Target Difficulty and Corporate Risk Taking

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ABSTRACT

This study empirically examines the relation between the difficulty level of CEOs' internal performance targets and corporate risk taking. We predict a U-shaped relation between target difficulty and corporate risk taking such that firms exhibit higher risk taking when performance targets are very easy or very difficult and lower risk taking when target difficulty is medium. Using recently available data on performance targets in CEOs' annual bonus plans in 2,493 firm-year observations, we find results consistent with our hypothesis. Our results are robust to alternative measures of target difficulty, alternative measures of risk taking, and alternative research specifications. Cross-sectional analyses reveal that the U-shaped relation between target difficulty and risk taking is more pronounced when CEOs have less equity incentives and are less powerful. We contribute to the target setting literature by providing the first archival evidence on the relation between target difficulty and corporate risk taking.

Keywords: *target difficulty; performance target; risk taking; return volatility*

Data Availability: Data are available from the public sources cited in the text.

JEL Classification: J33; M12; M40; M52

1. INTRODUCTION

Performance targets constitute a critical element of firms' planning, budgeting, and control systems. Targets frequently serve as benchmarks for performance evaluation purposes (Arnold and Artz 2015; Indjejikian, Matějka, Merchant, and Van der Stede 2014; Merchant and Van der Stede 2012) and hence target achievement has significant impact on managers' career prospects and reputation (e.g., Bennett, Bettis, Gopalan, and Milbourn 2017). Prior accounting research on performance targets has largely focused on the impact of targets on *effort*-related agency problems (e.g., Bonner, Hastie, Sprinkle, and Young 2000; Fisher, Maines, Peffer, and Sprinkle 2002). For example, recent accounting research documents the consequences of target ratcheting on effort reduction (e.g., Aranda, Arellano, and Davila 2014; Bouwens and Kroos 2011; Indjejikian et al. 2014). However, except for Sprinkle, Williamson, and Upton (2008)'s experimental study, there has been scant research on the effect of performance targets on *risk*-related agency problems. Our study utilizes recently available data on performance targets for CEOs of large US public firms to provide the first archival evidence on an important yet under-explored effect of target difficulty: corporate risk taking.

Risk taking is essential for long-run firm growth and shareholder welfare (Guay 1999; Tsui 2015). However, risk taking represents a central aspect of agency problems because risk-averse and undiversified managers who have most of their wealth tied to the value of their firms are motivated to reject positive net present value projects that are too risky (Guay 1999; Smith and Stulz 1985). Hence, firms with growth opportunities would benefit if risk-averse managers could be motivated to invest in high-risk, positive-NPV projects (Coles et al. 2006; Guay 1999; Tsui 2015). Prior literature focuses on mitigating risk-related agency problems with convex compensation contracts such as equity incentives (Armstrong and Vashishtha 2012; Coles et al.

2006; Guay 1999; Park and Vrettos 2015; Rajgopal and Shevlin 2002; Tsui 2015). However, there are mixed theoretical predictions and empirical evidence on the effectiveness of equity incentives in inducing risk taking. On the one hand, equity incentives such as stock options may encourage executives to take risk that could potentially generate large increases in firm value so that they can benefit from such increases (John and John 1993; Smith and Stulz 1985; Rajgopal and Shevlin 2002). On the other hand, equity incentives increase managers' exposure to firm risk, and therefore provide managers with incentives to reduce such exposure by reducing firm risk or only taking on systematic risk that can be hedged with a market portfolio (Armstrong and Vashishtha 2012). Consequently, empirical evidence on the effect of equity incentives on executives' risk taking behavior is mixed and inconclusive. Our study complements prior literature by examining how performance targets in annual bonus plans affect executives' risk taking behaviors. This research question is particularly important given an increasing use of performance targets in executive compensation in the last decade (Bennett et al. 2017; Bettis, Bizjak, Coles, and Young 2014; Carter, Lynch, and Tuna 2007; Core and Packard 2017; Hayes, Lemmon, and Qiu 2012).[1]

We predict a U-shaped relation between CEOs' internal performance target difficulty and corporate risk taking. Specifically, when the target is very easy, managers are less concerned about the potential of missing performance targets and the significant costs associated with it, so they are more likely to choose riskier projects with higher expected payoffs. As target difficulty increases and the target becomes "tight", choosing risky projects would increase the likelihood of missing the target. Due to the significant costs associated with missing the target (e.g. job termination), safer investments become more desirable to managers. Finally, as target difficulty continues to increase and the target becomes extremely challenging, managers are more likely to

[1] 68 percent of the largest U.S. firms use explicit targets in executive compensation by 2012 (Bettis et al. 2014).

take on more risky projects because risky projects would be the only way to potentially achieve the target.

Prior studies on target setting have primarily used proprietary data, experimental or survey methods. One reason for this is the lack of archival data on internal performance targets. Such data became available only recently. In December 2006, the U.S. Securities and Exchange Commission started requiring public firms to disclose detailed executive compensation information including targets used in incentive contracts. Recent studies find that the use of performance targets has gained popularity over the last decade, with 68 percent of the largest U.S. firms specifying explicit performance standards in executive compensation by 2012 (Bettis et al. 2014). We utilize the recently available disclosure to examine the association between the difficulty level of CEOs' internal performance targets and corporate risk taking.

Our sample consists of 2,493 firm-year observations on the earnings per share (EPS) target specified in annual executive bonus plans of S&P 1500 firms. We focus on annual bonus plans because bonus plans represent the most prevalent form of compensation for different types of firms. Moreover, prior research suggests that, despite their smaller magnitude relative to equity compensation, earnings-based bonuses may actually provide a stronger source of incentives to executives because executives consider earnings to be more controllable than stock prices (Armstrong, Chau, Ittner, and Xiao 2017; Bushman and Smith 2001; Murphy and Jensen 2011). A recent paper by Guay, Kepler, and Tsui (2018) documents that the actual performance sensitivity of bonuses is more than ten times bigger than regression estimates documented in prior studies and that cash bonuses account for a substantial percentage of CEOs' total compensation for many CEOs early in their tenures.

In the main analysis, we use consensus analysts' annual EPS forecasts to proxy for the firm's expected performance and define *ex ante* target difficulty as the difference between the firm's EPS target and the consensus analysts' forecasts scaled by the absolute consensus analysts' forecasts. Thus, a higher value indicates higher target difficulty, while a lower or negative value indicates lower target difficulty. Following prior literature, we measure corporate risk taking with a firm's stock return volatility (e.g., Cadman, Campbell, and Klasa 2016; Guay 1999; Park and Vrettos 2015). Consistent with our prediction, we find a U-shaped relation between target difficulty and stock return volatility. Our results are economically significant. When performance targets are below analyst forecasts (i.e. when targets are relatively easy), a one standard deviation decrease in targets would increase stock return volatility by 7.5 percent; when performance targets are above analyst forecasts (i.e. when targets are relatively difficult), a one standard deviation increase in targets would increase stock return volatility by around 8.6 percent.

We recognize that using analyst EPS forecast as a proxy for expected earnings performance has its shortcomings. Analyst forecasts might not reflect the internal earnings expectation and might contain intentional biases either from analysts' conflict of interests or from managers' strategic guidance. To alleviate such concerns, we construct three alternative proxies for expected earnings: 1) management EPS forecasts, which better reflect internal earnings expectations, but are less commonly available and could reflect managers' strategic guidance to influence target setting; 2) model-based earnings forecast (Hou et al. 2012), which is free from potential intentional bias in analyst or management forecasts, but is not as timely in incorporating relevant information as analyst forecasts; and 3) actual (*ex post*) EPS, which can better capture actual internal earnings expectation when insiders have more accurate expectations than forecasts disclosed to external parties, but contains the effect of *ex post* business shocks. We use these alternative proxies of

earnings expectations to construct alternative measures of target difficulty. Our results are robust to these alternative measures of target difficulty.

Moreover, return volatility could reflect factors other than firm risk, such as market organization and trading processes (e.g., Hasbrouck 2007). To corroborate our main results, we also directly measure the key observable risk taking policies including R&D investment, acquisition activities, leverage, and segment concentration. In addition, we use volatility of financial performance measures (earnings and cash flow) as alternative measures of firm risk. Our results are largely robust to these alternative measures of risk taking.

We also document cross-sectional variations in the association between target difficulty and corporate risk taking. Specifically, we predict and find that the U-shaped relation between target difficulty and corporate risk taking is more pronounced when CEOs have less incentives from equity holdings. We also predict and find that the U-shaped relation between target difficulty and corporate risk taking is more pronounced when the CEO is less powerful because target achievement is more likely to influence the CEO's compensation and job turnover under such circumstances.

