Stock Repurchases and Executive Compensation Contract Design: The Role of Earnings Per Share Performance Conditions

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Abstract

Compensation contracts that link payoffs to earnings per share (EPS) provide executives with direct and potentially powerful incentives to manage EPS realisations. Since stock repurchases directly affect both the numerator and denominator in the EPS calculation, we test whether managers' stock repurchase decisions are sensitive to explicit EPS-related incentives. Findings reveal a strong association between stock repurchase activity and the presence of EPS-based compensation arrangements. The predicted odds of a repurchase for firms where executive compensation depends on EPS performance are almost twice the level observed for firms where rewards are independent of EPS. Repurchase likelihood is also increasing in EPS target difficulty. Bonus-based EPS conditions are associated with the strongest effect on repurchase propensity, followed by share option plans with EPS-based vesting conditions. Further tests do not support the hypothesis that EPS-based contracts and associated stock repurchase activity represent an efficient contracting solution to the agency problems of free cash by motivating self-interested executives to disgorge surplus cash to shareholders in a timely manner. We conjecture that executives may use repurchases opportunistically to maximise their compensation at the expense of external shareholders; and that such behavior persists either because it represents an unavoidable agency cost associated with a second best contracting solution, or because management-friendly boards successfully appease external monitors by adopting performance targets that at the same time provide executives with ancillary earnings management opportunities.

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I. INTRODUCTION

This study investigates the link between firms' stock repurchase activity and the presence of earnings per share performance conditions in executive compensation contracts. Our analysis seeks to address the apparent disconnect between theory and practice regarding stock repurchases. One the one hand, traditional academic theories identify factors such as signalling (Vermaelen 1981), agency costs (Fenn and Liang 2001), and leverage (Dittmar 2000) as important determinants of repurchase activity. On the other hand, survey and anecdotal evidence highlights earnings per share (EPS) as a primary driver of managers' repurchase decisions (Caster et al. 2006; Brav et al. 2005; Badrinath and Varaiya 2000). Identifying why managers attached such weight to the EPS impact of their stock repurchase decisions therefore represents an important step toward a better understanding of this increasingly significant aspect of corporate payout policy.

Stock repurchases affect both the numerator and denominator in the EPS calculation (Hribar et al. 2006; Bens et al. 2003; Guay 2002). Recent research has started to shed light on the links between repurchase decisions and EPS-related considerations. Kahle (2002), Bens et al. (2002), and Bens et al. (2003) focus on the dilutive impact of employee stock options (ESOs). Their findings suggest that stock repurchases represent a managerial response to EPS dilution concerns. Evidence also suggests that managers use repurchases for benchmark-beating purposes, including meeting or exceeding analysts' EPS forecasts (Hribar et al. 2006), preserving a sequence of EPS improvement (Myers et al. 2006), and maintaining historic EPS growth rates (Bens et al. 2003). However, neither the dilution nor benchmark-beating explanations offer an explicit link between EPS performance and managerial wealth. For example, precisely why managers care about EPS dilution is unclear in a traditional corporate finance framework (Guay

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2002; Kalhe 2002). And while prior research reveals a valuation premium to benchmark-beating, Hribar et al. (2006) find that such premiums are largely eliminated for positive earnings surprises resulting from accretive stock repurchases.

Our analysis builds on prior research by examining whether managers' stock repurchase decisions are sensitive to explicit EPS-related incentives provided by executive compensation contracts. Compensation contracts linking rewards to EPS performance provide executives with direct and potentially powerful incentives to manage reported EPS (over and above any implicit market-based gains). We therefore test whether stock repurchase activity is higher for firms that condition executive compensation on EPS performance.

Empirical tests employ data for a comprehensive sample of UK non-financial firms over the period January 1998 through December 2003. Several features make the UK a particularly attractive setting in which to explore the link between stock repurchases and compensation contract design. First, in addition to executive bonus plans that routinely condition rewards on EPS performance, executives' long-term incentives such as stock options and restricted stock frequently employ EPS-based vesting conditions (Carter et al. 2008; Main and Neate 2006; Conyon et al. 2000). Explicit contractual arrangements linking both short- and long-term elements of compensation to EPS performance create particularly strong incentives for UK executives to manage EPS realisations through repurchases. Second, regulatory restrictions governing the treatment of stock repurchases during our sample period help simplify our empirical tests by tempering the link between repurchase activity and the dilutive effects of ESOs. In particular, UK company law prior to December 2003 required repurchased shares to be cancelled immediately. As a result, the cost of using repurchases to offset ESO-related EPS dilution was relatively high for UK firms (because issuing new shares is administratively more costly than re-issuing treasury stock). Accordingly, UK firms with large ESO programs typically established a wholly-owned trust company to repurchase (and re-issue) shares on behalf of the firm. Shares acquired by these ESO trusts do not meet the legal definition of a stock repurchase

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and are excluded from our sample.[1] Third, UK firms are required to disclose the volume and

value of shares repurchased, enabling us to construct accurate firm-level measures of repurchase

activity. This approach contrasts with the majority of extant US studies that employ proxies for

the level of repurchase activity (e.g., Hribar et al. 2006; Bens et al. 2002; Fenn and Liang 2001;

Dittmar 2000; Jagannathan et al. 2000; Stephens and Weisbach 1998).

Findings reveal a statistically and economically significant association between stock

repurchase activity and the presence of EPS-based compensation arrangements. The predicted

odds of a repurchase for firms where executive compensation depends on EPS performance are

almost twice the level observed for firms where rewards are independent of EPS. Further, the

odds ratio associated with EPS-based compensation arrangements is similar to (and in many cases

larger than) odds ratios for more traditional determinants of repurchase activity such as excess

cash flow and scarce investment opportunities. We also present evidence that repurchase

likelihood is increasing in EPS target difficulty for stock option plans. Bonus-based EPS

conditions are associated with the strongest effect on repurchase propensity, followed by stock

option plans with EPS-based vesting conditions. Overall, our results provide compelling evidence

that EPS-contingent compensation arrangements represent an important determinant of UK

managers' stock repurchase decisions.

An obvious question raised by our findings is why firms continue to link executive

compensation to EPS targets despite the additional earnings management opportunities that such

arrangements create, particularly given the evidence in Bens et al. (2002) that managers may

divert resources away from potentially value-increasing investments to fund EPS-driven stock

repurchases. We propose and test an efficient contracting explanation for this apparent paradox.

Specifically, because EPS targets incentivize managers to manipulate reported performance by

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[1] Consistent with the absence of ESO-related motives for stock repurchases in the UK, none of our sample
firms mentioned the dilutive impact of stock-based compensation plans among the list of repurchase

repurchasing stock, we conjecture that EPS-based contracts may help overcome agency problems of free cash flow by motivating self-interested executives to disgorge surplus cash to shareholders in a timely manner. We explore this hypothesis in two ways. First, if conditioning executive compensation on EPS performance helps overcome the agency costs of surplus cash, then the link between stock repurchases and EPS-based contractual incentives should be more pronounced for firms with excess cash. This prediction is tested by examining the interaction between the presence of EPS targets and proxies for surplus cash. Second, if the decision to tie executive compensation to EPS is an endogenous response to the agency problems of excess cash, then the strength of the association between stock repurchases and EPS-based compensation arrangements should diminish once this endogeneity is accounted for. We test this prediction by estimating a system of equations that includes separate models for the probability of a stock repurchase and the incidence of EPS targets in executive compensation contracts.

Neither our interaction tests nor our recursive simultaneous-equations bivariate probit model analysis reveal any support for the efficient contracting hypothesis. We therefore speculate on alternative explanations for the observed link between repurchase activity and EPS-based compensation arrangements. One possibility is that opportunistic executives use repurchases to maximise their compensation at the expense of external shareholders; and such behavior persists either because it represents an unavoidable agency cost associated with a second best contracting solution, or because management-friendly boards successfully appease external monitors by adopting performance targets that at the same time provide executives with ancillary earnings management opportunities.

Our study contributes to prior research in several ways. First, we document an important determinant of stock repurchase activity in the form of EPS-based executive compensation contracts that is new to the academic literature but which is entirely consistent with an

reasons disclosed in their annual reports. In contrast, 66 percent of US managers surveyed by Brav et al.

explanation frequently proffered by management to justify their repurchase decisions. Second, our findings help reconcile evidence regarding the manipulation of EPS using stock repurchases (Bens et al. 2002; Bens et al. 2003; Hribar et al. 2006; Myers et al. 2006) with the apparent absence of an equilibrium incentive structure to support managers' myopic focus on short-term EPS (Guay 2002, 405; Larcker 2003, 46). Compensation contracts based on EPS targets provide executives with explicit incentives to manage EPS realisations via stock repurchases. Third, our analysis speaks to prior work on performance measure choice in managerial compensation contracts. While prior research highlights the relative merits of accounting- versus market-based measures (Sloan 1993), the choice between unscaled accounting metrics versus per share-scaled metrics has been largely overlooked. Our results provide one reason why managers may prefer per share-based performance measures, and why shareholders should think twice before acquiescing to such preferences.

The remainder of this paper is organized as follows. Section II develops the link between stock repurchase activity and executive compensation arrangements, and reviews the structure of executive compensation plans in the UK. Section III provides details of our sample, data, and research design. Section IV reports results of tests examining the association between stock repurchases and EPS-based executive compensation arrangements. Section V presents tests of the efficient contracting hypothesis and discusses managerial opportunism as an alternative possibility. Section VI concludes.

II. LITERATURE REVIEW AND INSTITUTIONAL OVERVIEW
Stock Repurchases, Earnings Management, and Executive Compensation

Despite being largely overlooked in the corporate payout policy literature, managers and financial commentators have long recognized the EPS implications of stock repurchases (Caster

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(2005) cited stock options as an important or very important factor influencing their repurchase decision.

et al. 2006; Badrinath and Varaiya 2000). The impact of stock repurchases on reported EPS represents the net of both numerator and denominator effects. The numerator effect, which works to reduce EPS, represents the decline in earnings caused by an increase in borrowing (for repurchases financed with debt) or a reduction in investment returns (for repurchases financed using cash reserves). The denominator effect serves to increase EPS by reducing the number of shares outstanding. Repurchases have a positive net effect on EPS when a firm's earnings-to-price ratio exceeds its opportunity cost of funds (i.e., either the after-tax return on short-term cash investments or the cost of debt). Conversely, repurchases reduce EPS if the earnings-to-price ratio is less than the opportunity cost of funds (Guay 2002; Bens et al. 2003; Hribar et al. 2006). Survey evidence reported by Brav et al. (2005) highlights the central role that EPS considerations play in shaping managers' stock repurchase decisions, with three-quarters of senior executives questioned citing EPS growth as an important factor affecting their repurchase decision.

