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Internet Appendix for

Cheng, Harford, and Zhang: Bonus Driven Repurchases

Additional Analyses discussed in Section 4.5

Discretionary accruals

It is natural to ask whether managers using repurchases to manipulate the denominator also use discretionary accruals to manipulate the numerator of EPS. Alternatively put, why repurchase when they can manage earnings to achieve the same personal bonus benefit? The two could be complements or substitutes. It is possible that managers turn to repurchases once they have exhausted the flexibility afforded them by discretion over accruals. To answer the question, we estimate an OLS regression of earnings discretionary accruals with year and industry fixed effects. The model is as follows:

$$DA_{i,t} = \beta_0 + \beta_1 Size_{i,t-1} + \beta_2 MTB_{i,t-1} + \beta_3 EPSfactor_{i,t} + \mu_{i,t}. \quad (4)$$

DA is the discretionary accruals that are derived via the modified Jones' model (Jones, 1991; Roychowdhury, 2006).[1] The estimated coefficient on *EPSfactor* is 0.001 with a standard error of 0.003. EPS-linked bonuses by themselves do not lead to greater discretionary accruals. We further test whether greater discretionary accruals are

[1] We estimate the model of accrual: $Accruals_t/A_{t-1} = \alpha_0 + \alpha_1 (1/A_{t-1}) + \beta_1 (\Delta S_t/A_{t-1}) + \beta_2 (PPE_{t-1}/A_{t-1}) + \varepsilon_t$. *Accruals* are income before extraordinary items (COMPUSTAT data #18). ΔS is the change in sales (data #12). *PPE* is the net property, plant, and equipment (data #8). All variables other than the first intercept are scaled by lagged total assets (data #6). The regressions are estimated for firms in every industry-year, with industries defined by two-digit SIC codes. The residuals are the discretionary accruals.

associated with greater repurchases. We examine the correlation between buyback ratios and discretionary accruals. The Pearson correlation coefficient between them is -0.012, with p-value being 0.136. Thus, if anything, greater accruals are associated with lower repurchases. This is sensible as greater accruals means that less of the firm's earnings represent actual cash flow that could be used for repurchases.

We further compare repurchasing firms to those that manage earnings. For contrast, we define two groups: those with high discretionary accruals and with no repurchases and those with low discretionary accruals and with repurchases. High/Low discretionary accruals are defined as the top and bottom thirds of the discretionary accruals distribution. Table 11 shows that the group of "Low DA & with repurchasing" are larger and more profitable firms with lower leverage, with a higher payout ratio, and thus lower cash-to-asset ratio, and with lower management option ratio. The group of "Low DA & with repurchasing" have lower valuations than the group of "High DA & with no repurchasing", as indicated by their lower market-to-book ratios and abnormal returns. Intuitively, higher valued and higher leverage firms make greater use of discretionary accruals instead of repurchases. The probit regression in the last column of Table 11 confirms those findings. We conclude that while each tool can manipulate EPS, they tend to be used by different firms or at different times for a given firm.

Insert IA Table 1

Accretive repurchases

To distinguish between repurchases that are accretive and those that are not, we compare *As-if EPS* with the reported EPS (with buyback) by repurchasing firms. We find that 29% of the repurchasing observations are accretive by at least one cent and 72% are

accretive in the sense that they increase EPS by any amount.[2] To test whether a firm is more likely to conduct accretive repurchases when its CEO's bonus is tied to EPS, first we estimate the probit regression of repurchasing with the independent variables specified as in Column 1 of Table 5, but we exclude the EPS linking dummy from the regression. From this, we derive the predicted probability of repurchasing (the propensity score) for each firm in the sample of repurchasing and non-repurchasing firms. We then estimate the probit regression of "accretive repurchasing" on the subset of repurchasing firms, with the dummy of EPS linking and the propensity score derived earlier as the independent variables. The test determines whether, controlling for the choice to repurchase, EPS linking firms are more likely to make accretive repurchases. The estimation, using 3,768 observations, includes year and industry fixed-effects:

$$\text{Accretive Repurchase} = \phi\left(\underset{(0.089)}{-1.418} \; \underset{(0.042)}{+0.085 \times \text{EPSFactor}} \; \underset{(0.163)}{+1.617 \times \text{Propensity Score}}\right)$$

The coefficient on EPS linking is 0.085, with a standard error of 0.042, so that it is significant at the 95% level, suggesting that a firm is more likely to conduct accretive repurchases when its CEO's bonus is tied to EPS.[3] Thus, accounting for the opportunity cost of the repurchases, we still find support for Hypothesis 1.

Timing of the Repurchase

[2] In 28% of the repurchases, the reported EPS (with buyback) is below As-is EPS; only in 10% of the repurchases, the reported EPS (with buyback) is below As-is EPS by one cent or more.