One potential alternative explanation for our results is that information uncertainty is positively associated with both return volatility and the larger difference between performance targets and analysts' forecasts (which we interpret as very easy or very challenging targets). We conduct additional analyses to rule out this alternative explanation.

It is worth noting that even though we focus on EPS targets used in annual cash bonus plans, earnings targets are also widely used in performance-based equity grants. According to Bettis, Bizjak, Coles, and Kalpathy (2016), 70 percent of large US firms granted performance vesting equity awards to top executives and around 50 percent of these equity awards were based

upon achieving absolute earnings performance targets. We observe from our sample that when earnings targets used in equity grants and cash bonus plans have the same evaluation horizon, 72 percent of the time the level of earnings target is identical between cash bonuses and equity grants. As a result, our findings could have similar implications for performance conditions associated with equity grants.

Our study makes two primary contributions to the accounting literature. First, we contribute to the growing stream of literature on the effect of targets on employee behavior and firm performance (e.g., Aranda et al. 2014; Armstrong et al. 2017; Arnold and Artz 2015; Casas-Arce, Holzhacker, Mahlendorf, and Matějka forthcoming; Indjejikian et al. 2014; Ioannou, Li, and Serafeim 2016; Matějka and Ray 2017) by providing the first large sample archival examination of the effect of target difficulty on corporate risk taking. Prior literature on target setting and target difficulty has primarily focused on the effects of targets on effort-related agency problems. We complement this literature by shedding light on the effects of targets on risk-related agency problems.

Second, we also contribute to the literature on executive compensation and corporate risk taking (e.g., Armstrong and Vashishtha 2012; Laux and Ray 2017; Park and Vrettos 2015; Tsui 2015). Prior literature has focused almost exclusively on the impact of executives' equity holdings (stocks or options) on risk taking. However, since FAS 123R became effective in 2005, the granting of stock options has diminished, while the use of performance conditions in executive compensation has become more prevalent. By documenting the U-shaped relation between CEOs' performance target difficulty and corporate risk taking and showing that this relation is stronger when CEOs have less equity holdings, our study contributes to a more complete understanding of the effect of executive compensation on corporate risk taking.

The remainder of this paper is organized as follows. Section 2 discusses prior literature and develops the hypothesis. Section 3 describes the sample, variable measurement, and research design. Section 4 presents the results and Section 5 concludes.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Background and Literature Review

2.1.1. Target Difficulty and Performance

Targets exist in most business organizations (Merchant and Van der Stede 2012; Indjejikian et al. 2014) and serve multiple roles simultaneously, including planning, motivation, and performance evaluation (Arnold and Artz 2016). There are conflicts between these different roles of targets such that the optimal level of target difficulty may vary with the specific role. For example, for planning purposes, targets should be set at a realistic level and reflect the expected performance so that resources can be allocated most efficiently. However, for motivation purposes, targets should be set as challenging but achievable to induce optimal effort (Merchant and Manzoni 1989). To give another example, for motivation purposes, targets should not be adjusted ex post for the impact of external circumstances, but for performance evaluation purposes, targets need to consider adjusting for the effects of uncontrollable events (Indjejikian et al. 2014). Recent survey evidence based on a large number of controllers suggests that although theory might suggest that firms should use different targets for different roles, most firms just use a single target for these different roles (Arnold and Artz 2016). To arrive at this single target, firms have to weigh the importance of the different roles and make trade-offs between the different roles. Therefore, the level of the performance target often reflects a compromised realization of different "ideal targets" serving the different roles discussed above.

One of the most important features of targets is the level of target difficulty (Locke and Latham 2002). Prior literature has primarily focused on the impact of target difficulty on *effort*-related agency problems (e.g., Bonner et al. 2000; Fisher et al. 2002). Prior literature provides competing theoretical arguments and mixed evidence on the association between target difficulty and effort. On the one hand, prior literature on target setting suggests that difficult but achievable targets maximize the motivational effect and induce greater levels of effort. In particular, agency theorists argue that easy targets can be the outcome of agency problems, where agents build in slack to extract more rent from the organization (Jensen and Meckling 1976). In line with the rent extraction concern related to target setting, a large stream of accounting literature on budgeting and target-setting focuses on how to design management control systems to elicit truthful budgets and hence increase target difficulty (e.g., Chow, Cooper, and Waller 1988; Shields and Young 1993). On the other hand, researchers argue that targets that are too challenging are less likely to be achieved and may reduce employee effort (Arnold and Artz 2015).

Despite the large literature on the effect of target difficulty on *effort*-related agency problems, there has been little research on the effect of target difficulty on *risk*-related agency problems. One exception is Sprinkle et al. (2008), which predict a U-shaped relation between target difficulty and individual risk taking. However, Sprinkle et al. (2008) did not explicitly test the impact of very challenging targets on risk taking. Also, Sprinkle et al. (2008) use student participants in their experiment, while we examine the effect of CEOs' performance goals on their risk taking behaviors. Because CEOs of larger corporations face compensation schemes, utility functions, and risk taking decisions dramatically different from those faced by participants in experiments, it is unclear *ex ante* whether the conclusions on the relation between target difficulty and individual effort and risk taking from Sprinkle et al. (2008) would apply to our research setting.

To address this gap in the literature, our paper focuses on the impact of target difficulty on risk taking.

2.1.2. Performance Targets in Executive Compensation

Over the past decade, we observe a significant increase in the use of performance targets in executive compensations (Bettis et al. 2014; Carter et al. 2007; Core and Packard 2017; Hayes, Lemmon, and Qiu 2012). These changes are likely triggered by FAS 123R (effective in 2005), which requires options to be expensed at grant date fair values, as opposed to intrinsic values, and at the same time eliminates varying expenses associated with performance vesting awards. The growing use of performance targets in executive compensation contracts is also likely due to investors' increasing demand for greater transparency of pay for performance standards in executive compensation. Because the performance target reflects the board of directors' expectations of the manager's performance and missing the performance target is likely to result in significant career and reputational losses for the manager, the performance target represents a convex point in managers' utility-performance function (Bennett et al. 2017).[2]

In 2006, the SEC increased mandatory requirement on the disclosure of executive compensation, including disclosures on performance targets used in the top five named executives' compensation contracts. Using publicly available disclosures on executive compensation, recent research documents a significant increase in the use of performance-vesting provisions in large U.S. firms. Bettis et al. (2014) examine the 750 largest public firms in the U.S. and find that firms using performance conditions increased from 21 percent in 1998 to 68 percent in 2012.

[2] In addition to performance targets, there are often two other performance goals in executive compensation: 1) threshold, i.e. the minimum level of performance required to receive any cash bonus; and 2) maximum, i.e., the maximum level of performance to receive any additional bonus. We note that the levels of threshold and maximum goals are highly correlated with performance targets, i.e., more challenging performance targets are also associated with more challenging threshold and maximum goals. Furthermore, it would be challenging to develop empirical proxies for the lowest or the highest possible performance outcomes, so it would be challenging to measure target difficulty in the threshold and the maximum. Therefore, we focus on the performance target in our study.

Performance conditions are not only set for annual cash bonuses, but also for long-term equity and cash grants. Also, both accounting and stock performance measures are used as performance metrics. According to Bettis et al. (2014), accounting measures have gained popularity in recent years. By 2012, 85.6 percent of U.S. public firms used at least one accounting-based measure in performance pay, while the use of price-based measures fell slightly over the same period. Despite the increasing significance of performance targets in executive compensation in recent years, their impact on corporate risk taking is largely unknown. Our study aims to fill this void.

2.2. Hypothesis Development

We predict a U-shaped relationship between the difficulty level of internal performance targets and corporate risk taking. We discuss the rationale behind our prediction below.

First, we predict that a very easy target will lead to greater corporate risk taking. This is because when the target is very easy, managers are less concerned about the potential of missing performance targets and the significant costs associated with missing the target, so they are more likely to choose riskier projects with higher expected payoffs. Prior research suggests that easier targets could provide managers an environment to safely experiment with new strategies and to flexibly respond to changes in the operating conditions, and therefore result in greater risk taking and innovation (Bourgeois 1981; Cyert and March 1963; Dunk 1995). Prior research in accounting provides some support for this prediction. For example, prior accounting studies on budgetary slack using case studies or surveys suggest that in uncertain settings with multiple financial and non-financial objectives, easing budget goals can encourage managers to dedicate more effort to nonfinancial objectives such as customer focus and product quality and engage in more innovation and experimentation (Davila and Wouters 2005; Lillis 2002; Van Der Stede 2000).[3] Sprinkle et al.