Recent research has begun to explore the link between stock repurchases and EPS in several contexts. One EPS-related factor predicted to motivate repurchases is earnings dilution caused by ESO plans.[2] Accretive stock repurchases can offset the dilutive effects of ESOs on reported EPS in several ways. For example, while ESO exercises reduce basic EPS by increasing the weighted average number of shares outstanding for the period, managers can mitigate this dilution by repurchasing shares to fund option exercises. Bens et al. (2002) and Kahle (2002) present evidence consistent with this option-funding hypothesis. Conversely, Bens et al. (2003) conclude that repurchases are not a response to the dilutive impact of option exercises on basic EPS. Instead, their results suggest that the link between repurchases and options is driven by the

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[2] Implicit in this predicted link is the assumption that managers care about EPS dilution. However, as Guay (2002, 397) and Kahle (2002, 240) discuss, to the extent that stock prices incorporate investors' assessment of equity value and the claim on earnings inherent in potentially dilutive securities such as ESOs, managers' concern about dilution is hard to explain in a traditional corporate finance framework where only cash flows matter. Nevertheless, survey evidence reveals that managers are sensitive to the issue of earnings dilution (Graham and Harvey 2001).

effect of ESOs on *diluted* EPS. In particular, tests reveal that repurchase activity is increasing in the extent to which outstanding ESOs are in-the-money.

In addition to helping offset the dilutive impact of ESOs, stock repurchases motivated by EPS considerations have been linked with benchmark-beating earnings management activity. Controlling for dilution effects, Bens et al. (2003) find that repurchases are increasing in the amount by which earnings undershoot the level required to sustain historical diluted EPS growth. Myers et al. (2006) document similar behaviour in a sample of firms characterised by long strings of consecutive quarterly EPS increases, where managers appear to strategically time stock repurchases to boost reported EPS when the string would otherwise be broken. Meanwhile, Hribar et al. (2006) conclude that managers use stock repurchases to meet or beat analysts' consensus EPS forecasts. However, neither Bens et al. (2003), Myers et al. (2006) nor Hribar et al. (2006) identify the explicit managerial incentives underlying this benchmark-beating earnings management behaviour.[3] Instead, they assume managerial wealth is an implicit function of the market-based rewards associated with achieving earnings benchmarks (in the form of higher stock-related compensation, greater job security, and a lower cost of capital). However, several factors militate against this assumed link. First, investors appear to discount the repurchase-induced accretive component of EPS surprises (Hribar et al. 2006), thereby restricting managers' stock-based gains. Second, insofar as repurchases increase current EPS at the expense of future EPS (Bens et al., 2002), the long-term managerial payoffs to myopically manipulating EPS are unclear (Guay 2002; Larcker 2003).

Compensation contracts represent a potentially powerful source of incentives for managers. Research demonstrates that corporate payout decisions and the level of earnings management activity are both sensitive to executives' compensation arrangements. Regarding the link between compensation contracts and earnings management, a large body of research

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indicates that executives use their accounting discretion to manipulate earnings in response to compensation-driven considerations [see Bushman and Smith (2001) for a discussion]. Similarly, a growing body of evidence reveals a link between corporate payout decisions and executive compensation arrangements. For example, firms where executives' annual bonus pool is contingent on dividends paid are associated with higher dividend payouts and yields (White 1996), while ESOs that are not dividend protected create incentives for executives to reduce dividend payments (Lambert et al. 1989; Kahle 2002; Fenn and Liang 2001; Brown et al. 2004; Chetty and Saez 2005). In related work, Aboody and Kasznik (2007) demonstrate how compensation plan design can help align managers' cash payout decisions with shareholders' tax-driven payout preferences. Finally, Wallace (1997) investigates the link between performance conditions used in executive bonus plans and a range of corporate decisions including payout policy. Using a sample of firms adopting residual income-based plans (which penalise managers for accumulating capital that earns less than the opportunity cost of capital), Wallace (1997) documents a post-adoption rise in stock repurchase activity as managers liquidate unproductive assets. Wallace's evidence is particularly pertinent to our study because it demonstrates that corporate payout policy is sensitive to the performance measures employed in executive compensation contracts.

Earnings per share is a popular performance metric used in executive compensation contracts (Murphy 1999, 2000; Conyon et al. 2000; Pass et al. 2000). Compensation contracts that tie managerial rewards to EPS create explicit incentives for executives to manage the EPS denominator through stock repurchases (over and above any implicit market-based incentives associated with increasing stock-based wealth and improving job security). These direct incentives are absent in compensation contracts that employ non-per-share-based earnings metrics such as return on assets, and non-accounting measures such as stock price or qualitative targets

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[3] Indeed, Bens et al. (2003, 75-76) conclude that explicit compensation contract considerations are *not* the

linked to personal objectives. Accordingly, we predict that stock repurchase activity will be positively associated with the incidence of EPS-based performance conditions in executive compensation contracts. Since the incentives to manage the EPS denominator are expected to be increasing in the proportion of total performance-contingent compensation directly linked to EPS, we test this prediction in a setting where EPS conditions frequently determine executives' long-term stock-based rewards as well as their short-term bonus payments. The UK is an example of a system where both short- and long-term components of executive compensation are often contingent on EPS (Carter et al. 2008; Main and Neate 2006; Conyon et al. 2000; Pass et al. 2000).

Overview of Executive Compensation Arrangements in the UK

The typical compensation package for a UK executive director includes both short-term bonus arrangements and longer-term incentives such as stock options and restricted stock (Conyon and Murphy 2000). Bonus payments are normally linked to short-term performance measures and objectives. In addition, UK firms regularly impose performance vesting conditions on stock-based plans.[4] Widespread adoption of performance vesting conditions in executives' long-term compensation plans can be traced to recommendations made by a study group established by the Confederation of British Industry to review the structure and governance of executive compensation. The resulting Greenbury Report (1995) proposed that all long-term incentive schemes (including option plans) should be subject to challenging performance criteria. From December 31, 1995, revised London Stock Exchange rules required all listed firms to either comply with the Greenbury recommendation or publish a statement explaining non-compliance. Further pressure to adopt performance conditions in long-term incentive plans came from

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source of their findings linking stock repurchases to EPS manipulation.

influential shareholder groups including the Association of British Insurers and the National

Association of Pension Funds. As a result, performance-based long-term compensation

arrangements are now commonplace among UK firms (Carter et al. 2008). The performance

vesting executive stock option plan operated by Rentokil Initial PLC typifies the performance

contingent option arrangements employed by many UK firms:

> Before the exercise of an option under Level 1, the company's annual growth in
> earnings per share on average over the first three consecutive calendar years,
> commencing in the year in which the option is granted, is at least 4% per annum in
> excess of the UK rate of inflation… (Annual Report, 2001: 27).

Similarly, the long-term incentive plans (LTIPs) operated by Boots Group PLC illustrate

arrangements used by many UK firms:

> The long term schemes provide a direct link between the pay of executive directors
> and the creation of value for shareholders by rewarding directors for the company's
> performance in terms of total shareholder return (TSR) over a three or four year
> performance period relative to a peer group of ten other leading companies which the
> remuneration committee consider to be appropriate comparators by virtue of their
> size and markets in which they operate (Annual Report and Accounts, 2002: 22).

While best practice compensation guidelines did not favour any single performance metric,

survey evidence reveals widespread adoption of EPS-based targets. For example, Conyon et al.

(2000) report that 72 percent of stock option plans with performance-contingent vesting

conditions define targets in terms of EPS growth, while Pass et al. (2000) find that 34 percent of

LTIPs surveyed had an EPS performance condition. Accordingly, the performance conditions

applied in long-term compensation arrangements often mirror those used in short-term bonus

plans, where EPS targets have long been used. All else equal, widespread use of EPS targets in

both the short- and long-run elements of executive compensation is expected to create powerful

incentives for UK executives to manage EPS realisations through stock repurchases.[5]

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[4] Traditionally, stock options for US executives are granted at fair market value on the grant date and vest
over time (Murphy 1999). Gerakos et al. (2005) document that some US firms have started granting stock
options and restricted stock awards with performance contingent vesting and payout conditions.
[5] We focus on managing EPS through stock repurchases. Repurchases and managerial accounting
discretion represent alternative (but not necessarily mutually exclusive) approaches to manipulating

III. DATA AND METHODS

Sample and Data

The initial sampling frame comprises all UK-resident firms (excluding closed-end investment trusts) listed on the London Stock Exchange (LSE) with fiscal year-ends between January 1, 1998 and April 30, 2003. The sample period starts in 1998 because executive compensation data are collected with a one-year lag and disclosures relating to performance conditions in executive compensation contracts are very patchy pre-1997. The sample window is truncated at April 2003 when Thomson replaced its Datastream Company Accounts data with financial statement data from its Worldscope database.[6]

Firm-level stock repurchase data relate to aggregate reacquisitions made during a fiscal year. Only repurchases executed in the open market or via self-tender offer are used in subsequent tests. Annual repurchase data for UK firms are not available in electronic form and are therefore hand collected from firms' published financial statements.[7] This process involves identifying potential repurchasing firms using a variety of news sources including the London Stock Exchange Regulatory News Service, the Securities Data Corporation, and *The Financial Times*. Financial statements with year-ends between January 1998 and April 2003 are then examined for all firms in the provisional list to identify the number, value and fraction of shares repurchased.

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reporting performance. Consistent with prior research, we do not address questions of when and why executives prefer one method of managing EPS over another. Nevertheless, several factors suggest that stock repurchases may represent a particularly attractive means of managing EPS. First, stock market investors typically view repurchases favourably and as such are less likely to question executives' underlying repurchases motives. Second, if challenged by investors executives can provide convincing, non-earnings-management-based explanations to support their repurchase decisions.