[3] In untabulated tests, we also perform multinomial logit estimation over the decision space of no repurchase, accretive repurchase, and non-accretive repurchase. The results confirm that EPS-linking makes accretive repurchases more likely.

For EPS-linking firms, the third and fourth quarter see greater buyback activity than earlier quarters. A Kruskal-Wallis test confirms the statistical significance of the differences among the four quarters. For non-EPS-linking firms, there are no statistically significant differences among the four quarters. The results are consistent with our expectation: CEOs whose bonus is tied to EPS are more likely to buy back shares towards the end of a year.

Equity-based compensation of CEOs

In the earlier analysis, we consider management options, i.e., the number of shares underlying options held by the top five executives scaled by the number of shares outstanding, as one factor in share buyback decisions. However, stock option holdings are noisy measures of managerial incentives as they do not explicitly measure the relation between CEO portfolio wealth and stock returns. We compute the CEO's delta using the one-year approximation method outlined in Core and Guay (2002). The mean and median CEO portfolio delta in our sample are $881,122 and $249,661, respectively. That is, for a 1% increase in stock price, the CEO's wealth tied to stock and options, on average, increases by more than $880,000. In untabulated tests, we find that our original management options variable is highly correlated with the managerial delta, such that managerial delta does not add anything new to the buyback regressions and does not change the EPS-linking results.

Internet Appendix Table 1: Repurchasing and discretionary accruals

We compare two groups of firms: those with low discretionary accruals but with repurchasing, and those with high discretionary accruals but without repurchasing. High/Low discretionary accruals (DA) are defined as the top and bottom thirds of the discretionary accruals distribution. Discretionary accruals are derived via the modified Jones' model (Jones, 1991; Roychowdhury, 2006). In the last column, we report the probit regression on those two groups, with the dependent variable being one if a firm is in the group of "high DA & with no repurchasing", and being zero if it is in the group of "low DA & with repurchasing". The remaining variables are defined in Table 2.

Appendix Table 1 (continued)

	Low DA & with repurchasing	*High DA & with no repurchasing*	*t-test: t-stat (p-value)*	*Rank test: Chi-squared (p-value)*	*Probit Regression =1, if "high DA & with no repurchasing"; =0, if "low DA & with repurchasing"*
Total assets	4,966	5,245	0.36	128.63	-0.201***
	(1,327)	(748)	(0.72)	(<0.001)	(0.028)
	N=1,818	N=2,242			
Market-to-book	1.85	2.16	5.40	7.16	-0.008
	(1.41)	(1.48)	(<0.001)	(0.007)	(0.023)
	N=1,814	N=2,230			
Cash-to-assets	0.12	0.20	13.98	141.05	-0.005
	(0.06)	(0.11)	(<0.001)	(<0.001)	(0.216)
	N=1,818	N=2,236			
Profitability	0.06	0.02	14.13	187.64	-1.752***
	(0.07)	(0.04)	(<0.001)	(<0.001)	(0.435)
	N=1,818	N=2,236			
Payout ratio	0.20	0.12	9.02	201.28	-0.111
	(0.08)	(0.00)	(<0.001)	(<0.001)	(0.129)
	N=1,746	N=2,088			
Industry-adjusted	0.02	0.07	11.05	119.09	0.765***
leverage	(0.00)	(0.04)	(<0.001)	(<0.001)	(0.243)
	N=1,816	N=2,237			
Abnormal return	7.35%	18.37%	4.08	11.52	0.151***
	(-1.37%)	(2.31%)	(<0.001)	(0.001)	(0.044)
	N=1,818	N=2,242			
Management options	0.027	0.033	6.74	62.08	-0.496
	(0.021)	(0.027)	(<0.001)	(<0.001)	(1.369)
	N=1,818	N=2,242			
Intercept					0.376
					(0.453)
Year fixed effects					Yes
Industry fixed effects					Yes
# of observations					3,902
Chi-squared					799.53
Prob> Chi-squared					<0.001

***, **, and *: significance at 1%, 5%, and 10% level, respectively.

Internet Appendix Table 2

Probit analysis of share buyback and tying CEO bonus to EPS

(Corresponds to Table 5 in the paper)

In this table, we report the estimated coefficients and standard errors obtained from the probit regression of share buyback. Column (1) excludes the firms that do not have a bonus plan or that do not provide information on whether EPS is a factor in the bonus award, while Column (2) - (4) include all the firms. Columns (3) and (4) incorporate additional explanatory factors from Bens, et al (2003): Below_EPS_Growth=1 if $E_0<E_{-1}*(1+g)$ (current period earnings are less than last period earnings multiplied by the expected growth rate); =0 otherwise. The expected growth rate is proxied by the EPS growth rate from year t-2 to t-1. ESO_EX: employee options exercised during the year/shares outstanding as of the end of last year. The numbers in the parentheses are the standard errors. The standard errors are clustered at the firm level, and are also robust to heteroskadesticity.