[3] While budgetary slack in the accounting literature is related to target difficulty in our study, we note a distinct literature on slack in the management literature. *Slack* (sometimes labelled "*organizational slack*") refers to "the

(2008)'s experimental study find that easier performance target leads to higher level of risk taking. Using a proprietary dataset from a Chinese firm, Li (2017) finds that easier time budgets for lower-level employees are positively associated with innovations generated by these employees.

Second, as target difficulty increases and the target becomes "tight", choosing risky projects significantly increases the likelihood of missing the target and therefore safer investments become more desirable to managers. This is a classic example of risk-related agency problems, where risk-averse and undiversified managers reject positive net present value projects that are too risky (Guay 1999; Smith and Stulz 1985).

Finally, when the target becomes very challenging, managers are forced to take on more risky projects because safer projects, even executed perfectly, would not enable the managers to achieve the target. Prior research in the management literature has shed some light on this prediction. For example, Singh (1986)'s theoretical model predicts that when performance is below satisficing level, organizations are likely to take more risk. There is some empirical evidence consistent with this prediction. For example, Deephouse and Wiseman (2000) find that when firms' expected performance levels are below the target, managers attempt to increase the expected performance to the target level by making riskier operational decisions. Similarly, Díez-Esteban, García-Gómez, López-Iturriaga, and Santamaría-Mariscal (2017) use data from a sample of international listed firms from 2001 to 2013 to show that firms adopt a more risk-seeking attitude when the expected stock market performance is below target. In the accounting literature, Ioannou et al. (2016) use data on carbon emissions to document that target difficulty is more effective for

pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output" (Nohria and Gulati 1996: 1246). Examples of slack include redundant employees, idle capacity, and excess financial resources. Regarding the link between slack and risk taking, both the theoretical prediction and empirical evidence are mixed (Bourgeois 1981; Cyert and March 1963; Dunk 1995; Nohria and Gulati 1996). We consider this literature distinct from our study because slack defined in this literature focuses on the resources available rather than the difficulty level of targets.

projects that require more novel knowledge and innovation (e.g. process efficiency and low carbon energy) than for projects that require large monetary investment but less innovation (e.g. transportation and building). This is consistent with the argument that more challenging targets are more likely to induce risk taking and experimentation (Wood and Locke 1990). The above discussion leads to the following hypothesis.

Hypothesis: *The relationship between target difficulty and corporate risk taking is U-shaped such that firms will exhibit higher levels of risk taking when the target is very easy or very difficult and lower levels of risk taking when target difficulty is medium.*

3. SAMPLE, VARIABLE MEASUREMENT, AND RESEARCH DESIGN

3.1. Sample Selection

Our sample period begins in 2006, which is the first year of mandatory disclosure of performance targets used in executive compensation for public firms. Our sample period ends in 2015. Our sample consists of firms that use "Earnings per Share (EPS)" as a performance measure in their CEOs' annual bonus plans. We focus on EPS instead of other earnings-based metrics such as operating earnings or earnings growth because 1) EPS is the most commonly used performance measure in bonus plans (Bennett et al. 2017) and 2) definitions of other earnings metrics are often vague and inconsistent with earnings definitions used in analysts' or management EPS forecasts, making it empirically challenging to measure target difficulty. We focus on annual cash bonus plans because EPS is used less frequently in equity grants, which are not granted on an annual basis.

To obtain data on EPS target, we start with S&P 1500 firms in the ExecuComp database and collect EPS targets used in cash bonus plans of CEOs from Incentive Lab. For S&P 1500 firms that are not covered by Incentive Lab, we hand collect EPS targets from firms' proxy statements. To construct our measure for risk taking and control variables, we collect data from CRSP,

Compustat, I/B/E/S, and Thompson Reuters institutional (13f) holdings. Our final sample consists of 2,493 firm-year observations, representing 539 unique firms. Appendix A provides details about our sample selection procedures.

3.2. Variable Measurement

3.2.1. Target Difficulty

The independent variable in our study is *ex ante* EPS target difficulty. This measure intends to capture the deviation of performance targets from expected performance levels. EPS is the most important performance measure for executives (Graham et al. 2005) and is also one of the most commonly used performance measures in CEOs' annual bonus contracts (Bennett et al. 2017). We use analysts' EPS forecasts as our main proxy for firms' expected EPS performance because they have been shown to predict actual EPS performance better than time-series models (e.g., O'brien 1988) and the majority of S&P 1500 firms are covered by analysts. We measure target difficulty (*TGDIF*) by calculating the difference between a firm's EPS target for executives' annual bonus contracts and analysts' consensus forecasts. Specifically, we subtract mean consensus analysts' forecast for year t (*MEANEST*) measured in the third month of year t from the EPS target in the bonus plan for year t (*TARGET*), which is determined by the compensation committee during the first quarter of year t. Thus, a higher value indicates higher target difficulty, whereas a lower or negative value indicates lower target difficulty. We then scale the value using the absolute value of the mean consensus analysts' forecast. To test our hypothesized U-shaped relation between target difficulty and corporate risk taking, we include a squared term of target difficulty in our main regression. Specifically, we regress our proxy of corporate risk taking behavior on a linear and squared term of target difficulty and expect a negative coefficient for the linear term (*TGDIF*) and a positive coefficient for the squared term ($TGDIF^2$).

We also recognize that using analyst EPS forecasts as a proxy for expected earnings performance has its shortcomings. Analysts' forecasts might not reflect managers' earnings expectations and might contain intentional biases either from analysts' conflict of interests or from managers' strategic guidance. To alleviate such concerns, we construct three alternative proxies for expected earnings. First, we use management EPS forecasts, which better reflect internal earnings expectation, but are less commonly available and could reflect managers' strategic guidance to influence target setting. Second, we use a model-based earnings forecast, which is free from potential intentional bias in analysts' or management forecasts, but does not incorporate information as timely as analysts' forecasts. In constructing the model-based earnings forecast, we employ the cross-sectional prediction model developed by Hou, van Dijk, and Zhang (2012) and follow Easton, Kelly, and Neuhierl (2017) to estimate a median regression of this prediction model.[4] Third, we use actual (*ex post*) EPS, which contains ex post business shocks, but may better capture internal earnings expectation if ex post shocks are random in our sample.

One potential concern with using target difficulty in annual bonus plans to examine risk-taking is that the outcomes of risk-taking decisions often take longer than one year to be realized, so such decisions may not have an immediate impact on a CEO's bonus for the current year. We note, however, prior literature provides robust evidence that target difficulty in annual bonuses is positively serially correlated, i.e. targets remain relatively easy (or difficult) through time (Indjejikian et al. 2014), representing a long-term compensation policy. We confirm such persistence in target difficulty in our sample.[5] As a result, target difficulty in annual bonus plans

[4] Easton et al. (2017) show that median regression generates better forecasts compared to random walk forecasts, whereas OLS regression does not perform better than random walk forecasts.

[5] Specifically, for firms with targets in the least difficult (i.e. easiest) quintile in the current year, 38 percent of them will continue to have targets in the least difficult quintile in the following year and 23 percent of them will have targets in the second least difficult quintile in the following year. Similarly, for firms with targets in the most difficult quintile in the current year, 43 percent of them will continue to have targets in the most difficult quintile in

actually captures managers' expected target difficulty not just for the current year but also for the longer-term.

3.2.2. Corporate Risk Taking

Risk taking is an integral part of most managerial decisions, from investment, financing decisions to operating activities. Some of these activities, such as R&D, leverage, and segment concentration, are observable. However, many activities that are critical to risk taking, such as project selection, are unobservable. Therefore, following prior literature (e.g., Coles et al. 2006; Guay 1999; Park and Vrettos 2015), we use return volatility as a comprehensive measure of the outcome of corporate risk taking, where higher return volatility reflects a higher level of corporate risk taking. Following prior studies, we compute return volatility using daily stock returns and measure the annual return volatility by taking the average of the monthly variances over a 12-month window, where the first month is defined as nine months prior to the end of fiscal year t and the last month is defined as three months after the end of fiscal year t. Lastly, we take the natural logarithm of the annual return volatility and use this as our dependent variable (*RETVOL*). Figure 1 depicts the timeline of our study. As shown in Figure 1, the measure of *ex ante* target difficulty reflects information in the first quarter of fiscal year t, which precedes the measure of *RETVOL*. While we cannot observe when exactly managers make risk-relevant decisions, such timing alignment increases the likelihood that managers have full knowledge of target difficulty before making risk-relevant decisions.