[6] Thomson replaced the Datastream Company Accounts archive with Worldscope as part of a data consolidation exercise. We limit the scope of our analysis to Datastream Company Accounts data because these financial statement items are recorded on an 'as reported' basis whereas Worldscope accounting data are adjusted by Thomson analysts to provide a degree of international comparability. Differences between as-reported Datastream data and adjusted Worldscope data are particularly dramatic in relation to cash flow items for UK firms (Alves et al. 2007).

The resulting sample comprises 580 repurchase firm-year observations for 306 firms. Financial firms are then excluded because the Datastream Company Accounts database does not report certain key accounting items for these firms. Utilities are also removed due to a lack of non-repurchasing firms in the same sector for matching purposes (see below). A further 28 observations are lost due to missing financial statement data required to construct one or more of our test variables. The final sample consists of 384 repurchase firm-years for 217 firms. Details of the sample selection procedure are presented in panel A of Table 1.

Panel B of Table 1 reports the industry composition of our final sample. Repurchasing firms are drawn from 26 Datastream level-4 non-financial industry groups, with no single industry accounting for more than 13 percent of the final sample. Panel C reveals that the aggregate value of shares reacquired during the sample window is almost £23 billion, with an average (median) annual repurchase value of £59 million (£2.5 million) per firm. Repurchase activity in the UK is increasing over time, consistent with evidence documented in previous research (Oswald and Young 2008). The average (median) annual repurchase involves approximately five (three) percent of common shares outstanding.

Empirical tests require details of performance conditions used in executive compensation contracts, data on which are also hand collected from firms' published annual reports and financial statements. Collecting such data for all LSE-listed non-repurchase firms is infeasible. We therefore employ a case-control matched sample design whereby each of the 384 repurchase firm-year observations is twinned with a time-, industry- and size-matched non-repurchasing firm.[8] Matching by industry (Datastream level-4) helps control for factors that are expected to

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[7] LSE-listed firms are required to report the aggregate number and value of shares repurchased during the fiscal year in their published financial statements, categorized by repurchase method (e.g., open market, self-tender offer, privately negotiated, etc.)

[8] Case-control matching unavoidably leads to disproportionate random sampling on the dependent variable. Subsequent tests are not biased, however, because we use logistic regression, a well-known property of which is that slope coefficients remain unbiased even in the presence of disproportionate random sampling on the dependent variable (Prentice and Pike 1979).

affect payout policy (Smith and Watts 1992) and compensation arrangements (Antle and Smith 1986), while matching by size (lagged total assets) helps control for established associations between firm size and repurchase activity (Dittmar 2000; Jagannathan et al. 2000), and between firm size and compensation arrangements (Pass et al. 2000). Non-repurchase control firms are matched with repurchasers at the fiscal year-end immediately preceding the repurchase year. Non-repurchasers must not have executed a buyback at any point prior to the matching year or during the subsequent two-year period.

Details of the following performance-related elements of executive compensation are extracted from repurchase and non-repurchase firms' annual reports in the matching year: short-term bonus plans, stock option plans, and long-term incentive plans. Bonus plans comprise all arrangements where rewards are tied to short-term ($\leq$ one-year) performance targets. Stock option plans comprise all stock-based arrangements granting executives the right to acquire shares at a non-zero exercise price. [Firm-wide employee stock option plans and save-as-you-earn schemes are excluded from our data.] LTIPs consist of all remaining long-term compensation arrangements not classified as stock options (e.g., deferred bonus schemes, share matching schemes, zero strike price options, stock appreciation rights, long-term bonus plans, etc.). Performance conditions for all active plans in each category are recorded.

The data collection process has to confront two disclosure problems. First, some firms' annual report and accounts fail to unambiguously disclose usage of one or more of the three plan types. Since UK law requires shareholder approval for all stock-based compensation arrangements, we use previous years' Annual General Meeting (AGM) resolutions to verify the existence of stock option plans and stock-based LTIPs. No such approval is required in the case of short-term bonus plans and cash-based LTIPs. We therefore examine remuneration disclosures

up to two years ahead for evidence of plan existence.[9] Using these methods, we are able to verify

the status of each performance-related compensation element for all firms in our sample with the

exception of one repurchase firm and one non-repurchase firm (where the presence of a bonus

plan remains indeterminate). Second, some firms fail to provide details of the performance

conditions used in one or more of their plans.[10] Again, full details of all stock option plans and

stock-based LTIPs, including performance conditions where applicable, must be disclosed in the

AGM resolution at the time shareholder approval is initially sought. We therefore search past

AGM resolutions for information on missing performance conditions. In the case of short-term

bonus plans and cash-based LTIPs where prior shareholder approval is not required, we again

examine remuneration disclosures up to two years ahead for details of performance conditions

prevailing at the beginning of the repurchase year. Cases where we cannot unambiguously

determine whether an EPS performance condition applies are coded non-disclosers.

Research Design

We expect EPS performance conditions to be more prevalent in repurchasing firms'

executive compensation contracts compared with those of their non-repurchaser counterparts. We

test this prediction using the following conditional logistic model:[11]

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[9] Compensation disclosures in the UK improved dramatically during the late 1990's and early 2000's. When using one- and two-period-ahead remuneration disclosures, we are careful to distinguish between 'old' plans (i.e., those existing at the time of matching) and new plans subsequently introduced.

[10] Prior to December 31, 2002, remuneration reporting was governing by the Combined Code, which encouraged (but did not require) firms to disclose in their annual report and accounts details of the performance conditions used in executive compensation plans. Following incorporation of the Directors' Remuneration Regulations into UK company law in December 2002, LSE-listed firms are now *required* to disclose details of the performance conditions used in long-term compensation plans. In contrast, disclosures relating to bonus plans remain voluntary.

[11] Incomplete disclosure of performance conditions means that EPS realisations may take one of three values: EPS condition is used and disclosed (1); EPS condition is unambiguously not used (0); and EPS condition is indeterminate due to insufficient disclosure (-1). Defining *EPS* in equation (1) as a three-way categorical variable imposes a linearity constraint on the data. If the linearity assumption is rejected then interpreting the coefficient on this variable is difficult. The alternative (unconstrained) approach is to recode the three-way variable as three separate dummy variables and then use two of these in place of the original variable (Allison 1999, 128-130). Tests reveal that imposing the linearity constraint on our data

$$Log\left(\frac{p_{it}}{1-p_{it}}\right) = \gamma_1 NDISC_{ijt-1} + \gamma_2 EPS_{ijt-1} + \sum_{k=1}^{K} \theta_k Controls_{kit-1} , \qquad (1)$$

where p_{it} is the latent probability that firm i repurchases shares in year t ($y_{it} = 1$); $NDISC$ is an indicator variable taking the value of one if the presence of an EPS performance condition is indeterminate for at least one of the j compensation components (j = bonus plans, stock option plans, or LTIPs) and zero otherwise; EPS is an indicator variable taking the value of one if an EPS performance condition is used in at least one of the j compensation components and zero otherwise; and $Controls$ is a vector of K additional factors expected to influence the repurchase decision. All explanatory variables are measured at the start of the repurchase year.

The conditional logistic model is the appropriate estimation method for the matched pairs structure of our data (Allison, 1999: 203). Following Breslow (1982), we estimate the model by fitting a standard logistic regression (with the intercept suppressed) to a constant response variable and a series of covariates each of which represents the difference between respective case-control matched pair observations. Accordingly, the dependent variable in these models takes a value of one for each matched pair $i = 1, …384$, while all explanatory variables are computed as the difference between the ith pairwise combination. As with all logit models, slope coefficients in equation (1) are not biased by disproportionate sampling on the dependent variable.[12]

The vector of control variables in equation (1) is drawn from prior research on the determinants of stock repurchase activity and includes the market-to-book ratio, net leverage, dividend yield, prior-period abnormal stock price performance, and firm size (Stephens and Weisbach, 1998; Barth and Kasznik 1999; Dittmar 2000; Ikenberry, Lakonishok and Vermaelen

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leads to a reduction in model fit (the change in the likelihood ratio statistic is significant at the 0.01 level), suggesting that the unconstrained formulation presented in equation (1) is more appropriate for our data.
[12] We also estimated equation (1) using a standard unmatched logistic model (results not tabulated). As expected, findings using this unmatched approach are slightly weaker than those obtained using the

2000; Grullon and Michaely 2002). We also control for the well-established link between repurchases and surplus cash (Stephens and Weisbach 1998; Dittmar 2000; Guay, and Harford 2000; Jagannathan, Stephens, and Weisbach 2000; Lie 2000). The presence of surplus cash is captured using both stock (surplus cash holdings) and flow (excess cash flow) measures. Our measure of surplus cash holdings is cash and cash equivalents in excess of the level required for normal operations and investments. Following Dittmar and Mahrt-Smith (2007), Harford (1999) and Opler, Pinkowitz, Stulz, and Williamson (1999), we estimate surplus cash holdings using the residual from the following optimal cash regression:

$$
\frac{Cash\ Holdings_{it}}{Assets_{it-1}} = \gamma_0 + \gamma_1 \frac{Market_{it}}{Book_{it}} + \gamma_2 \frac{Net\ Working\ Capital_{it}}{Assets_{it-1}}
$$

$$
+ \gamma_3 \frac{Operating\ Cash_{it-1}}{Assets_{it-1}} + \gamma_4 \frac{Net\ Debt_{it}}{Net\ Assets_{it}} + \gamma_5 \frac{R\&D_{it}}{Sales_{it}} \tag{2}
$$

$$
+ \gamma_6 \log(Market\ Cap_{it}) + \gamma_7 Dividend\ Dummy_{it} + \varepsilon_{it}
$$

The variables (and Datastream item codes) in the optimal cash regression are as follows: *Cash Holdings* is cash and cash equivalents (375); *Assets* is total assets (392); *Market* is the book value of debt (392 – 305) plus the market value of equity (MV); *Book* is the book value of assets (392); *Net Working Capital* is non-cash current assets (376 – 375) minus current liabilities (389); *Operating Cash* is cash flow from operations (1015); *Net Debt* is total liabilities net of cash holdings (321 + 389 – 375); *Net Assets* is total assets minus cash and cash equivalents (392 – 375); *R&D* is research and development expenditure (436); *Sales* is total revenues (104); *Market Cap* is fiscal year-end share price multiplied by the number of shares outstanding; and *Dividend Dummy* is an indicator variable equal to one if an ordinary dividend (187) is paid, and zero otherwise. Equation (2) is estimated separately each year using the entire population of Datastream non-financial firms with non-missing data after excluding the top and bottom

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conditional logistic model that adjusts for matching. Nevertheless, the overall tenor of the conclusions is

percentiles of scaled cash holdings. Based on the residuals from (2), we construct an indicator variable for surplus cash holdings that takes the value of one where $\varepsilon_{it} > 0$ and zero otherwise.

