of R&D expenses to the book value of assets at the end of year t.

Table 4 reports the results of this analysis using market-to-book value of asset as growth opportunity proxy. Effects of investment opportunities using the common growth factor are quite the same in this research and hence I do not report the results here. Looking at both Tobit and logit models, my analysis confirms the negative relationship between share repurchase and the growth options. For the Tobit models, it is also interesting to see that the significance of executive stock options improves (i.e., marginally insignificant) after introducing the growth opportunity proxy.

4. Conclusion

The theoretical literature on managerial entrenchment makes a number of relatively unambiguous refutable predictions regarding firm repurchase policy. It directly incorporates the strength of executive characteristics, external takeover threats, and firm characteristics. I extend this framework to also allow for the role of managerial incentive contracts. Under this framework, the predictions are that the likelihood and the size of share repurchase is positively related to the use of equity-based compensation contracts, but negatively related to the quality of the firm's investment opportunity set and the power of the top manager. These predictions are distinct from the implications of traditional signaling models and free cash-flow hypothesis.

This study investigates how corporate repurchase policy is related to top executive compensation contract. Using data for a sample of more than 2,040 companies, I present empirical evidence suggesting that managerial equity-based compensation incentives to increase cash payouts of companies with potentially the most entrenched managers, that is, those with longer listing history, higher executive power measured by CEO's tenure and the amount of cash compensation, and fewer investment opportunities or high free cash flows. This evidence shows that equity-based compensations help to reduce non-value-maximizing behaviors taken by the entrenched managers in general.

This empirical analysis largely supports the predictions made by the managerial entrenchment model, both for the likelihood of repurchases and the size of repurchases. In general, this study shows that the decision of share repurchase is directly related to executive and firm characteristics, and the richness of the managerial compensation contract plays an important role in the determination of share repurchase decision.

Exhibit 1. Definition of Variables

The dependent and independent variables used in the analysis are defined below. As a general rule, for dependent variables in year t, the regressors are taken to be the beginning of the year values. Thus, for stock variables, the values are as of the end of year t-1 and for follow variables the values are taken from year t-1. The theoretically predicted sign in the binary choice and repurchase yield regressions for the independent variables is also indicated. A positive (negative) sign implies that increases in variable value increase (decrease) the likelihood of repurchase or the amount of the repurchase, holding other things fixed.

Dependent variable	Construction of the variable
Stock Repurchase Yield	It is calculated as the dollar value of purchase of common shares in a given year divided by the average market value of equity in the beginning and the end of the year.
Stock Repurchase Index	An indicator equals to 1 if a firm's stock repurchase yield is greater than 0 in year t; otherwise 0.

Independent Variables	Predicted Sign	Definition of the variable
Service Length	Positive	Number of years credited toward the CEO's retirement plan: extracted from Execucomp database.
Long Tenure	Negative	A dummy variable equaling I only if the CEO has served on his/her position for more than 25 years.
Compensation Ratio	Negative	Percentage of a CEO's cash salary and bonus to his/her total compensation in a given year, calculated using records obtained from the ExecuComp database.
Stock Options Exercised	Positive	Log(1+Value of stock options exercised in year t): extracted from ExecuComp database.
Salary & Bonus	?	Log (1+ value of cash salary and bonus given to a CEO in year t): extracted from the ExecuComp database.
Long-term Incentive Plan	Positive	Log (1+value of long-term incentive plan in year t): extracted from ExecuComp database.
Executive Stock Options	Positive	Log (1+value of executive stock options): extracted directly from Execucomp database.
In-the-money Options	Positive	Log (1+value of in-the-money exercisable executive stock options): extracted from Execucomp database.
Director Shares	Positive	Log(1+MV of director shares in year t). Number of shares is obtained from ExecuComp, share price is obtained from CRSP daily file, it is the average price between year t-1 and year t.
Restricted Shares held by CEO	Positive	Log(1+value of restricted shares held by CEO in year t). Value of restricted shares is reported by the firm and is directly obtained from ExecuComp.
Common Shares held by CEO	Positive	Log(1+MV of shares held by CEO in year t):number of shares held by CEO is extracted from ExecuComp database; share price is obtained from CRSP daily file, it is the average price between year t-1 and year t.
Tangible Assets	?	(Net book value of Property, Plant, and Equipment) /value of assets. Both items are from Compustat.
Firm Age	Positive	Set equal to the current reporting year minus the beginning date of a firm's listing year obtained through CRSP monthly file.
Investment Opportunities	Negative	Market Value-to-Book Value Ratio of Firm Equity.
Firm Size	Positive	Log (1+ market value of assets), where market value of assets is calculated as the book value of liability plus market value of equity.
Leverage	Negative	Debt/(Debt + Equity). The book value of debt and the market value of equity are used.