(Figure 1)

Return volatility could be determined by factors other than corporate risking, such as market organization and trading processes (e.g., Hasbrouck 2007). To corroborate results using

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the following year and 18 percent of them will have targets in the second most difficult quintile in the following year.

return volatility, we also analyze the effect of target difficulty on some of the key observable aspects of risk taking policies including R&D investment, merger and acquisitions, segment concentration, and leverage. Moreover, we use the volatility of financial performance measures (i.e., quarterly earnings and quarterly operating cash flows) over a three-year window starting from the current fiscal year as alternative measures of risk taking. These two measures capture the consequences of corporate risk taking directly through financial performance without potential complications of noise in stock returns. However, compared with return volatility, standard deviation of earnings or cash flows only reflect volatility in recognized accounting performance, and hence fail to account for any impact of risk taking activities that have not been recognized in accounting or cash performance. In addition, the reporting of financial performance is less frequent compared with that of stock returns and thus might include larger measurement errors.

3.3. Research Design

We estimate the following regression model to examine the relation between target difficulty and corporate risk taking:

$$RETVOL_{i,t} = \alpha_0 + \alpha_1 TGDIF_{i,t} + \alpha_2 TGDIF^2_{i,t} + \alpha_3 SIZE_{i,t} + \alpha_4 AGE_{i,t-1} + \alpha_5 BTM_{i,t-1} + \alpha_6 TENURE_{i,t} + \alpha_7 CASHCOMP_{i,t-1} + \alpha_8 DELTA_{i,t-1} + \alpha_9 VEGA_{i,t-1} + \alpha_{10} TERMPYMT_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

Subscripts *i* and *t* denote firm *i* and fiscal year *t*. *TGDIF* is the value of a firm's target difficulty which we measure by subtracting the mean consensus analysts' one-year-ahead EPS forecast from the EPS target, and $TGDIF^2$ corresponds to the squared value of *TGDIF*.

Our hypothesis posits a nonlinear relation between target difficulty and corporate risk taking. Thus we predict that $\alpha_1<0$ and $\alpha_2>0$, such that corporate risk taking is higher for firms that either have very difficult or very easy targets compared to targets of medium difficulty.

In model (1), we follow prior literature (Cadman et al. 2016; Coles et al. 2006; Guay 1999) to control for other factors that might influence risk-taking: firm size (*SIZE*), firm age (*AGE*), growth opportunities (*BTM*), CEO tenure (*TENURE*), cash compensation for the CEO (*CASHCOMP*), the sensitivity of the CEO's equity and option holdings to stock return (*DELTA*), the sensitivity of the CEO's equity and option holdings to stock return volatility (*VEGA*), and the CEO's severance payment (*TERMPYMT*). We estimate our models using ordinary least squares (OLS) and include year-fixed effects and industry-fixed effects based on the 2-digit SIC code. We cluster standard errors by firms (Petersen 2009). To mitigate the influence of outliers, we winsorize all of our continuous variables at the 2nd and 98th percentile.

4. RESULTS

4.1. Descriptive Statistics

Table 1 presents the summary statistics for the main and control variables. The mean and median target difficulty (*TGDIF*) in the sample are 0.16 percent and -0.73 percent respectively. Untabulated results show that 927 firm-year observations have positive *TGDIF* values (*ex ante* difficult target), and 1,426 firm-year observations have negative *TGDIF* values *(ex ante* easy target). The mean value of log return volatility (*RETVOL*) in our sample is -4.791, which corresponds to raw return volatility of 0.8 percent. All the control variables have distributions that are similar to those reported in prior research (Cadman et al. 2016; Coles et al. 2006). Moreover, in untabulated results, we find that cash compensation is a significant component of the total compensation in our sample firms. Specifically, annual cash compensation (bonus) comprises about 46 percent (23 percent) of total annual compensation of CEOs in our sample.

(Table 1)

Table 2 presents the Pearson and Spearman correlations of these variables. While there is a significantly positive association between *TGDIF* and *RETVOL*, this positive association may mask a nonlinear relation between them. To explore this possibility, we plot the level of *RETVOL* against the level of *TGDIF* in Figure 2. Consistent with our prediction, the plot shows a U-shaped relation between target difficulty and firm risk. Specifically, return volatility is the highest at both ends of the decile ranking of target difficulty and the lowest at the medium level of target difficulty.

(Table 2)

(Figure 2)

4.2. Test of Hypothesis

Table 3, Column (1) presents the results of estimating regression model (1). Consistent with our prediction and the observation in Figure 2, we find a U-shaped relation between target difficulty and corporate risk taking measured by stock return volatility. Specifically, we find a significantly negative coefficient on the linear term *TGDIF* and a significantly positive coefficient on $TGDIF^2$. These results provide support for our hypothesis. Our results are also economically significant. Specifically, in untabulated findings we find that when performance targets are above analyst forecasts, a one standard deviation increase in targets would lead raw stock return volatility to increase by around 8.6 percent; when performance targets are below analyst forecasts, a one standard deviation decrease in targets would lead raw stock return volatility to increase by around 7.5 percent.

We find that the signs and magnitudes of the coefficients of our control variables are generally consistent with the results from prior research (Cadman et al. 2016; Coles et al. 2006). Specifically, book-to-market and expected payments in event of involuntary termination are positively associated with *RETVOL*, while firm age and firm size is negatively associated with

RETVOL. We do not find a significant relation between *RETVOL* and the CEO's wealth sensitivity to stock volatility (*VEGA*). This is consistent with the results of studies that examine more recent periods in which *VEGA* shows a negative or insignificant coefficient (Anderson and Core forthcoming; Yost forthcoming). We also find a positive but insignificant coefficient on *DELTA*, consistent with the findings in Yost (forthcoming).

In column (2) of Table 3, we replace year fixed effects and industry fixed effects in column (1) with industry-year interaction fixed effects to address concerns of time-varying industry risk. In Column (2), the U-shaped relation between target difficulty and stock return volatility remains significant, suggesting that this U-shaped relation is not a manifestation of time-varying industry characteristics.

(Table 3)

4.3. Alternative Measures of Target Difficulty

In this section, we test our hypothesis using three alternative measures of target difficulty. Our first alternative measure of target difficulty is the difference between the firm's EPS target and management one-year-head EPS forecast ($TGDIF_{mf}$). Our second alternative measure of target difficulty is the difference between the firm's EPS target and model-based EPS forecast ($TGDIF_{hvz}$). Our third alternative measure of target difficulty is the difference between the firm's EPS target and *ex post* realized EPS (*TGDEV*). Panel A of Table 4 presents the correlations of these alternative measures of target difficulty. As shown in Panel A of Table 4, our main measure of target difficulty *TGDIF* has the highest correlation with the *ex post* target difficulty measure *TGDEV*, providing support for our use of analyst forecasts as the primary benchmark to measure target difficulty.

Panel B of Table 4 shows that our main results of a U-shaped relation between target difficulty and corporate risk taking are robust to all three alternative measures of target difficulty. Although none of the four measures of target difficulty capture target difficulty without error, finding consistent results across four complementary proxies increases our confidence in the U-shaped relation between target difficulty and corporate risk taking.

(Table 4)

4.4. Alternative Measures of Corporate Risk Taking

In the main analyses, we use stock return volatility as a comprehensive measure to capture both observable and unobservable forms of corporate risk taking. In this section, we test our hypothesis using specific, observable measures of risk taking policies. Following Coles et al. (2006), we use greater R&D investment, higher segment concentration, and higher leverage as proxies for a higher level of corporate risk taking. We also examine acquisition activities as a proxy for corporate risk taking. As diversifying acquisitions are more likely to reduce firm risk (Cadman et al. 2016; Gormley and Matsa 2016), we examine whether firms with more difficult or easy targets are more likely to acquire firms in the same 2-digit SIC industry and less likely to acquire firms in a different 2-digit SIC industry. *SIC2M&A* is an indicator variable equal to 1 if the firm acquired a target in its 2-digit SIC industry and 0 otherwise, and *M&A* is an indicator variable equal to 1 if the firm acquired a target not in its 2-digit SIC industry and 0 otherwise.

Panel A of Table 5 reports results using these four specific risk taking measures. Consistent with our hypothesis, R&D is significantly higher and firms are less likely to make diversifying acquisitions when target difficulty is either very high or low. Although the signs of the rest of the coefficients on target difficulty are generally consistent with our prediction, they are not

statistically significant. Overall, direct measures of firms' investment behaviors provide some evidence consistent with our hypothesis.

In addition, we use the volatility of financial performance measures (i.e., quarterly earnings and quarterly operating cash flows) over a three-year window starting from the current fiscal year as alternative measures of corporate risk taking. Panel B of Table 5 reports results using these alternative measures of corporate risk taking. Consistent with our main results using return volatility, we also document a significant U-shaped relation between target difficulty and earnings (cash flow) volatility.