We use two measures of excess cash flow, one based on operating activities (*Free cash flow*) and one based on non-operating activities (*Excess investing cash*). Following Opler and Titman (1993) and Fenn and Liang (2001), our measure of free cash flow is an indicator variable equal to one for firms with a market-to-book ratio less than the annual sample median and operating cash flow (scaled by lagged total assets) greater than the annual sample median, and zero otherwise. (Annual sample medians are computed using the entire population of Datastream non-financial firms with non-missing data.) Our measure of excess investing cash is an indicator variable taking the value of one when the net cash inflow from investing activities is positive and zero otherwise. Investing cash inflows result from the sale of fixed assets (Datastream item 1024), intangible assets (1028), associates and other investments (1031), and subsidiaries (1036). Firms with positive net cash inflows from investing activities are unusual because the continual process of replacing existing assets and expanding the stock of productive new assets typically results in net investing cash *outflows*.

While Fenn and Liang (2001), Dittmar (2000) and others document a link between ESO plans and stock repurchases by US firms, UK regulatory rules governing stock repurchases mitigated against such behavior during our sample period. In particular, UK company law required all repurchased shares to be cancelled immediately prior to December 2003, thereby reducing the appeal of stock repurchases as a means of funding ESO exercises. Instead, UK firms frequently established a wholly-owned trust to purchase shares to fund ESO plans. Accordingly, no control for the presence of an ESO plan is deemed necessary in equation (1).

IV. RESULTS

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unaffected. Results are available from the authors on request.

Descriptive Statistics

The incidence of bonus plans, stock option plans, and LTIPs is presented in panel A of Table 2. Frequency counts reported in columns 2-4 reveal that most firms operate at least one bonus plan and one stock option plan. In contrast, only a third of firms have an active LTIP. Cross-sample comparisons indicate that repurchase firms are more likely to operate a bonus plan whereas non-repurchase firms are more likely to have an LTIP. Consistent with the absence of powerful ESO-related motives for stock repurchases in the UK, the frequency of firms with at least one option plan is statistically similar across the two samples. The final three columns in panel A report summary statistics based on the number of active plans. Repurchase firms are associated with a marginally higher mean (median) number of bonus plans. Conversely, the mean (median) non-repurchase firm has a higher number of active option plans and LTIPs.

Plan-level details of performance conditions are reported in panel B of Table 2. Focusing initially on bonus plans, 30 percent of the 360 plans operated by repurchase firms have EPS performance conditions compared with only 24 percent of 343 comparable plans operated by non-repurchase firms. In contrast, aggregate profit-based targets such as operating profit and profit before tax are more common among non-repurchase firms. Note also that repurchase firms are characterised by poorer disclosure of bonus-related performance conditions: 25 percent of plans in the repurchase sample contain no details of performance conditions compared with only 17 percent of plans in the non-repurchase sample. Similar patterns are apparent for option plans. Option exercise is conditional on EPS performance in 60 percent of repurchase firms' option plans compared with 46 percent of plans in the non-repurchase sample. Results for both bonus and option plans provide preliminary evidence that repurchase activity is positively associated with the presence of EPS performance conditions in executive compensation contracts. In contrast, little difference in the incidence of EPS conditions exists for LTIPs: approximately 40 percent of plans in both samples are conditional on EPS performance.

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Summary statistics for our main test variables are reported in panel A of table 3. Seventy percent of repurchase firms have at least one plan linking at least one element of executives' compensation (bonus, option or LTIP) to EPS. The comparable figure for non-repurchase firms is 63 percent, which is significantly lower (probability value < 0.01) based on a paired Wilcoxon test. Analysing the incidence of EPS targets for each compensation element separately reveals that repurchasers are significantly more likely to have at least one bonus plan and at least one stock option plan tied to EPS. In contrast, repurchase and non-repurchase firms are equally likely to have at least one LTIP conditional on EPS. Consistent with prior research, repurchase firms have higher free cash flow and dividend yields, and lower market-to-book ratios and net leverage compared to their non-repurchase counterparts.

Conditional Logistic Results

Coefficient estimates and model summary statistics for conditional logistic regressions relating the probability of a repurchase to the incidence of EPS-based performance conditions in executive compensation contracts are reported in table 4. Consistent with table 3, *EPS* in Model 1 equals one when at least one plan links at least one element of executives' compensation to EPS and zero otherwise. As predicted, the estimated coefficient on *EPS* is positive and highly significant. Further, results suggest that the presence of EPS performance conditions also represent an economically important driver of repurchase activity. The predicted odds of a repurchase for firms where executives' compensation depends on EPS performance are almost twice those of firms where payouts are independent of EPS. Further, the odds ratio for *EPS* in Model 1 is similar to (and in many cases higher than) the odds ratios associated with traditional determinants of repurchase activity such as excess cash flow and scarce investment opportunities.

Model 1 also reveals that repurchase firms are less likely to disclose details of performance conditions used executives' compensation contracts. The estimated coefficient on *NDISC* is positive and highly significant, while the odds ratio is large relative to other variables.

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We have no predictions concerning the link between repurchase activity and the transparency with which firms disclose details of executives' compensation arrangements. However, the evidence is suggestive of managerial opportunism: firms where repurchases are routinely driven by attempts to inflate executives' EPS-based compensation seek to conceal this fact by suppressing details of the link between pay and EPS performance. The extent to which the observed link between EPS performance conditions and stock repurchase activity represents managerial opportunism or efficient contracting is a theme we explore in section V.

Of the control variables in Model 1, coefficient estimates on excess cash flow, market-to-book ratio, and net leverage are statistically significant and of the predicted sign. In addition, the coefficient on dividend yield is positive and significant, suggesting that dividends and repurchases represent complimentary payout methods in the UK. Finally, after controlling for differences in lagged total assets via our matching procedure, repurchasers are characterised by lower market capitalisation at the beginning of the repurchase year. This is consistent with undervaluation playing a role in the repurchase decision.

Models 2-4 in Table 4 report separate analyses for the bonus, option, and LTIP components of executive compensation, respectively. Results suggest that bonus-based EPS conditions have the greatest effect on repurchase propensity. The estimated coefficient on EPS_{Bonus} is positive and significant at the 0.01 level, with an odds ratio of 1.8. Stock option plans where vesting is contingent on EPS also increase the likelihood of a repurchase, although the effect is both statistically and economically lower than that associated with bonus plans. The presence of an LTIP where rewards are conditioned on EPS has no power to discriminate between repurchasers and non-repurchasers. Finally, Model 5 provides evidence on the incremental effects associated with EPS-based bonus, option and LTIP arrangements. Results indicate that EPS-based bonus and stock option plans are associated with incrementally positive effects on repurchase likelihood. The implied probability of a repurchase is 0.69 when both bonus and option plans are

conditional on EPS performance, compared with 0.62 (0.56) for firms where only bonus (option) plans are linked to EPS, and 0.48 where neither compensation element is related to EPS.[13]

Supplementary Tests

This section reports results of two supplementary tests designed to further explore the link between repurchases and EPS-contingent compensation arrangements. Our first test examines the association between EPS targets and the value of shares repurchased. All else equal, if EPS conditions increase repurchase incentives then the amount spent repurchasing stock should be positively associated with the incidence of such performance conditions. Table 5 reports coefficient estimates and model summary statistics for OLS regressions relating firms' annual spend on repurchases (scaled by lagged total assets) to the presence of at least one plan linking at least one element of executives' compensation to EPS. Models are estimated using the 384 repurchase firm-year observations. (Findings for tobit models estimated using both repurchase and non-repurchase years for firms in the repurchase sample, plus all non-repurchase firm-years in the non-repurchase sample, are entirely consistent with those reported in Table 4 for conditional logistic regressions.) As expected, estimated coefficients on *EPS* are positive and significant in Table 5, indicating that firms spend relatively more on repurchases when at least one element of executive compensation is contingent on EPS performance.

All else equal, tougher performance targets are predicted to create stronger earnings management incentives. Accordingly, if repurchases are a response to compensation arrangements linking executive pay to EPS performance then repurchase incentives are expected to be increasing in EPS target difficulty. We test this prediction by comparing EPS target levels for repurchase and non-repurchase firms. Results reported in the previous section reveal the link between repurchases and EPS performance conditions is confined to the bonus and option

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[13] Implied probabilities are computed holding all remaining binary (continuous) explanatory variables

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components of executive compensation. Unfortunately, disclosure of EPS thresholds in short-term bonus plans is not mandatory and very few UK firms voluntarily provide such information. However, following best practice guidelines published by Greenbury (1995) and the Association of British Insurers (2001), most UK firms provide details of performance thresholds in performance-vesting option plans. Subsequent tests therefore focus on stock option plans.

The majority of firms with EPS vesting options measure performance over a three-year window, with EPS growth benchmarked against growth in the retail price index (RPI) over the corresponding period (Main and Neate 2006; Conyon et al. 2000). Accordingly, our measure of target difficulty (*EPS_GROW*) is the minimum rate of EPS growth in excess of RPI growth required to trigger partial or complete vesting. Results are reported in table 6 using two sampling approaches. The first approach preserves pairwise matching by retaining only those cases where both repurchase and control firms have an EPS-contingent option plan *and* where both provide details of the corresponding performance thresholds. This approach yields sample of 107 matched pairs. The second (unconstrained) sampling method includes all firm-years where EPS option vesting conditions are disclosed. This method yields a final sample of 377 observations, comprising 201 repurchase firm-years and 176 non-repurchase firm-years.