Appendix Table 2 (continued)

	=1, if net repurchase is positive; =0, otherwise	=1, if net repurchase is positive; =0, otherwise	=1, if net repurchase is positive; =0, otherwise	=1, if net repurchase is positive; =0, otherwise
Column	(1)	(2)	(3)	(4)
EPSfactor=1, if EPS is a factor in CEO bonus; =0, otherwise	0.132*** (0.030)	0.144*** (0.026)	0.164*** (0.033)	0.139** (0.060)
Below_EPS_Growth			0.112*** (0.033)	0.161*** (0.058)
ESO_EX			--	-2.403 (1.808)
Log of total assets	0.181*** (0.012)	0.178*** (0.011)	0.187*** (0.013)	0.269*** (0.024)
Profitability	2.817*** (0.255)	2.699*** (0.210)	2.638*** (0.222)	2.572*** (0.452)
Cash	0.436*** (0.118)	0.287*** (0.099)	0.497*** (0.124)	0.255 (0.219)
Payout ratio	0.019 (0.062)	-0.028 (0.056)	-0.017 (0.068)	-0.176 (0.128)
Industry-adjusted leverage	-0.748*** (0.113)	-0.808*** (0.098)	-0.747*** (0.117)	-0.686*** (0.211)
Takeover	-0.062 (0.133)	-0.054 (0.117)	-0.057 (0.134)	-0.099 (0.145)
Market to book	-0.052*** (0.012)	-0.056*** (0.010)	-0.042*** (0.012)	0.093*** (0.032)
Abnormal return	-0.066** (0.027)	-0.066*** (0.023)	-0.071*** (0.021)	-0.123** (0.055)
Management options	3.202*** (0.700)	2.698*** (0.600)	3.401*** (0.757)	5.816*** (1.433)
Earnings are negative	-0.232*** (0.044)	-0.227*** (0.038)	-0.306*** (0.048)	-0.330*** (0.099)
Intercept	-2.571*** (0.320)	-2.099*** (0.246)	-2.453*** (0.414)	-1.791*** (0.824)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Number of observations	8,961	11,333	7,611	2,458
Chi-squared	911.29	1,150.88	1,093.12	478.46
Prob> Chi-squared	<0.001	<0.001	<0.001	<0.001

***, **, and *: significance at 1%, 5%, and 10% level, respectively.

Internet Appendix Table 3:

Probit regressions of share repurchasing:The propensity score matching approach

(Corresponds to columns 3 and 4 of Table 5 in the paper)

We implement the matching procedure as following: first, we estimate the probit model of EPS linking for each year; we then predict the propensity for the firm to link CEO bonus with EPS and we sort the sample by the predicted probabilities (propensity score); for each EPS-linking firm, we find a non-EPS-linking firm with the closest propensity score; finally, we estimate the probit and tobit models of share repurchasing using the matched-pair sample. We report the estimated coefficients and standard errors obtained from probit regressions of share repurchasing on the propensity score matched-pair sample. Columns (3) and (4) incorporate additional explanatory factors: Below_ESP_Growth and ESO_EX from Bens, et al (2003). The standard errors are clustered at the firm level, and are also robust to heteroskadesticity.

Appendix Table 3 (continued)

	=1, if net repurchase is positive; =0, otherwise	=1, if net repurchase is positive; =0, otherwise	=1, if net repurchase is positive; =0, otherwise
Column	(2)	(3)	(4)
EPSfactor=1, if EPS is a factor in bonus decisions; =0, otherwise	0.181***	0.188***	0.135**
	(0.035)	(0.037)	(0.064)
Below_EPS_Growth		0.129***	0.267***
		(0.039)	(0.065)
ESO_EX		--	-0.867
			(0.726)
Log of total assets	0.196***	0.202***	0.316***
	(0.017)	(0.017)	(0.030)
Profitability	3.616***	3.296***	2.625***
	(0.438)	(0.311)	(0.620)
Cash	0.706***	0.667***	0.286
	(0.168)	(0.166)	(0.276)
Payout ratio	-0.215***	-0.167**	-0.134
	(0.076)	(0.079)	(0.143)
Industry-adjusted leverage	-0.288*	-0.456***	0.457
	(0.151)	(0.153)	(0.271)
Takeover	0.578***	0.591***	0.456**
	(0.165)	(0.161)	(0.181)
Market to book	-0.036***	-0.028**	0.078**
	(0.014)	(0.014)	(0.037)
Abnormal return	-0.009	-0.014	0.069
	(0.023)	(0.025)	(0.086)
Management options	4.967***	5.733***	11.956***
	(0.995)	(1.014)	(1.924)
Earnings are negative	-0.359***	-0.451***	-0.449***
	(0.056)	(0.059)	(0.123)
Intercept	-2.278***	-2.484***	-1.278***
	(0.491)	(0.534)	(0.430)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Number of observations	5,956	5,522	2,078
Number of EPS-linking observations	2,978	2,761	1,039
Chi-squared	767.35	1,092.54	506.35
Prob> Chi-squared	<0.001	<0.001	<0.001

***, **, and *: significance at 1%, 5%, and 10% level, respectively.

Internet Appendix Table 4:

Probit analysis of being awarded a bonus

(Corresponds to Table 8 in the paper)

We present the probit analysis of whether a CEO is awarded a bonus in a year.