(Table 5)

4.5. Cross-Sectional Variations in the Relation between Target Difficulty and Corporate Risk Taking

To provide further support for our hypothesis, we examine cross-sectional variations in the relation between target difficulty and risk taking in this section. If target difficulty affects corporate risk taking behavior, we expect such impact to vary with CEOs' incentive from stock holdings and CEO power. We discuss each analysis below.

First, we expect the U-shaped relation between the difficulty of CEOs' performance targets in cash bonuses and risk taking to be more pronounced when CEOs' equity incentives are weaker. To the extent that executives with large equity holdings have motives to increase shareholders' wealth by taking the optimal level of risk, large equity holdings may mitigate the impact of performance targets associated with annual cash bonuses on risk taking incentives. We measure CEOs' equity incentives with "Delta" (i.e., the sensitivity of the CEO's stock and option portfolio value to stock return).

Furthermore, we expect the relation between target difficulty and risk taking to be more pronounced when the CEO is less powerful. When the CEO is more powerful, missing the performance targets in cash bonuses is less likely to result in CEO turnover and thus the impact of performance targets on CEO behavior would be attenuated. We measure CEO power as CEO duality (i.e. whether the CEO also serves as chairman of the Board).

Results presented in Table 6 are consistent with our expectations. In particular, we find that the U-shaped relation between target difficulty and risk taking is more pronounced when the CEO has less equity incentives and when CEO is less powerful. These results provide further support for our hypothesis.

(Table 6)

4.6. Ruling out Information Uncertainty as an Alternative Explanation

One potential alternative explanation for the U-shaped relation between target difficulty and corporate risk taking we document above is that both return volatility and the magnitude of the gap between performance targets and analysts' forecasts are influenced by information uncertainty. We conduct the following tests to rule out this potential alternative explanation.

First, we control for information uncertainty with five different measures, including lagged return volatility, analysts' forecast dispersion, *ex post* absolute error in the consensus analysts' forecasts, management forecast range, and *ex post* absolute errors in management forecasts. Results summarized in Table 7 Panel A show that after controlling for information uncertainty proxies in regression (1), the U-shaped relation between target difficulty and return volatility remains significant. These results suggest that our results are unlikely to be explained by information uncertainty.

Furthermore, we conduct partition analyses based on the level of information uncertainty. If our results were driven by the correlation between target difficulty and information uncertainty, our results would be more pronounced in the subsample with larger variations in information uncertainty because our measure of target difficulty would be more likely to capture information uncertainty in this subsample. We use the level of information uncertainty to proxy for variations in information uncertainty and partition our sample based on the level of information uncertainty.[6] Results presented in Panel B of Table 7 show that, contrary to this alternative explanation, the association between target difficulty and firm risk actually becomes weaker in the subsample with higher information uncertainty.

Collectively, results in Table 7 suggest that our results are unlikely to be driven by information uncertainty.

(Table 7)

4.7. Addressing Sample Selection Bias

Our sample consists of firm years where EPS targets are included in bonus plans and disclosed in proxy statements (see Appendix A). It is likely that the use and disclosure of EPS targets are nonrandom and our analyses might suffer from selection bias. In this section, we conduct analyses to address potential selection bias.

First, to alleviate concerns of the potential selection bias resulting from the use of EPS in cash bonus plans, we use a Heckman two-stage method (Wooldridge 2010). In the first stage, we estimate a Probit model for the use of EPS as a performance measure in cash bonus plans (i.e. *EPSUSER*=1) on the ExecuComp population. *EPSUSER* equals 1 when the firm uses EPS in the CEO's cash bonus plans, and 0 otherwise. We follow Kim and Ng (2018) and include percentage

[6] We confirm in our sample that the level of information uncertainty is positively correlated with the cross-sectional variation in information uncertainty.

of institutional ownership (*PCTMGR*), percentage of transient institutional ownership (*PCTTRA*), natural logarithm of the number of business segments (*LOGSEG*), percentage of female directors (*PCTFEM*), percentage of independent directors (*BOARDINDEP*), dividend yield (*DIVYLD*), fair value of restricted stock awards (*RESAWARDFV*), fair value of option awards (*OPTIONFV*), R&D expenditures (*R&D*), effective tax rate (*ETR*), and number of analysts following the firm (*ANCOV*) as explanatory variables in the Probit model. We also include all other control variables used in equation (1) in the Probit model. In the second stage, we obtain an inverse mills ratio (*IMR*) from the first stage Probit model and add it as another control variable in our main regression model (1). The results of the second stage regression are presented in Panel B of Table 8. We again find a significant nonlinear relation between target difficulty and corporate risk taking, similar to the results reported in Table 3, suggesting that our findings are not driven by a firm's choice of using EPS in cash bonus plans.

(Table 8)

Second, we examine whether our results are driven by the selection bias resulting from firms' selective disclosure of internal targets in the proxy statement. Although the new disclosure rule requires firms to disclose in detail the performance measures used in their incentive plans, firms may choose not to disclose such information if the disclosure would result in competitive harm to the firm (Chen, Matsumura, Shin, and Wu 2015). To control for such selection bias, we again apply the Heckman two-stage regression. In the first stage, we estimate a Probit model of the disclosure choice (*TGDISCLOSER*=1) on the sample of firms using EPS in the cash bonus plan. *TGDISCLOSER* is an indicator variable that equals 1 when the firm uses EPS targets in the cash bonus plan *and* discloses the EPS targets in the proxy statement, and 0 otherwise. In this Probit model, we include all control variables used in regression model (1) and the variables used in

Robinson, Xue, and Yu (2011) to explain the selective disclosure in proxy statements. These variables include excess compensation (*EXCESSCOMP),* expected compensation (*EXPECTCOMP),* the extent of product differentiation (*PRODDIFF*), the market size of the firm's industry (*MKTSIZE*), the market entry cost of the firm's industry (*ENTCOST*), the length of the proxy statement (*LPRXY*), and the annual buy-and-hold return (*RET*). Furthermore, to control for the possibility of actual performance affecting the decision to disclose internal targets, we additionally add negative analysts' forecast errors (*AFE_NG)* and positive analysts' forecast errors (*AFE_PS*) as explanatory variables in the first stage Probit model. In the second stage, we add the inverse mills ratio (*IMR*) generated from the first stage model as an additional control variable in regression model (1). The results of the second stage regression are presented in Panel B of Table 9. We find that our inferences remain unchanged after controlling for the selective disclosure of performance targets in the proxy statements.

(Table 9)

4.9. Additional Robustness Checks

We conduct three additional tests to assess the robustness of the U-Shaped relation between target difficulty and risk-taking.

First, we examine an alternative specification of the U-shaped relation. Specifically, we rank target difficulty into quintiles for each year. We define the top quintile as the most difficult target and the bottom quintile as the easiest target and replace *TGDIF* and $TGDIF^2$ with the top quintile and bottom quintile dummies in regression model (1). We find that firms in the top and bottom quintiles have significantly larger *RETVOL* than those in the middle three quintiles of target difficulty. These results are consistent with our main results in Table 3.

Second, in another alternative specification of the U-shaped relation, we replace *TGDIF* and a squared term of *TGDIF* (*TGDIF***TGDIF*) with *TGDIF_PS* and *TGDIF_NG* in regression model (1). *TGDIF_PS* equals *TGDIF* when *TGDIF* is positive and 0 otherwise. Similarly, *TGDIF_NG* equals *TGDIF* when *TGDIF* is negative and 0 otherwise. Thus, *TGDIF_PS* and *TGDIF_NG* capture the extent of target difficulty when the target is higher (lower) than the earnings expectations. We find a significantly positive coefficient on *TGDIF_PS* and a significantly negative coefficient on *TGDIF_NG*, supporting the U-shaped relation we document in Table 3. The rest of our results also remain robust to this alternative specification of the U-shaped relation.

Third, we examine the sensitivity of our findings to the timing of consensus analysts' forecasts. In Table 3, we compare EPS targets in bonus plans with the mean consensus analysts' forecasts calculated in the third month of fiscal year t. In untabulated results, we use the consensus forecasts in the first month or the second month of fiscal year t to calculate our target difficulty measure. Our results remain largely unchanged when we use these alternative timing of consensus analysts′ forecasts in our target difficulty measure.

5. CONCLUSION

This study empirically examines the relation between target difficulty and corporate risk taking. We predict a U-shaped relation between target difficulty and corporate risk taking, i.e. firms are likely to have higher levels of risk taking when targets are very easy or very difficult and lower level of risk taking when target difficulty is medium. We use recently available data on performance targets in executives' annual bonus contracts in 2,493 firm-year observations to test our hypothesis. We measure target difficulty as the difference between a firm's EPS target in cash bonus plans and the consensus analysts' forecast, scaled by the consensus, and we measure

corporate risk taking with stock return volatility. Our results are consistent with our prediction and are robust to alternative measures of target difficulty, alternative measures of risk taking, and alternative regression specifications.