Panel A of table 6 reports univariate tests of option-related EPS target difficulty. Focusing initially on results for the matched sample, the mean (median) three-year abnormal EPS growth target for repurchase firms is 5.9% (6.0%) compared with 4.6% (4.0%) for their non-repurchase counterparts. Paired t- and Wilcoxon tests reject the null hypothesis of no difference in target difficulty at the 0.05 and 0.02 levels, respectively. Similar results are apparent in the final three columns of panel A using the unconstrained sample. Comparable (though statistically weaker) findings also hold in panel B of table 6 after controlling for other repurchase

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constant at one (their sample means).

determinants.[14] Overall, these results support the prediction that repurchase incentives are increasing in EPS target difficulty.

V. FURTHER ANALYSIS

Efficient Contracting

Linking executive compensation to EPS growth provides management with a means of manipulating reported performance (through stock repurchases) that can easily be avoided by using alternative accounting metrics such as ROA and operating profit, or by using market-based measures such as TSR. It is somewhat puzzling, therefore, why EPS performance conditions remain a popular choice in executive compensation contracts despite the repurchase-related earnings management that such arrangements appear to encourage. Understanding this apparent paradox is particularly pertinent given that managers may divert resources away from value-increasing investments to fund EPS-motivated stock repurchases (Bens et al. 2002).

One possibility is that use of a per share-based performance metric with its corresponding implications for stock repurchase activity may represent an efficient contracting outcome designed to align the interests of management and shareholders by incentivizing managers to take decisions that promote shareholder value. Specifically, to the extent that EPS targets create explicit incentives for managers to manipulate reported performance by repurchasing shares, EPS-based compensation contracts may provide a simple means of motivating self-interested executives to distribute surplus cash to shareholders in a timely manner. Accordingly, the evidence reported in tables 4-6 indicating a link between EPS-based compensation contracts and stock repurchase activity may be a consequence of efficient contracting arrangements aimed at alleviating the agency costs of surplus cash. The remainder of this section reports findings for two tests of this efficient contracting hypothesis.

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[14] Sensitivity tests controlling for the presence of an EPS contingent bonus plan yield identical conclusions.

If conditioning executive compensation on EPS performance helps overcome the agency costs of surplus cash by incentivizing self-interested managers to inflate EPS growth through stock repurchases, then the probability of a repurchase should be higher for firms with excess funds that tie executive compensation to EPS. We test this prediction by interacting our EPS indicator variables with proxies for surplus cash. Table 7 reports coefficient estimates and model summary statistics for logistic regressions that expand equation (1) to include interactions between EPS targets and *Surplus cash holdings*, *Free cash flow*, and *Excess investing cash*. In the interests of parsimony, table 7 only reports coefficient estimates for the relevant main effect and interaction variables. (Results for all remaining control variables are very similar to those reported in table 4.) Since coefficient estimates for interaction variables in a conditional logistic model are difficult to interpret, we present results estimated using pooled logistic models. The price paid for improved interpretability is a reduction in statistical power due to a failure to preserve the matched structure of our data.

Model 1 in table 7 is estimated using the *EPS* indicator variable, which equals one when at least one element of executives' compensation is conditioned on EPS and zero otherwise. Consistent with the conditional logistic results reported in table 4, estimated coefficients for the *EPS* and *Free cash flow* main effects are positive and significant. In contrast, the coefficient on *EPS × Free cash flow* is statistically indistinguishable from zero. Likewise, coefficient estimates on the *EPS × Surplus cash holdings* and *EPS × Excess investing cash* interactions are also insignificant. Findings for Model 1 therefore provide no support for the view that EPS-contingent compensation arrangements help overcome the agency costs of surplus cash by strengthening the association between repurchases and excess cash. Similar results are apparent in Models 2 and 3 where the bonus and option components of executive compensation are examined individually. The only evidence in table 7 consistent with the efficient contracting hypothesis is the positive coefficient on $EPS_{Bonus} \times Excess\ investing\ cash$ (two-tailed probability value = 0.08). Overall,

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these findings provide little support for view that EPS-based contracts and accretive stock repurchases coexist as part of an optimal contracting solution to the agency costs of surplus cash.

Preceding tests treat compensation contract design as exogenous. If the decision to condition executive compensation on EPS represents an endogenous response to agency problems of excess cash, then the apparent link between EPS-contingent compensation and repurchase activity documented in tables IV-VII could be the result of model misspecification. We address the issue of endogeneity by estimating the following two-equation system:

$$\Phi^{-1}(p_{it}) = \beta_0 + \beta_1 EPS_{it-1} + \sum_{k=1}^{K} \theta_k Controls_{kit-1} \tag{3a}$$

$$\Phi^{-1}(q_{it-1}) = \alpha + \sum_{n=1}^{3} \lambda_n Excess\ cash_{nit-1} + \sum_{m=1}^{M} \delta_m Controls_{mit-1}\ , \tag{3b}$$

where p_{it} is the latent probability that firm i repurchases shares in year t ($y_{it} = 1$); q_{it-1} is the latent probability that firm i conditions executive compensation on EPS in year t-1 ($z_{it-1} = 1$); $\Phi^{-1}(p_{it})$ and $\Phi^{-1}(q_{it-1})$ are the inverse of the cumulative distribution functions of a standard normal variable; *EPS* is an indicator variable taking the value of one if at least one compensation element is conditional on EPS and zero otherwise; *Excess cash* is a vector of three surplus cash proxies ($n = $ *Surplus cash holdings*, *Free cash flow*, and *Excess investing cash*); and *Controls* are vectors of K and M additional factors expected to influence the repurchase decision and the choice of EPS targets, respectively. Control variables for the repurchase model are the same as outlined in equation (1). To the best of our knowledge, a well specified model of performance metric choice in executive compensation contracts does not exist. Accordingly, we view the specification of equation (3b) as exploratory. Firm size is included to capture general size-related effects and because large firms are more likely to use innovative compensation arrangements (Kole, 1997). The market-to-book ratio is included because accounting performance measures are more likely to be used where earnings provide a more accurate estimate of managerial performance, such as firms with assets in place (Smith and Watts 1992; Kole 1997). Indicator

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variables for dividend-paying firms and those with positive R&D spending are included because high investment firms and those with strong growth opportunities are more likely to use performance conditions (of any type) in executive compensation contracts (Smith and Watts 1992; Kole 1997). Following Sloan (1993), we also include an industry-level proxy for the noise in stock returns relative to the noise in reported earnings. Finally, we include an indicator variable to control for firms that provide incomplete disclosure of performance conditions employed in executive compensation contracts.

Table 8 reports coefficient estimates for equations (3a) and (3b) estimated using a recursive simultaneous-equations bivariate probit method to account for the binary nature of both dependent variables [Greene (2003: 715-718)]. Results from the EPS model provide mixed evidence regarding the link between excess cash problems and EPS-contingent executive compensation arrangements. Consistent with the efficient contracting hypothesis, the probability of at least one element of executive compensation being conditional on EPS is positively related to free cash flow. Contrary to efficient contracting predictions, however, firms with surplus cash holdings are less likely to tie executive compensation to EPS. More importantly in the context of our analysis, results reported in table 8 for the repurchase model indicate that the significant association between repurchases and *EPS* persists even after controlling for the endogenous nature of performance measure choice. These findings, together with those reported in table 8, do not support the efficient contracting explanation for the observed link between stock repurchase activity and EPS-contingent executive compensation plans..

Alternative Explanation

An alternative interpretation of the findings documented in section IV is that opportunistic executives use stock repurchases to maximise their compensation payouts at the expense of external shareholders. Several plausible scenarios could explain such a contracting outcome despite the associated costs to shareholders. First, assuming that boards select the

appropriate set of compensation arrangements to maximize shareholder wealth for a given set of circumstances, EPS-driven stock repurchases may simply represent an unavoidable agency cost associated with a second best contracting solution. An alternative and potentially more sinister possibility is that some boards choose to condition executive compensation on EPS performance because such arrangements help placate external monitors while simultaneously minimising executives' compensation risk through provision of ancillary earnings management opportunities associated with a per share-based performance metric.

While our empirical tests do not directly address the opportunism hypothesis, several factors point toward this being a plausible explanation for the observed link between repurchase activity and executive compensation arrangements. First, prior research documents extensive evidence of managers using their accounting and investment discretion to game compensation realisations. Accordingly, it should come as little surprise if management also use the flexibility afforded by stock repurchases to boost reported performance and enhance compensation payouts. Second, results in section IV reveal poor disclosure practices by repurchase firms in relation to the performance conditions used in executive compensation contracts. This lack of transparency contravenes best practice guidelines and hints at the possibility of egregious compensation practices. Finally, prior to the publication of Greenbury Report in 1995 and subsequent adoption of performance vesting conditions in executive stock-based compensation plans, stock repurchase levels in the UK were negligible (Oswald and Young 2004). The fact that changes to the design of compensation contracts have been accompanied by substantial growth in repurchase activity is *prima facie* evidence that widespread adoption of EPS targets may have strengthened the incentives for managers to engage in stock repurchases.

VI. SUMMARY AND CONCLUSIONS

This paper examines the impact on firms' stock repurchase activity of EPS performance conditions in executive compensation contracts. Our analysis connects three literatures. One body

of research demonstrates how aspects of corporate payout policy, including the level of dividend payments and the choice between dividends and stock repurchases, are sensitive to executives' compensation arrangements. Another body of work based on surveys and anecdotal evidence highlights managerial concern over EPS as an important factor affecting firms' stock repurchase activity. A third group of studies concludes that managers use stock repurchases to achieve key firm-level EPS performance thresholds. Our analysis integrates these three literatures by exploring how firms' stock repurchase policy is shaped by contractual arrangements that create a direct link between executive compensation and EPS performance.

Using a comprehensive sample of UK non-financial firms that undertook stock repurchases during the period 1998 through 2003, we document a statistically and economically strong link between stock repurchase activity and the presence of EPS performance conditions in executive compensation contracts. The predicted odds of a repurchase for firms where compensation depends on EPS performance are almost twice the level observed for firms where rewards are independent of EPS. Bonus plans and stock option plans that employ EPS performance conditions are associated with incrementally significant effects on the probability of a repurchase. We also document positive associations between the amount spent repurchasing stock and EPS-contingent executive compensation, and between the probability of a repurchase and the level at which EPS-based vesting conditions are set in executive stock option plans. While we are unable to categorically reject the possibility that stock repurchases motivated by EPS-based compensation arrangements represent an efficient contracting solution to the agency problems of surplus cash, the empirical evidence does not support this explanation. Managerial opportunism aimed at maximizing compensation payouts at external shareholders expense represents a more plausible explanation for our findings.