Table 1. Tobit and Logit Analysis of the Share Repurchase

For the Tobit Repurchase Yield regression, the dependent variable is the repurchase yield that is calculated in a manner explicated in Exhibit 1. A positive (negative) coefficient sign indicates that the variable is positively (negatively) associated with the amount of repurchases. For the logit Repurchase Likelihood regression, the dependent variable is an index equal to 1 if a firm repurchases shares in year *t* (calendar year), or 0 otherwise.

Value of stock repurchase and the book value of asset are obtained from Compustat while market value of equity is obtained through CRSP. The associated *t*-statistic is reported in the parenthesis.

Explanatory Variables	Predicted Sign	Tobit Repurchase Yield		Logit Repurchase Likelihood	
		Specification (1)	Specification (2)	Specification (1)	Specification (2)
Intercept	—	-8.006 (-8.85)***	-6.495 (-10.96)***	-1.137 (-9.69)***	-0.933 (-12.04)***
Service Length	Positive	0.252 (3.12)***	0.417 (4.96)***	0.038 (3.56)***	0.063 (5.54)***
Long Tenure	Negative	—	-1.173 (-2.01)**	—	-0.171 (-2.21)**
Compensation Ratio	Negative	-0.636 (-1.56)	—	-0.199 (-3.83)***	—
Salary & Bonus	?	0.494 (3.69)***	—	0.122 (6.95)***	—
Executive Stock Options	Positive	—	0.047 (1.26)	—	0.018 (3.59)***
Director Shares	Positive	0.536 (5.87)***	—	0.102 (8.08)***	—
Stock Options Exercised	Positive	0.087 (2.59)**	0.153 (4.42)***	0.021 (4.87)***	0.032 (6.72)***
Long-term Incentive Plan	Positive	0.189 (3.67)***	—	0.037 (5.03)***	—
Restricted Shares held by CEO	Positive	—	0.068 (1.89)*	—	0.029 (5.66)***
Common Shares held by CEO	Positive	—	0.153 (3.14)***	—	0.042 (6.68)***
Tangible Assets	?	-2.012 (-3.78)***	-1.727 (-3.02)***	-0.337 (-4.95)***	-0.358 (4.75)***
Firm Age	Positive	0.858 (6.32)***	0.884 (6.28)***	0.178 (10.2)***	0.199 (10.65)***
Number of Observations		7101	6708	7101	6708
Percentage Correctly Predicted		—	—	61.3	60.1
Estimated Sigma		8.89	8.56	—	—
Log Likelihood		-9086.11	-7478.49	-5237.37	-4360.96
p-value of χ^2 of Log likelihood		< 0.001	< 0.001	< 0.001	< 0.001
Pseudo R^2		19.5%	33.7%	10.6%	9.7%

Asterisks *, **, *** indicate *t*-statistic significance at 10%, 5%, and 1% levels, respectively.

Table 2. The Effect of Firm Size on the Amount and the Likelihood of Share Repurchase

For the Tobit Repurchase Yield regression, the dependent variable is the repurchase yield that is calculated in a manner explicated in Exhibit 1. A positive (negative) coefficient sign indicates that the variable is positively (negatively) associated with the amount of repurchases. For the logit Repurchase Likelihood regression, the dependent variable is an index equal to 1 if a firm repurchases shares in year *t* (calendar year), or 0 otherwise.

Firm Size is measured as *log (1+market value of assets)* for year *t*. The market value of assets is calculated as book value of liabilities plus market value of equity. Dividends and the market value of equity are obtained from CRSP file while share repurchase and book value of asset are obtained through Compustat. The value of *t*-statistic is reported in the parenthesis.