We contribute to the literature on how target difficulty affects manager and employee behaviors by providing the first archival examination of the relation between target difficulty and corporate risk taking. In addition, we also contribute to the literature on corporate risk taking. Prior studies have largely focused on the impact of equity incentives on executives' risk taking decisions. Our study complements these studies by documenting the impact of target difficulty in annual bonus plans on risk taking.

Limitations of our study provide opportunities for future research. While we conduct robustness tests to mitigate endogeneity concerns by controlling for industry and firm fixed effects and controlling for information uncertainty, we cannot completely rule out all potential endogeneity issues.

We focus on bonus contracts because bonus plans represent the most prevalent form of compensation for different types of firms and researchers argue that earnings-based bonuses may provide a stronger source of incentives to executives than equity incentives despite their smaller magnitude because executives consider earnings to be more controllable than stock prices and care about their reputation based on whether they meet the targets in the bonus plans (Armstrong et al. 2017; Bennett et al. 2017; Bushman and Smith 2001; Murphy and Jensen 2011). Because the non-cash portion of executive compensation accounts for a significant percentage of total executive compensation, future research can examine the impact of target difficulty in the non-cash portion of executive compensation on corporate risk taking. Finally, we only examine annual bonus plans for CEOs. Theory of our research should also generalize to other executives and non-executive

employees. Future research can examine whether the results of our study generalize to the other types of employees.

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Appendix A

Sample Selection

	Obs. (*n*)
Unique firm-year observations from the intersection of COMPUSTAT and ExecuComp that satisfy the following data requirements: non-financial (SIC 6000–6999) firms; fiscal years ending after December 15, 2006, and before March 31, 2016; non-missing values for return volatility (RETVOL).	14,520
Require non-missing values for variables used to explain firm risk in prior studies, including BTM_{t-1}, AGE_{t-1}, $CASHCOMP_{t-1}$, TENURE, $DELTA_{t-1}$, SIZE, $VEGA_{t-1}$, and $TERMPYMT_{t-1}$.	13,352
Require non-missing consensus analyst EPS forecasts at the end of the first quarter of the fiscal year	13,031
Require the use of EPS as a performance metric for CEO in the annual cash bonus plan	2,946
Require the disclosure of EPS target level in the annual cash bonus plan	**2,493**
	Unique firms = 539

Appendix B

Variable Definitions

Variable*	Definition
Dependent variables of interest	
RETVOL	Volatility of daily stock return for the 12-month window starting from the fourth month of the fiscal year. A minimum of 120 trading days is required.
M&A	An indicator variable equal to 1 if the firm acquired a target not within the same 2-digit SIC industry, 0 otherwise.
SIC2M&A	An indicator variable equal to 1 if the firm acquired a target within the same 2-digit SIC industry, 0 otherwise.
LEVERAGE	Leverage ratio is defined as book value of debt divided by market value of assets, which is defined as book value of total assets minus book value of common equity plus market value of common equity.
R&D	R&D expenditures (Compustat XRD) divided by the absolute value of gross profit.
SEGHHI	The concentration of segment revenue is defined as the sum of the squared segment revenue ratio, segment revenue divided by firm-wide revenue, of all business segments.
STDCFO	Volatility of quarterly operating cash flows, scaled by total assets, for 3-year window starting from the current fiscal year.
STDROA	Volatility of quarterly net income, scaled by total assets, for 3-year window starting from the current fiscal year.
Independent variables of interest and their components	
ACTUAL	Actual EPS used to determine cash bonus of the fiscal year, which is hand-collected from the proxy statements.
HVZEST	EPS forecast estimated using Hou, Van Dijk, and Zhang (2012) methodology. The forecasting model is estimated on the Execucomp sample and using median regression (Easton, Kelley, and Neuhierl 2017).
MEANEST	Consensus analysts' one-year ahead mean EPS forecast made at the end of first quarter of fiscal year.
MF	Management one-year ahead EPS forecast announced by the end of first quarter of fiscal year.
TARGET	EPS target used to determine cash bonus of the fiscal year, which is set by the end of first quarter.
TGDEV	TARGET – ACTUAL, scaled by the absolute value of ACTUAL.
TGDIF	TARGET – MEANEST, scaled by the absolute value of MEANEST.
$TGDIF_{mf}$	TARGET – MF, scaled by the absolute value of MF.
$TGDIF_{hvz}$	TARGET – HVZEST, scaled by the absolute value of HVZEST.
Control variables in the main regression	
SIZE	Natural logarithm of market value of equity at end of first quarter.
AGE	Natural logarithm of firm age.
BTM	Book value of equity divided by the market value of equity at end of fiscal year.
TENURE	Natural logarithm of the CEO's tenure.
CASHCOMP	Natural logarithm of one plus the CEO's cash compensation (ExecuComp Salary + Bonus + Non-equity incentives).

DELTA	Natural logarithm of one plus the change in dollar value of the CEO's equity/option portfolio associated with a 1 percent change in the firm's stock price, estimated using Core and Guay (2002) and Coles et al. (2006) methodology.
VEGA	Natural logarithm of one plus the change in the dollar value of the CEO's equity/option portfolio for a 1 percent change in underlying return volatility, estimated using Core and Guay (2002) and Coles et al. (2006) methodology.
Other variables	
ABSAFE	Absolute value of analyst forecast error. Analyst forecast error is defined I/B/E/S actual EPS minus one-year ahead EPS consensus forecast made at the end of the first quarter, scaled by the absolute value of the EPS forecast.
ABSMFE	Absolute value of management forecast error. Management forecast error is defined I/B/E/S actual EPS minus management forecast made at the end of the first quarter, scaled by the absolute value of the management forecast.
AFDISP	Analyst forecast dispersion is defined as the standard deviation of analysts' one-year ahead EPS forecast made at the end of first quarter, scaled by the absolute value of corresponding consensus forecast.
AFE	Analyst forecast error is defined I/B/E/S actual EPS minus one-year ahead EPS consensus forecast made at the end of the first quarter, scaled by the absolute value of the EPS forecast.
AFE_PS	The maximum of AFE and 0.
AFE_NG	The minimum of AFE and 0.
ANCOV	The number of analysts issuing one-year ahead EPS forecast at the end of first quarter.
BOARDINDEP	Percentage of independent directors on the board in BoardEx.
BOARDSIZE	Number of directors on the board in BoardEx.
CEOPOWER	A measure of CEO's influence over the board, which equals 2 if CEO is both the chairman and president; 1 if CEO is the chairman; and 0 otherwise.
DIVYLD	Cash dividends divided by income before extraordinary items (Compustat DV/IB)
ENTCOST	The natural log of entry cost in a firm's industry (Robinson et al, 2011)
EPSUSER	An indicator variable that equals 1 when the firm uses EPS as a performance metric in the cash bonus plan, and 0 otherwise.
ETR	Effective tax rate is defined as total income taxes divided by pre-tax income (Compustat TXT/(TXT+IB))
EXCESSCOMP	The estimated excess compensation for the CEO (Robinson et al. 2011)
EXPECTCOMP	The expected compensation for the CEO (Robinson et al, 2011)
IMR	Inverse mills ratio estimated from the first-stage Probit model of Heckman two-stage regressions.
LOGSEG	Natural logarithm of the number of business segments.
LPRXY	Natural logarithm of the length of the proxy statement (Robinson et al. 2011)
MFRANGE	The upper bound minus the lower bound of the management EPS forecast range, scaled by the absolute value of their average. This variable is measured at the end of first quarter of the fiscal year.
MKTSIZE	Natural logarithm of the market size of the firm's industry (Robinson et al. 2011)
OPTIONFV	The fair value of CEO stock options grants, scaled by the market value of equity (Execucomp OPTION_AWARDS_FV).
PCTFEM	Percentage of female directors on the board in BoardEx.
PCTMGR	Percentage of institutional ownership during the fiscal year.

PCTTRA	Percentage of transient institutional ownership during the fiscal year. Classification of institutional investors is collected from (http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html).
PRODDIFF	The extent of product differentiation in a firm's industry (Robinson et al, 2011)
RESAWARDFV	The fair value of CEO restricted stock grants, scaled by the market value equity.
RET	Annual buy-and-hold return for the 12-month starting from the fourth month of the fiscal year.
TGDISCLOSER	An indicator variable that equals 1 when the firm uses EPS as a performance metric in the cash bonus plan AND discloses the level of EPS target in the proxy statement, and 0 otherwise.

* Variables are defined for fiscal year t.