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Table 1. Selection process and descriptive statistics for open market share repurchase sample

Panel A: Sample selection

Firm-years with fiscal year-ends between January 1, 1998 and April 30, 2003 that executed at least one open market share repurchase transaction (excl. investment trusts)		580
Less:		
Banks, insurance, investment and real estate firms	158	
Utilities	10	
Firm-years with insufficient financial statement data from Datastream	28	(196)
Final sample		384

Panel B: Industry composition for repurchase sample

Industry group	No.	% of final sample
Aerospace and defence	1	0.3
Automobiles and parts	2	0.5
Beverages	10	2.6
Chemicals	8	2.1
Construction and building materials	43	11.2
Distributors	27	7.0
Electronic and electrical equipment	17	4.4
Engineering and machinery	47	12.2
Food and drug retailers	2	0.5
Food producers and processors	21	5.5
Household goods and textiles	30	7.8
Healthcare	3	0.8
Information technology hardware	3	0.8
Leisure and hotels	28	7.3
Media and entertainment	12	3.1
Mining	5	1.3
Oil and gas	8	2.1
Packaging	6	1.6
Personal care and household products	2	0.5
Pharmaceuticals and biotechnology	8	2.1
Retailers, general	33	8.6
Software and computer services	17	4.4
Steel and other metals	2	0.5
Support services	25	6.5
Telecom services	1	0.3
Tobacco	2	0.5
Transport	21	5.5
	384	100

Panel C: Summary statistics for repurchases

		Value of shares repurchased (£m)				Fraction of shares repurchased				
Year	N	Mean	St. dev	Median	Sum	Mean	St. dev	Max	Median	Min
1998	59	19.7	48.3	2.7	1159.8	0.05	0.05	0.35	0.03	0.00
1999	63	38.4	155.9	2.7	2418.8	0.05	0.06	0.40	0.03	0.00
2000	81	68.3	239.6	2.7	5536.1	0.06	0.08	0.41	0.04	0.00
2001	69	61.9	201.8	2.9	4272.7	0.05	0.04	0.17	0.04	0.00
2002	72	98.0	359.3	2.1	7059.0	0.04	0.05	0.28	0.02	0.00

Table 1 *continued*

2003	40	53.8	160.7	1.8	2152.9	0.04	0.04	0.14	0.03	0.00
All	384	58.9	225.2	2.5	22599.1	0.05	0.06	0.41	0.03	0.00

Notes: The initial sampling frame consists of all UK-resident firms listed on the London Stock Exchange that repurchased shares in the open market in one or more fiscal years ending January 1, 1997 through May 1, 2003. Each repurchase firm-year is treated as a separate observation. Industry groupings in panel B are based on Datastream's level-4 industrial classification. The value of shares repurchased (panel C) is the aggregate amount spent on open market repurchases during fiscal year t (including expenses associated with the repurchase program). The fraction of shares repurchased (panel C) is the number of shares repurchased during fiscal year t as a fraction of the total number of ordinary shares outstanding at the beginning of year t.

Table 2. Summary statistics and features of compensation plan components for repurchasing and non-repurchasing matched pairs. The sample comprises 384 firm-year repurchases executed between January 1998 and April 2003, and 384 non-repurchase firm-years matched by fiscal year, industry and firm size.

Panel A: Frequency of plans

Compensation component	Plan status by firm			Number of plans				
	≥ 1 plan	No plan	Not disclosed	N	Mean	St dev	Median	Max
Bonus plans								
Repurchasers	354	29	1	360	0.935	0.287	1	2
Non-repurchasers	337	46	1	343	0.890	0.345	1	2
p-value for difference	0.037				0.056		0.055	
Option plans								
Repurchasers	345	39	0	425	1.112	0.574	1	3
Non-repurchasers	349	35	0	473	1.234	0.628	1	3
p-value for difference	0.621				0.005		0.007	
Long-term incentive plans								
Repurchasers	123	261	0	139	0.362	0.561	0	2
Non-repurchasers	146	238	0	166	0.432	0.601	0	3
p-value for difference	0.051				0.062		0.074	

Panel B: Performance measures by plan

Performance measures by compensation component	Frequency counts			
	Repurchasers		Non-repurchasers	
	N	%	N	%
Bonus plans				
Earnings per share	108	(30.0)	81	(23.6)
Profit before tax / EBIT / Operating profit	159	(44.2)	184	(53.6)
Residual income	7	(1.9)	3	(0.8)
Return on capital	7	(1.9)	21	(6.1)
Share price / Total shareholder return	9	(2.5)	14	(4.1)
Personal objectives	32	(8.9)	31	(9.0)
Other	39	(10.8)	70	(20.4)
Not disclosed	90	(25.0)	57	(16.6)
Total number of plans	360		343	
Option plans				
Earnings per share	253	(59.5)	217	(45.9)
Profit before tax / EBIT / Operating profit	9	(2.1)	5	(1.1)
Return on capital	3	(0.7)	0	(0.0)
Share price / Total shareholder return	34	(8.0)	55	(11.6)
Other	3	(0.7)	1	(0.2)
No performance condition	117	(27.5)	189	(40.0)
Not disclosed	23	(5.4)	6	(1.3)
Total number of plans	425		473	
Long-term incentive plans				
Earnings per share	56	(40.3)	68	(41.0)
Profit before tax / EBIT / Operating profit	6	(4.3)	9	(5.4)
Residual income	0	(0.0)	3	(1.8)
Return on capital	3	(2.2)	7	(4.2)

Table 2 *continued*

Share price / Total shareholder return	96	(69.1)	101	(60.8)
Other	1	(0.7)	5	(3.0)
No performance condition	14	(10.1)	11	(6.6)
Not disclosed	0	(0.0)	5	(3.0)
Total number of plans	139		166	

All compensation data relate to compensation contracts for executive directors. Data are collected on all plans for the following three elements in executives' compensation contracts: bonuses, share options and long-term incentives. Bonus plans comprise all arrangements where rewards are tied to short-term (≤ one-year) performance targets. Share option plans consist of incentive contracts that grant executives the right to acquire their firm's shares a non-zero exercise price. (Firm-wide employee share option plans and save-as-you-earn schemes are not included.) Long-term incentive plans (LTIPs) consist of all remaining long-term compensation arrangements not classified as share options (e.g., deferred bonus schemes, share matching schemes, stock appreciation rights, and long-term bonus plans). Probability values reported in panel A are for chi-square tests (column 2), paired t-tests (column 6) and paired Wilcoxon tests (column 8). For each compensation component (bonuses, options and LTIPs), the sum of performance measure percentages reported in panel B may exceed one hundred because some firms use multiple measures in a single plan.

Table 3. Descriptive statistics. The sample comprises 384 firm-year repurchases executed between January 1998 and April 2003, and 384 non-repurchase firm-years matched by fiscal year, Datastream level-4 industry group, and lagged total assets.

	Repurchase sample (N = 384)							Non-repurchase sample (N = 384)							p-value for
	Mean	St dev	Max	Q3	Median	Q1	Min	Mean	St dev	Max	Q3	Median	Q1	Min	difference
Compensation variables															
NDISC	0.16	0.37	1	0	0	0	0	0.08	0.28	1	0	0	0	0	0.01
EPS	0.70	0.46	1	1	1	0	0	0.63	0.48	1	1	1	0	0	0.02
$NDISC_{Bonus}$	0.23	0.42	1	0	0	0	0	0.15	0.36	1	0	0	0	0	0.01
EPS_{Bonus}	0.28	0.45	1	1	0	0	0	0.21	0.41	1	0	0	0	0	0.03
$NDISC_{Option}$	0.06	0.23	1	0	0	0	0	0.02	0.12	1	0	0	0	0	0.01
EPS_{Option}	0.59	0.49	1	1	1	0	0	0.52	0.50	1	1	1	0	0	0.04
$NDISC_{LTIP}$	0.00	0.00	0	0	0	0	0	0.01	0.11	1	0	0	0	0	0.06
EPS_{LTIP}	0.14	0.34	1	0	0	0	0	0.16	0.37	1	0	0	0	0	0.34
Control variables															
Surplus cash holdings	-0.01	0.09	0.77	0.03	-0.02	-0.06	-0.37	-0.00	0.11	0.76	0.04	-0.02	-0.06	-0.36	0.21
Free cash flow	0.38	0.49	1	1	0	0	0	0.25	0.43	1	0	0	0	0	0.01
Excess investing cash	0.17	0.38	1	0	0	0	0	0.15	0.35	1	0	0	0	0	0.38
Log(market cap.)	11.87	2.22	18.62	13.20	11.36	10.27	7.60	11.62	1.90	17.66	12.89	11.56	10.11	6.71	0.01
Market-to-book	1.43	0.80	6.37	1.62	1.20	0.95	0.50	1.65	1.79	29.75	1.72	1.25	0.99	0.46	0.13
Net leverage	-0.09	1.00	0.79	0.17	0.04	-0.12	-12.68	0.11	0.34	1.57	0.29	0.14	-0.00	-3.01	0.01
Dividend yield	0.04	0.03	0.50	0.06	0.04	0.03	0	0.03	0.04	0.50	0.05	0.03	0.01	0	0.01
Negative returns	0.57	0.50	1	1	1	0	0	0.59	0.49	1	1	1	0	0	0.48