Explanatory Variables	Predicted Sign	Tobit Repurchase Yield		Logit Repurchase Likelihood	
		Specification (1)	Specification (2)	Specification (1)	Specification (2)
Intercept	—	-7.643 (-8.15)***	-7.039 (-9.97)***	-1.257 (-10.40)***	-1.271 (-13.43)***
Service Length	Positive	0.267 (3.28)***	0.376 (3.95)***	0.032 (3.05)***	0.048 (4.11)***
Long Tenure	Negative	—	-1.110 (-1.89)*	—	-0.139 (-1.80)*
Compensation Ratio	Negative	-0.809 (-1.90)*	—	-0.147 (-2.72)**	—
Salary & Bonus	?	0.584 (3.97)***	—	0.095 (4.96)***	—
Executive Stock Options	Positive	—	0.034 (0.89)	—	0.011 (2.13)**
Director Shares	Positive	0.558 (6.04)***	—	0.094 (7.43)***	—
Stock Options Exercised	Positive	0.093 (2.75)**	0.142 (4.03)***	0.019 (4.39)***	0.026 (5.39)***
Long-term Incentive Plan	Positive	0.195 (3.76)***	—	0.035 (4.71)***	—
Restricted Shares held by CEO	Positive	—	0.058 (1.58)	—	0.023 (4.42)***
Common Shares held by CEO	Positive	—	0.131 (2.57)**	—	0.030 (4.59)***
Tangible Assets	?	-1.932 (-3.62)***	-1.779 (-3.11)***	-0.362 (-5.28)***	-0.397 (-5.22)***
Firm Age	Positive	0.902 (6.47)***	0.825 (5.65)***	0.164 (9.20)***	0.167 (8.65)***
Firm Size	Negative	-0.138 (-1.46)	0.136 (1.44)	0.044 (3.54)***	0.081 (6.26)***
Number of Observations		7101	6708	7101	6708
Percentage Correctly Predicted		—	—	61.4	60.3
Estimated Sigma		8.87	8.57	—	—
Log Likelihood		-9085.18	-7477.58	-5229.87	-4339.82
p-value of χ^2 of Log likelihood		< 0.001	< 0.001	< 0.001	< 0.001
Pseudo R^2		19.5%	33.7%	10.8%	10.3%

Asterisks *, **, *** indicate *t*-statistic significance at 10%, 5%, and 1% levels, respectively.

Table 3. Effect of Leverage on the Amount and the Likelihood of Share Repurchase

For the Tobit Repurchase Yield regression, the dependent variable is the repurchase yield that is calculated in a manner explicated in Exhibit 1. A positive (negative) coefficient sign indicates that the variable is positively (negatively) associated with the amount of repurchases. For the logit Repurchase Likelihood regression, the dependent variable is an index equal to 1 if a firm repurchases shares in year *t* (calendar year), or 0 otherwise.
Leverage is measured as the market value debt-capitalization ratio (i.e., debt/(debt + equity)). Consistent with the standard corporate finance practice, I use the market value of equity but the book value of debt. Leverage and market capitalization records are extracted from Compustat. The value of *t*-statistic is reported in the parenthesis.

Explanatory Variables	Predicted Sign	Tobit Repurchase Yield		Logit Repurchase Likelihood	
		Specification (1)	Specification (2)	Specification (1)	Specification (2)
Intercept	—	-7.851 (-8.62)***	-6.283 (-10.39)***	-1.068 (-9.03)***	-0.823 (-10.41)***
Service Length	Positive	0.273 (3.36)***	0.440 (5.18)***	0.049 (4.59)***	0.076 (6.63)***
Long Tenure	Negative	—	-1.246 (-2.12)**	—	-0.202 (-2.26)**
Compensation Ratio	Negative	-0.637 (-1.56)	—	-0.201 (-3.85)***	—
Salary & Bonus	?	0.4973 (3.70)***	—	0.1224 (6.92)***	—
Executive Stock Options	Positive	—	0.046 (1.22)	—	0.017 (3.42)***
Director Shares	Positive	0.555 (6.04)***	—	0.110 (8.66)***	—
Stock Options Exercised	Positive	0.072 (2.12)**	0.142 (4.04)***	0.014 (3.26)***	0.025 (5.31)***
Long-term Incentive Plan	Positive	0.190 (3.66)***	—	0.037 (5.02)***	—
Restricted Shares held by CEO	Positive	—	0.071 (1.97)*	—	0.031 (6.08)***
Common Shares held by CEO	Positive	—	0.144 (2.93)***	—	0.037 (5.86)***
Tangible Assets	?	-1.753 (-3.21)***	-1.516 (-2.59)**	-0.209 (-3.00)***	-0.239 (-3.09)***
Firm Age	Positive	0.874 (6.39)***	0.899 (6.34)***	0.191 (10.88)***	0.211 (11.19)***
Leverage	Negative	-1.623 (-2.51)**	-1.365 (-1.96)*	-0.756 (-9.15)***	-0.733 (-7.99)***
Number of Observations		7074	6684	7074	6684
Percentage Correctly Predicted		—	—	62.5	61.0
Estimated Sigma		8.90	8.59	—	—
Log Likelihood		-9058.85	-7455.79	-5175.23	-4311.53
p-value of χ^2 of Log likelihood		<0.001	<0.001	<0.001	<0.001
Pseudo R^2		19.8%	33.9%	11.9%	10.8%