Figure 1
Timeline of Variable Measurement

This figure depicts the timeline of our study. The EPS target used to determine cash bonuses for year t are set by the end of the first quarter of year t. We collect consensus analysts' EPS forecasts for year t made at the end of the first quarter of year t and use this measure to construct our target difficulty measure. We measure return volatility over a 12-month period starting from the fourth month of the fiscal year to examine the CEO's response to EPS target difficulty.

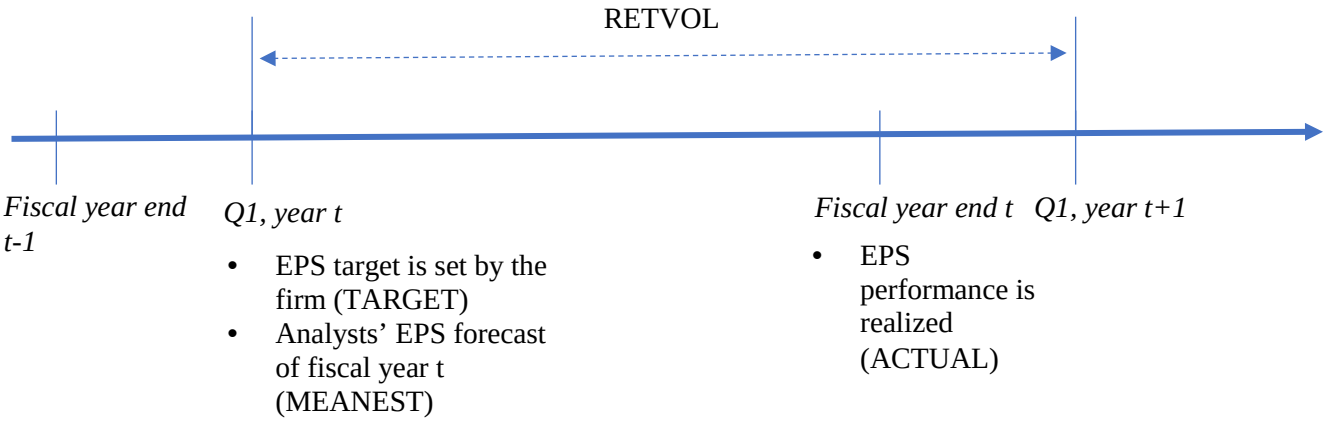

Figure 2
Association between Target Difficulty and Corporate Risk Taking

This figure plots the average log return volatility (RETVOL) and average raw return volatility for each decile portfolio of target difficulty (TGDIF). The sample includes 2,493 firm-year observations with EPS targets in CEOs' cash bonus plans from 2006 to 2014.

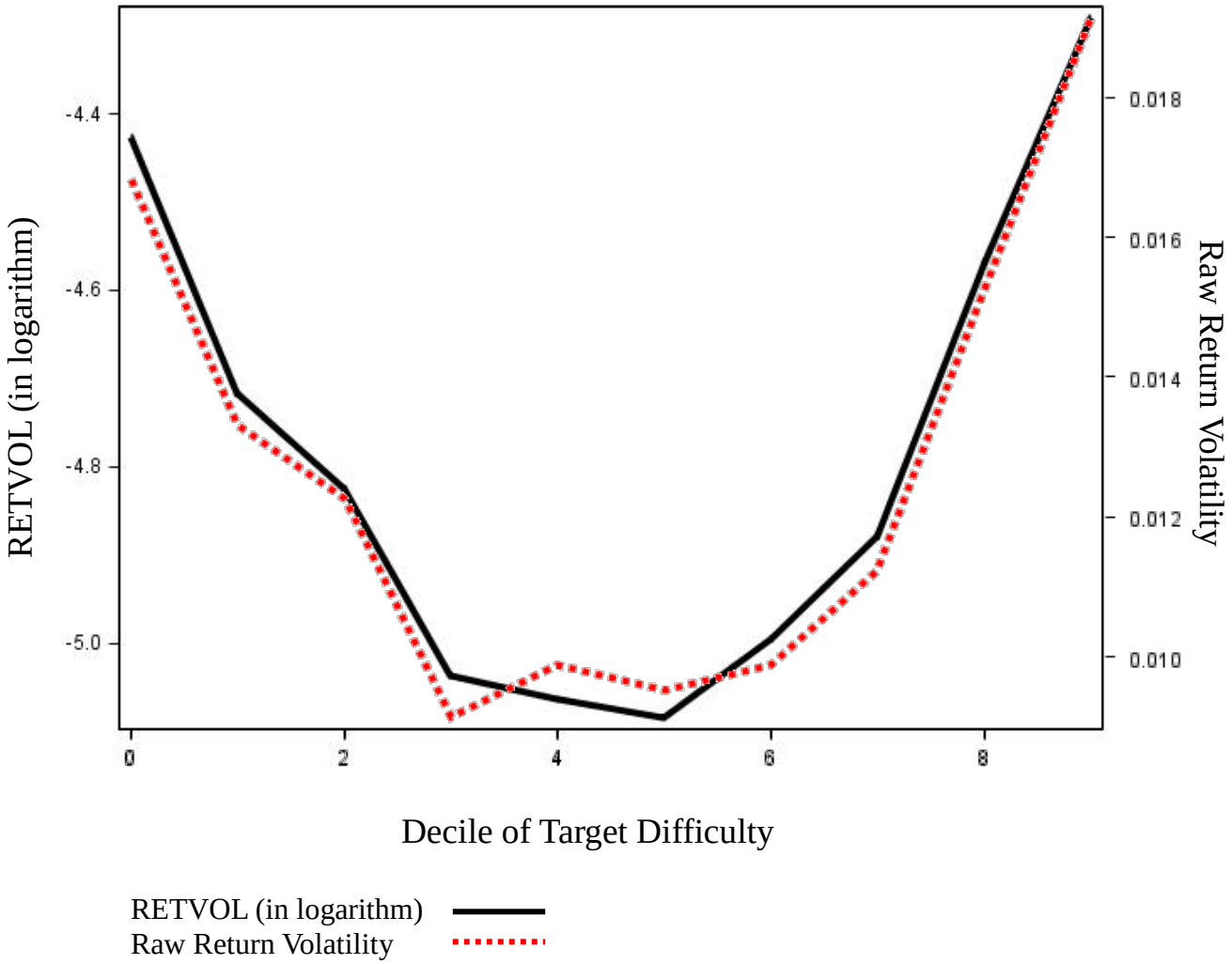

Table 1
Descriptive Statistics

Variable	MEAN	STD	Q1	MEDIAN	Q3
TGDIF	0.002	0.166	-0.043	-0.007	0.021
RETVOL	-4.791	0.892	-5.425	-4.857	-4.199
R&D	0.051	0.086	0.000	0.000	0.072
SEGHHI	0.846	0.247	0.659	1.000	1.000
LEVERAGE	0.168	0.127	0.070	0.145	0.250
M&A	0.335	0.472	0.000	0.000	1.000
SIC2M&A	0.037	0.189	0.000	0.000	0.000
SIZE	8.058	1.491	6.939	7.996	9.095
AGE_{t-1}	3.376	0.620	2.890	3.401	3.970
BTM_{t-1}	0.499	0.297	0.292	0.451	0.652
TENURE	1.901	0.735	1.365	1.934	2.405
$CASHCOMP_{t-1}$	7.482	0.801	7.035	7.520	7.963
$DELTA_{t-1}$	5.453	1.350	4.562	5.480	6.432
$VEGA_{t-1}$	3.953	1.927	2.958	4.334	5.379
$TERMPYMT_{t-1}$	0.483	0.885	0.000	0.142	0.555

This table presents descriptive statistics for our variables of interest. When the subscript is omitted, the variable is measured for fiscal year t. The sample includes 2,493 firm-year observations with EPS target in CEOs' cash bonus plans from 2006 to 2014. All variables are winsorized at 2 and 98 percentiles. Please refer to Appendix B for variable definition.