Variable definitions are as follows: *NDISC* is an indicator variable taking the value of one when insufficient disclosure renders the presence of an eps target indeterminate and zero otherwise; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan, or LTIP tied to earnings per share (eps) performance, and zero otherwise; $NDISC_{Bonus}$ is an indicator variable taking the value of one for firms that fail to explicitly disclose whether or not bonus payments are conditional on eps performance and zero otherwise; EPS_{Bonus} is an indicator variable taking the value of one for firms where bonus payments are fully or partially conditional on eps performance and zero otherwise; $NDISC_{Option}$ is an indicator variable taking the value of one for firms that fail to explicitly disclose whether or not option vesting is conditional on eps performance and zero otherwise; EPS_{Option} is an indicator variable taking the value of one for firms where option vesting is fully or partially conditional on eps performance and zero otherwise; $NDISC_{LTIP}$ is an indicator variable taking the value of one for firms that fail to explicitly disclose whether or not LTIP rewards are conditional on eps performance and zero otherwise; EPS_{LTIP} is an indicator variable taking the value of one for firms where LTIP rewards are fully or partially conditional on eps performance and zero otherwise; *Surplus cash holdings* is the residual from yearly OLS regressions of cash holdings (cash and cash equivalents [375] scaled by lagged total assets [392]) on the natural logarithm of market capitalisation, operating cash flow scaled by lagged total assets), net working capital (non-cash current assets [376 – 375] minus current liabilities [389] divided by total assets net of cash and cash equivalents), net leverage (total liabilities [321 + 389] net of cash and cash equivalents divided by total assets net of cash and cash equivalents), research and development ([119] divided by total revenue [104]), the market-to-book ratio, and dividend payout (an indicator variable taking the value of one for firms with non-zero ordinary

Table 3 *continued*

dividends [187] and zero otherwise; *Free cash flow* is an indicator variable taking the value of one for firms with a market-to-book ratio (book value of debt [392 –305] plus the market value of equity [MV] divided by total assets) less than the sample median for the year and net operating cash flow ([1015] scaled by lagged total assets [392]) greater than the sample median for the year, and zero otherwise; *Excess investing cash* is an indicator variable taking the value of one if investing cash flows [1040] are positive, and zero otherwise; *Market capitalisation* is share price multiplied by the number of shares outstanding; *Market-to-book* ratio is the book value of debt plus the market value of equity divided by total assets; *Net leverage* is total liabilities net of cash holdings divided by total assets net of cash holdings; *Dividend yield* is ordinary dividends per share (190) divided by share price; and *Negative returns* is an indicator variable taking the value of one if 12-month stock returns are less than the market return over the corresponding period, and zero otherwise. All variables are measured at the beginning of the repurchase year. The last column reports probability values for two-tailed paired Wilcoxon Sign Rank tests of the difference between repurchase and non-repurchase firms.

Table 4. Coefficient estimates and model summary statistics for conditional logistic regressions relating the probability of a share repurchase to the incidence of EPS-based performance conditions in executive compensation contracts, and a vector of control variables. The sample comprises 384 firm-year repurchases executed between January 1998 and April 2003, and 384 non-repurchase firm-years matched by fiscal year, Datastream level-4 industry group, and lagged total assets. Three values are reported for each covariate: the first value is the coefficient estimate; the second (italicised) value is the odds ratio; and the third (parenthesised) value is the probability value.

Variables	Predicted Sign	Model 1	Model 2	Model 3	Model 4	Model 5
Surplus cash holdings	(+)	-1.19	-1.04	-1.42	-1.22	-1.48
		0.31	*0.35*	*0.24*	*0.30*	*0.23*
		(0.22)	(0.29)	(0.14)	(0.20)	(0.15)
Free cash flow	(+)	0.61	0.60	0.63	0.63	0.49
		1.84	*1.82*	*1.87*	*1.88*	*1.64*
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Excess investing cash flow	(+)	0.40	0.40	0.35	0.33	0.26
		1.49	*1.49*	*1.42*	*1.39*	*1.30*
		(0.12)	(0.13)	(0.18)	(0.20)	(0.34)
Log(market capitalisation)	(?)	-1.16	-1.13	-1.11	-1.08	-1.17
		0.31	*0.32*	*0.33*	*0.34*	*0.31*
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Market-to-book	(−)	-1.26	-1.27	-1.35	-1.23	-1.34
		0.28	*0.28*	*0.26*	*0.29*	*0.26*
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Net leverage	(−)	1.25	1.17	1.16	1.16	1.19
		3.47	*3.21*	*3.19*	*3.20*	*3.27*
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Dividend yield	(?)	5.85	5.83	4.41	5.45	4.80
		346.51	*340.66*	*82.36*	*231.65*	*122.05*
		(0.04)	(0.03)	(0.09)	(0.05)	(0.08)
Negative returns	(+)	-0.17	-0.17	-0.18	-0.21	-0.08
		0.84	*0.84*	*0.83*	*0.82*	*0.93*
		(0.40)	(0.41)	(0.38)	(0.31)	(0.72)
NDISC	(?)	1.53				
		4.61				
		(0.01)				
EPS	(+)	0.68				
		1.98				
		(0.01)				
$NDISC_{Bonus}$	(?)		0.79			0.87
			2.21			*2.38*
			(0.01)			(0.01)
EPS_{Bonus}	(+)		0.59			0.55
			1.81			*1.73*
			(0.01)			(0.01)
$NDISC_{Option}$	(?)			1.80		1.86
				6.02		*6.44*

					(0.01)	(0.01)

Table 4 *continued*

EPS_{Option}	(+)				0.34	0.35
					1.40	*1.41*
					(0.08)	(0.09)
$NDISC_{LTIP}$	(?)				-14.98	-15.06
					0.01	*0.01*
					(0.99)	(0.99)
EPS_{LTIP}	(+)				-0.33	-0.42
					0.72	*0.66*
					(0.20)	(0.13)
Likelihood ratio		140.22	133.97	133.69	127.26	154.85
p-value		0.01	0.01	0.01	0.01	0.01
Pseudo R^2		0.41	0.39	0.39	0.38	0.44
% correctly classified		74.2	73.4	75.8	74.0	75.3

Variable definitions are as follows: *NDISC* is an indicator variable taking the value of one when insufficient disclosure renders the presence of an eps target indeterminate and zero otherwise; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan or LTIP tied to earnings per share (eps) performance, and zero otherwise; $NDISC_j$ is an indicator variable taking the value of one when insufficient disclosure renders the presence of an eps target indeterminate for the *j*th compensation element, and zero otherwise; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan or LTIP tied to earnings per share (eps) performance, and zero otherwise; *Surplus cash holdings* is the residual from yearly optimal cash holdings regressions (see table 3 for details); *Free cash flow* is an indicator variable taking the value of one for firms with a market-to-book ratio less than the sample median for the year and net operating cash flow greater than the sample median for the year, and zero otherwise; *Excess investing flows* is an indicator variable taking the value of one if investing cash flows are positive, and zero otherwise; *Market capitalisation* is share price multiplied by the number of shares outstanding; *Market-to-book* is the book value of debt plus the market value of equity divided by total assets; *Net leverage* is total liabilities net of cash holdings divided by total assets net of cash holdings; *Dividend yield* is ordinary dividends per share divided by share price; and *Negative returns* is an indicator variable taking the value of one if 12-month stock returns are less than the market return over the corresponding period, and zero otherwise. All variables are measured at the beginning of the repurchase year. Probability values are for one- (two-) tailed tests where the coefficient sign is (not) as predicted.

Table 5. Coefficient estimates and model summary statistics for OLS regressions of the natural logarithm of the annual spend on repurchases (scaled by lagged total assets) on the use of EPS performance conditions in executive compensation contracts and a vector of control variables. The sample comprises 384 firm-year repurchases executed between January 1998 and April 2003. Probability values are reported in parentheses.

Variables	Predicted Sign	Model 1	Model 2
Surplus cash holdings	(+)		0.31
			(0.03)
Free cash flow	(+)		0.15
			(0.34)
Excess investing flow	(+)		0.18
			(0.35)
Log(market capitalisation)	(?)		0.00
			(0.95)
Market-to-book	(−)		0.49
			(0.01)
Net leverage	(−)		-0.50
			(0.03)
Dividend yield	(?)		0.25
			(0.91)
Negative returns	(+)		0.27
			(0.06)
NDISC	(?)	0.43	0.41
		(0.10)	(0.11)
EPS	(+)	0.61	0.47
		(0.01)	(0.02)
Intercept	(?)	-4.51	-5.52
		(0.01)	(0.01)
N		384	384
F-statistic		4.44	5.17
p value		0.01	0.01
Adjusted R^2		0.02	0.10

Variable definitions are as follows: The dependent variable is the natural logarithm of aggregate amount (including expenses) spend on open market share repurchases during fiscal year t (scaled by lagged total assets); *NDISC* is an indicator variable taking the value of one when insufficient disclosure renders the presence of an eps target indeterminate and zero otherwise; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan, or LTIP tied to EPS performance, and zero otherwise; *Free cash flow* is an indicator variable taking the value of one for firms with a market-to-book ratio less than the sample median for the year and net operating cash flow greater than the sample median for the year, and zero otherwise; *Surplus cash holdings* is the residual from yearly optimal cash holdings regressions (see table 3 for details); *Excess investing flows* is an indicator variable taking the value of one if investing cash flows are positive, and zero otherwise; *Market capitalisation* is share price multiplied by the number of shares outstanding; *Market-to-book* is the book value of debt plus the market value of equity divided by total assets; *Net leverage* is total liabilities net of cash holdings divided by total assets net of cash holdings; *Dividend yield* is ordinary dividends per share divided by share price; and *Negative returns* is an indicator variable taking the value of one if 12-month stock returns are less than the market return over the corresponding period, and zero otherwise. All variables are measured at the beginning of the repurchase year. Probability values are for one- (two-) tailed tests where the coefficient sign is (not) as predicted.

Table 6. Univariate and multivariate comparisons of EPS vesting conditions used in executive share option plans. Tests are based on firm-years where executive option exercise is conditional on EPS performance and the minimum level of EPS growth required to trigger vesting is disclosed. Matched sample tests are restricted to cases where these conditions hold for both the repurchase and matched non-repurchase firm. Unconstrained sample tests use all available repurchase and non-repurchase observations satisfying these conditions (i.e., matching not preserved). Probability values are reported in parentheses.