The numbers in the parentheses are the standard errors. The standard errors are clustered at the firm level, and are also robust to heteroskadesticity.

	=1, if bonus>0; =0, otherwise	=1, if bonus>0; =0, otherwise	=1, if bonus>0; =0, otherwise
Column	(1)	(2)	(3)
EPSfactor =1, if EPS is a factor; =0, otherwise.	0.003 (0.053)	0.008 (0.049)	0.032 (0.046)
EPSfactor*buyback measure	0.171*** (0.071)	0.056*** (0.018)	3.816*** (1.218)
Net repurchase is positive	-0.033 (0.057)	--	--
Log of (1+net repurchase)	--	-0.029* (0.016)	--
Repurchase scaled by market value of equity	--	--	-2.374** (1.019)
Log of total assets	0.125*** (0.015)	0.123*** (0.016)	0.127*** (0.015)
One-year return to shareholders	0.646*** (0.047)	0.641*** (0.047)	0.639*** (0.047)
Profitability	1.161*** (0.294)	1.179*** (0.298)	1.194*** (0.298)
Intercept	-1.008*** (0.304)	-0.989*** (0.306)	-1.027*** (0.304)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Number of observations	9,604	9,604	9,604
Wald chi-squared	1,362.26	1,360.09	1,353.82
Prob > chi-squared	<0.001	<0.001	<0.001
Pseudo R-squared	0.21	0.21	0.21
Test if $\eta_3 + \eta_5$ =0: F-stat (p-value)	14.87 (<0.001)	13.81 (<0.001)	6.52 (0.01)

***, **, and *: significance at 1%, 5%, and 10% level, respectively.

Internet Appendix Table 5:

Multivariate analysis of share buyback and being right below threshold EPS

(Corresponds to Table 7 in the paper)

In this table, we present the estimated coefficients and standard errors obtained from probit regression of share buyback. Column (1) considers firms whose as-if EPS is below the threshold EPS but within 15% of the threshold and all other firms. Columns (2) and (3) consider firms whose as-if EPS is below the threshold EPS but within 15% of the threshold and firms whose as-if EPS is above the threshold EPS but within 15% of the threshold. The numbers in the parentheses are standard errors. The standard errors are clustered at the firm level, and are also robust to heteroskadesticity.

Appendix Table 5 (continued)

	=1, if net repurchase>0; =0, otherwise	=1, if net repurchase>0; =0, otherwise	=1, if net repurchase>0; =0, otherwise
Column	(1)	(2)	(3)
As-if EPS is right below the threshold earnings per share	0.459***	0.898***	2.104***
	(0.178)	(0.306)	(0.706)
Below_EPS_Growth		--	-0.185
			(0.528)
ESO_EX		--	21.72
			(30.30)
Log of total assets	0.216***	0.363***	0.353*
	(0.074)	(0.118)	(0.210)
Profitability	7.849***	12.637**	13.918**
	(1.914)	(5.818)	(7.147)
Cash	0.277	-0.126	-3.152
	(0.788)	(1.456)	(2.719)
Payout	-0.031	0.259	-2.212**
	(0.176)	(0.418)	(1.119)
Industry-adjusted leverage	-0.326	1.824	2.753
	(0.623)	(1.122)	(2.215)
Takeover	-0.814	-0.848	-2.155
	(0.450)	(0.699)	(1.338)
Market to book	-0.071	-0.211	-0.546
	(0.075)	(0.209)	(0.411)
Abnormal return	-0.338	-1.340**	-6.229***
	(0.208)	(0.598)	(1.795)
Management options	5.013	7.393	-31.712
	(3.261)	(6.575)	(20.403)
Earnings are negative	-0.165	-0.686	-1.060
	(0.360)	(0.987)	(2.363)
Intercept	-2.316***	0.365	0.652
	(0.645)	(3.137)	(6.223)
Year fixed effects	Yes	Yes	Yes
Industry (1-digit SIC code) fixed effects	Yes	Yes	Yes
Number of observations	385	179	125
Chi-squared	93.27	74.35	69.83
Prob> Chi-squared	<0.001	<0.001	<0.001

***, and **: significance at 1% and 5% level, respectively.