Asterisks *, **, *** indicate *t*-statistic significance at 10%, 5%, and 1% levels, respectively.

Table 4. The Effect of Investment Opportunities on the Amount and the Likelihood of Share Repurchase

For the Tobit Repurchase Yield regression, the dependent variable is the repurchase yield that is calculated in a manner explicated in Exhibit 1. A positive (negative) coefficient sign indicates that the variable is positively (negatively) associated with the amount of repurchases. For the logit Repurchase Likelihood regression, the dependent variable is an index equal to 1 if a firm repurchases shares in year *t* (calendar year), or 0 otherwise.

I use market-to-book value of asset as a proxy for the investment opportunity set. The market value of assets is calculated as book value of liabilities plus market value of equity. The market value of equity is obtained from CRSP file while book value of asset and liability are obtained through Compustat. The value of *t*-statistic is reported in the parenthesis.

Explanatory Variables	Predicted Sign	Tobit Repurchase Yield		Logit Repurchase Likelihood	
		Specification (1)	Specification (2)	Specification (1)	Specification (2)
Intercept	—	-7.498 (-8.11)***	-6.167 (-10.07)***	-1.077 (8.97)***	-0.894 (-11.10)***
Service Length	Positive	0.238 (2.95)***	0.399 (4.74)***	0.035 (3.36)***	0.061 (5.29)***
Long Career	Positive	—	-1.209 (-2.07)**	—	-0.174 (-2.26)**
Compensation Ratio	Positive	-0.764 (-1.86)*	—	-0.213 (-4.08)***	—
Salary & Bonus	?	0.479 (3.58)***	—	0.120 (6.83)***	—
Executive Stock Options	Positive	—	0.054 (1.44)	—	0.019 (3.79)***
Director Shares	Positive	0.528 (5.78)***	—	0.100 (7.89)***	—
Stock Options Exercised	Positive	0.091 (2.73)**	0.156 (4.51)***	0.022 (4.98)***	0.032 (6.81)***
Long-term Incentive Plan	Positive	0.185 (3.58)***	—	0.0369 (4.96)***	—
Restricted Shares held by CEO	Positive	—	0.064 (1.77)*	—	0.028 (5.58)***
Common Shares held by CEO	Positive	—	0.145 (2.97)***	—	0.041 (6.50)***
Tangible Assets	?	-2.315 (-4.25)***	-2.002 (-3.42)***	-0.371 (3.31)***	-0.390 (-5.01)***
Firm Age	Positive	0.833 (6.12)***	0.863 (6.12)***	0.175 (10.04)***	0.196 (10.46)***
Investment Opportunity	Negative	-4.599 (-2.61)**	-3.646 (-2.07)**	-0.497 (2.26)**	-0.4.2 (-1.77)*
Number of Observations		7013	6672	7013	6672
Percentage Correctly Predicted		—	—	61.4	60.5
Estimated Sigma		8.89	8.56	—	—
Log Likelihood		-9084.38	-7477.39	-5234.65	-4359.03
p-value of χ^2 of Log likelihood		< 0.001	< 0.001	< 0.001	< 0.001
Pseudo R^2		19.5%	33.7%	10.7%	9.9%

Asterisks *, **, *** indicate *t*-statistic significance at 10%, 5%, and 1% levels, respectively.

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