Panel A: Univariate tests

| | 3-year EPS growth (%) above growth in retail price index | | | | | |
| | Matched sample | | | Unconstrained sample | | |
Samples	N	Mean	Median	N	Mean	Median
Repurchasers	107	5.86	6.00	201	5.87	6.00
Non-repurchasers	107	4.58	4.00	176	5.00	4.00
Probability value for difference		(0.05)	(0.02)		(0.09)	(0.01)

Panel B: Logistic regressions

Variables	Predicted sign	Matched sample	Unconstrained Sample
Surplus cash holdings	(+)	-0.41	-1.65
		(0.83)	(0.24)
Free cash flow	(+)	0.27	0.68
		(0.24)	(0.01)
Excess investing flow	(+)	0.70	0.25
		(0.06)	(0.23)
Log(market capitalisation)	(?)	1.35	0.25
		(0.01)	(0.01)
Market-to-book	(−)	-1.01	-0.22
		(0.01)	(0.09)
Net leverage	(−)	-1.80	-2.74
		(0.04)	(0.01)
Dividend yield	(?)	3.32	6.32
		(0.29)	(0.16)
Negative returns	(+)	-0.43	-0.27
		(0.31)	(0.26)
EPS_GROW	(+)	0.09	0.04
		(0.06)	(0.05)
Intercept			-3.03
			(0.01)
Likelihood ratio		32.02	55.60
p-value		0.01	0.01
Pseudo R^2		0.35	0.18
% correctly classification		65.4	66.3
N		107	377

Probability values in panel A relate to two-tailed t-tests (Wilcoxon tests) for differences in means (medians). In panel B, conditional (standard) logistic regressions are used for the matched (unconstrained) samples. Variable definitions for

Table 6 *continued*

the logistic models are as follows: *EPS_GROW* is the three-year compound eps growth rate in excess of the growth in the retail price index required to trigger option vesting. For firms using staggered vesting conditions, *EPS_GROW* is the minimum eps growth rate required to trigger vesting. All remaining variables are as defined in Tables IV and V. Probability values in panel B are for one- (two-) tailed tests where the coefficient sign is (not) as predicted.

Table 7. Coefficient estimates and model summary statistics for pooled logistic regressions relating the probability of a share repurchase to the interaction between EPS-based performance conditions in executive compensation contracts and the presence of surplus cash, and a vector of control variables. The sample comprises 384 firm-year repurchases executed between January 1998 and April 2003, and 384 non-repurchase firm-years matched by fiscal year, Datastream level-4 industry group, and lagged total assets. Three values are reported for each covariate: the first value is the coefficient estimate; the second (italicised) value is the odds ratio; and the third (parenthesised) value is the probability value.

Variables	Predicted Sign	Model 2	Model 3	Model 4
Intercept	(?)	-2.91	-2.18	-2.16
		(0.01)	(0.01)	(0.01)
Surplus cash holdings	(+)	-0.89	-1.29	-0.94
		0.41	*0.28*	*0.39*
		(0.35)	(0.13)	(0.30)
Free cash flow	(+)	0.80	0.57	0.78
		2.23	*1.78*	*2.18*
		(0.01)	(0.01)	(0.01)
Excess investing cash flow	(+)	0.26	-0.21	-0.19
		1.29	*0.81*	*0.83*
		(0.27)	(0.42)	(0.59)
NDISC	(?)	1.53		
		4.64		
		(0.01)		
EPS	(+)	0.95		
		2.58		
		(0.01)		
EPS × Surplus cash holdings	(?)	-0.11		
		0.89		
		(0.61)		
EPS × Free cash flow	(?)	-0.41		
		0.66		
		(0.27)		
EPS × Excess investing cash	(?)	-0.38		
		0.68		
		(0.43)		
NDISC$_{Bonus}$	(?)		0.77	
			2.16	
			(0.01)	
EPS$_{Bonus}$	(+)		0.39	
			1.48	
			(0.09)	
EPS$_{Bonus}$ × Surplus cash holdings	(?)		0.18	
			1.19	
			(0.60)	
EPS$_{Bonus}$ × Free cash flow	(?)		-0.20	
			0.82	
			(0.61)	

Table 7 *continued*

$EPS_{Bonus} \times$ *Excess investing cash*	(?)		0.97	
			2.65	
			(0.08)	
$NDISC_{Option}$	(?)			1.64
				5.18
				(0.01)
EPS_{Option}	(+)			0.46
				1.58
				(0.03)
$EPS_{Option} \times$ *Surplus cash holdings*	(?)			-0.15
				0.86
				(0.52)
$EPS_{Option} \times$ *Free cash flow*	(?)			-0.40
				0.67
				(0.24)
$EPS_{Option} \times$ *Excess investing cash*	(?)			0.22
				1.24
				(0.62)
Additional control variables included		Yes	Yes	Yes
Likelihood ratio		116.67	107.09	102.26
p-value		0.00	0.00	0.00
Pseudo R^2		0.19	0.17	0.17
% correctly classified		65.50	63.20	65.40

Variable definitions are as follows: *NDISC* is an indicator variable taking the value of one when insufficient disclosure renders the presence of an eps target indeterminate and zero otherwise; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan or LTIP tied to EPS performance, and zero otherwise; *Surplus cash holdings* is the residual from yearly optimal cash holdings regressions (see table 3 for details); *Free cash flow* is an indicator variable taking the value of one for firms with a market-to-book ratio less than the sample median for the year and net operating cash flow greater than the sample median for the year, and zero otherwise; and *Excess investing flows* is an indicator variable taking the value of one if investing cash flows are positive, and zero otherwise. The vector of additional control variables (not reported) consists of: *Market capitalisation* is share price multiplied by the number of shares outstanding; *Market-to-book* is the book value of debt plus the market value of equity divided by total assets; *Net leverage* is total liabilities net of cash holdings divided by total assets net of cash holdings; *Dividend yield* is ordinary dividends per share divided by share price; and *Negative returns* is an indicator variable taking the value of one if 12-month stock returns are less than the market return over the corresponding period, and zero otherwise. All variables are measured at the beginning of the repurchase year. Probability values are for one- (two-) tailed tests where the coefficient sign is (not) as predicted.

Table 8. Coefficient estimates and model summary statistics for a two-equation system estimated using a recursive simultaneous-equations bivariate probit method. The EPS model relates the probability that at least one element of executive compensation is contingent on EPS performance to proxies for surplus cash and a vector of control variables. The repurchase model relates the probability of a stock repurchase to the presence of EPS performance conditions in executive compensation contracts and a vector of control variables. The sample comprises 384 firm-year repurchases executed between January 1998 and April 2003, and 384 non-repurchase firm-years matched by fiscal year, Datastream level-4 industry group, and lagged total assets.

EPS model:

$$\Phi^{-1}(q_{it}) = \alpha + \lambda_1 Surplus\ cash\ holdings_{it-1} + \lambda_2 Free\ cash\ flow_{it-1} + \lambda_3 Excess\ investing\ cash_{it-1} + \delta_1 NDISC_{it-1} + \delta_2 Log(Mktcap_{it-1})$$

$$+ \delta_3 Market\text{-}to\text{-}book_{it-1} + \delta_4 Dividend\ dummy_{it-1} + \delta_5 R\&D_{it-1} + \delta_6 RELVAR_{it-1}$$

	α	λ_1	λ_2	λ_3	δ_1	δ_2	δ_3	δ_4	δ_5	δ_6	N
Coefficient estimate	-1.91	-1.85	0.30	0.09	-6.18	0.14	-0.03	0.94	-1.74	0.11	768
p-value	(0.01)	(0.01)	(0.02)	(0.58)	(1.00)	(0.01)	(0.53)	(0.01)	(0.28)	(0.31)	

Repurchase model:

$$\Phi^{-1}(p_{it}) = \beta_0 + \beta_1 EPS_{it-1} + \theta_1 NDISC_{it-1} + \theta_2 Surplus\ cash\ holdings_{it-1} + \theta_3 Free\ cash\ flow_{it-1} + \theta_4 Excess\ investing\ cash_{it-1} + \theta_5 Log(Mktcap_{it-1})$$

$$+ \theta_6 Market\text{-}to\text{-}book_{it-1} + \theta_7 Net\ leverage_{it-1} + \theta_8 Dividend\ yield_{it-1} + \theta_9 Negative\ returns_{it-1}$$

	β_0	β_1	θ_1	θ_2	θ_3	θ_4	θ_5	θ_6	θ_7	θ_8	θ_9	N
Coefficient estimate	-1.51	1.66	1.69	-0.02	0.15	-0.05	0.04	-0.16	-0.84	1.65	-0.06	768
p-value	(0.01)	(0.01)	(0.01)	(0.98)	(0.20)	(0.72)	(0.27)	(0.01)	(0.01)	(0.06)	(0.48)	

Variable definitions are as follows: p_{it} is the latent probability that firm i repurchases shares in year t ($y_{it} = 1$); q_{it-1} is the latent probability that firm i conditions executive compensation on EPS in year t-1 ($z_{it-1} = 1$); $\Phi^{-1}(p_{it})$ and $\Phi^{-1}(q_{it-1})$ are the inverse of the cumulative distribution functions of a standard normal variable; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan or LTIP tied to EPS performance, and zero otherwise; $NDISC_j$ is an indicator variable taking the value of one when insufficient disclosure renders the presence of an eps target indeterminate for the jth compensation element, and zero otherwise; *EPS* is an indicator variable taking the value of one for firms with at least one bonus plan, option plan or LTIP tied to EPS performance, and zero otherwise; *Surplus cash holdings* is the residual from yearly optimal cash holdings regressions (see table 3 for details); *Free cash flow* is an indicator variable taking the value of one for firms with a market-to-book ratio less than the sample median for the year and net operating cash flow greater than the sample median for the year, and zero otherwise; and *Excess investing flows* is an indicator variable taking the value of one if investing cash flows are positive, and zero otherwise. The vector of additional control variables (not reported) consists of: *Market capitalisation* is share price multiplied by the number of shares outstanding; *Market-to-book* is the book value of debt plus the market value of equity divided by total assets; *Net leverage* is total liabilities net of cash holdings divided by total assets net of cash holdings; *Dividend yield* is ordinary dividends per share divided by share price; and *Negative returns* is an indicator variable taking the value of one if 12-month stock returns are less than the market return over the corresponding period, and zero otherwise; Dividend dummy is an indicator variable equal to one for dividend-paying firms and zero otherwise; R&D is an indicator variable equal to one for firm-years with positive spending on research and development, and zero otherwise;

Table 8 *continued*

RELVAR measures the noise in stock returns relative to the noise in reported earnings following Sloan (1993) and is estimated at the industry level. All variables are measured at the beginning of the repurchase year. Probability values relate to two-tailed tests.