Table 2
Correlation Coefficients

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 TGDIF		0.10***	0.05**	0.03*	-0.01	-0.06***	0.02	-0.16***	-0.05**	0.19***	0.03	-0.12***	-0.09***	-0.06***	0.00
2 RETVOL	0.05**		0.05**	0.26***	0.00	-0.05***	0.00	-0.47***	-0.34***	0.15***	0.07***	-0.21***	-0.14***	-0.12***	-0.04**
3 R&D	0.01	0.02		-0.02	-0.31***	0.07***	0.01	0.09***	-0.07***	-0.14***	0.05**	0.00	0.12***	0.18***	-0.04*
4 SEGHHI	0.03*	0.29***	-0.11***		0.00	-0.06***	-0.01	-0.15***	-0.15***	0.03	0.01	-0.13***	-0.01	0.02	-0.10***
5 LEVERAGE	-0.02	-0.08***	-0.34***	-0.02		-0.10***	0.03	0.01	0.19***	0.30***	-0.07***	0.05**	-0.15***	-0.10***	0.03
6 M&A	-0.06***	-0.05***	0.13***	-0.05**	-0.10***		-0.14***	0.16***	-0.01	-0.12***	0.02	0.15***	0.15***	0.15***	-0.01
7 SIC2M&A	0.02	0.00	0.00	-0.01	0.04*	-0.14***		-0.03	-0.03	0.03	-0.04*	0.00	-0.03	0.00	0.03
8 SIZE	-0.12***	-0.48***	0.13***	-0.15***	0.06***	0.16***	-0.03*		0.27***	-0.36***	-0.08***	0.56***	0.55***	0.42***	0.00
9 AGE $_{t-1}$	-0.08***	-0.38***	-0.03	-0.17***	0.26***	-0.02	-0.03*	0.30***		0.06***	-0.07***	0.16***	0.04*	0.10***	0.01
10 BTM$_{t-1}$	0.07***	0.11***	-0.23***	0.00	0.32***	-0.14***	0.03*	-0.35***	0.09***		-0.05**	-0.21***	-0.39***	-0.21***	0.08***
11 TENURE	-0.02	0.07***	0.04*	-0.01	-0.09***	0.03	-0.04*	-0.09***	-0.08***	-0.05**		0.04**	0.36***	0.08***	-0.14***
12 CASHCOMP $_{t-1}$	-0.13***	-0.30***	0.06***	-0.13***	0.11***	0.16***	0.00	0.70***	0.24***	-0.22***	0.03		0.39***	0.29***	0.07***
13 DELTA $_{t-1}$	-0.07***	-0.16***	0.17***	-0.02	-0.16***	0.16***	-0.03*	0.57***	0.04**	-0.41***	0.36***	0.50***		0.60***	-0.24***
14 VEGA $_{t-1}$	-0.02	-0.20***	0.24***	-0.01	-0.07***	0.17***	-0.01	0.55***	0.15***	-0.27***	0.10***	0.48***	0.67***		-0.09***
15 TERMPYMT	-0.01	-0.01	-0.03	-0.12***	0.07***	0.02	0.03*	-0.02	0.05**	0.12***	-0.08***	0.10***	-0.23***	-0.07***	

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

This table presents Pearson (above the main diagonal) and Spearman (below the main diagonal) correlations for our variables of interest. When the subscript is omitted, the variable is measured for fiscal year t. The sample includes 2,493 firm-year observations with EPS targets in CEOs' cash bonus plans from 2006 to 2014. Please refer to Appendix B for variable definition.

Table 3
Target Difficulty and Corporate Risk Taking

Variable	(1) Dep. Var = RETVOL	(2) Dep. Var = RETVOL
TGDIF	-0.217***	-0.266***
	(-2.83)	*(-3.30)*
$TGDIF^2$	1.105***	1.161***
	(6.89)	*(6.78)*
SIZE	-0.204***	-0.210***
	(-12.91)	*(-11.45)*
AGE_{t-1}	-0.177***	-0.181***
	(-5.86)	*(-5.49)*
BTM_{t-1}	0.176***	0.154**
	(3.33)	*(2.52)*
TENURE	0.003	-0.000
	(0.15)	*(-0.01)*
$CASHCOMP_{t-1}$	0.033**	0.035*
	(2.03)	*(1.69)*
$DELTA_{t-1}$	0.009	0.016
	(0.58)	*(0.89)*
$VEGA_{t-1}$	-0.011	-0.013
	(-1.01)	*(-1.02)*
$TERMPYMT_{t-1}$	0.013	0.014
	(1.07)	*(0.95)*
INTERCEPT	-3.386***	-2.901***
	(-20.27)	*(-15.63)*
N	2,493	2,493
Year FE	*Yes*	*No*
Industry FE	*Yes*	*No*
Industry-Year FE	*No*	*Yes*
Adjusted R^2	0.724	0.735

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

Panel A presents the associations between ex ante target difficulty and corporate risk taking measured by return volatility. Regressions are estimated using ordinary least square (OLS) with year- and industry-fixed effects, and year-industry-fixed effects. When the subscript is omitted, the variable is measured for fiscal year t. *t*-statistics are in parentheses and are based on standard errors clustered by firm.

Table 4
Alternative measures of target difficulty

Panel A: Correlations between alternative measures of target difficulty

Variable	TGDIF	$TGDIF_{mf}$	$TGDIF_{hvz}$	TGDEV
TGDIF		0.87***	0.26***	0.32***
$TGDIF_{mf}$	0.81**		0.26***	0.27***
$TGDIF_{hvz}$	0.23***	0.21***		-0.037
TGDEV	0.35***	0.22***	0.06**	

Panel B: Associations between alternative measures of target difficulty and corporate risk taking

Variable	Dep. Variable = RETVOL		
$TGDIF_{mf}$	0.114		
	(0.72)		
$TGDIF_{mf}^2$	4.181***		
	(5.90)		
$TGDIF_{hvz}$		-0.102*	
		(-1.76)	
$TGDIF_{hvz}^2$		0.772***	
		(6.44)	
TGDEV			-0.165**
			(-2.48)
$TGDEV^2$			0.295***
			(5.87)
INTERCEPT	-3.783***	-3.466***	-3.282***
	(-17.40)	*(-20.84)*	*(-14.97)*
N	1,649	2,493	1,859
Controls	*Yes*	*Yes*	*Yes*
Year & Industry FE	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.712	0.721	0.726

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

Panel A presents Pearson (above the main diagonal) and Spearman (below the main diagonal) correlations for alternative measures of target difficulty. Panel B presents the associations between alternative measures of target difficulty and corporate risk taking measured as RETVOL. Regressions are estimated using ordinary least square (OLS) with year- and industry-fixed effects. Control variables include AGE_{t-1}, BTM_{t-1}, $CASHCOMP_{t-1}$, $DELTA_{t-1}$, SIZE, TENURE, $TERMPYMT_{t-1}$, $VEGA_{t-1}$. When the subscript is omitted, the variable is measured for fiscal year t. *t*-statistics are in parentheses and are based on standard errors clustered by firm.

Table 5
Target Difficulty and Firm Risk Policies

Panel A: Impact of target difficulty on risk policies					
Variable	Dep. Var = R&D	Dep. Var = SIC2M&A	Dep. Var = M&A	Dep. Var = SEGHHI	Dep. Var = LEVERAGE
TGDIF	0.019	0.021	-0.000	0.032	-0.028
	(1.41)	*(0.65)*	*(-0.00)*	*(1.02)*	*(-1.39)*
$TGDIF^2$	0.048*	-0.004	-0.318**	0.049	0.062
	(1.77)	*(-0.06)*	*(-2.25)*	*(0.74)*	*(1.41)*
SIZE	0.011***	-0.006	0.056***	-0.006	-0.005
	(3.26)	*(-1.13)*	*(4.11)*	*(-0.96)*	*(-1.19)*
AGE_{t-1}	-0.012**	-0.006	-0.004	-0.029**	0.002
	(-2.04)	*(-0.80)*	*(-0.14)*	*(-2.24)*	*(0.28)*
BTM_{t-1}	-0.012	0.012	-0.025	-0.016	0.103***
	(-1.17)	*(0.67)*	*(-0.51)*	*(-0.66)*	*(5.75)*
TENURE	0.006	-0.013**	0.008	-0.000	-0.003
	(1.55)	*(-1.97)*	*(0.45)*	*(-0.095)*	*(-0.57)*
$CASHCOMP_{t-1}$	-0.008	0.014	0.030*	-0.015**	0.019**
	(-1.53)	*(1.52)*	*(1.70)*	*(-2.53)*	*(2.29)*
$DELTA_{t-1}$	-0.006*	-0.006	-0.015	0.008	-0.001
	(-1.76)	*(-1.02)*	*(-1.11)*	*(1.16)*	*(-0.29)*
$VEGA_{t-1}$	0.002	0.003	0.006	0.001	0.002
	(1.60)	*(1.05)*	*(0.66)*	*(0.19)*	*(0.63)*
$TERMPYMT_{t-1}$	-0.005**	0.001	-0.011	-0.002	0.004
	(-2.32)	*(0.30)*	*(-0.86)*	*(-0.23)*	*(1.41)*
INTERCEPT	0.081**			1.214***	0.000
	(2.14)			*(17.96)*	*(0.00)*
N	2,493	2,166	2,478	2,493	2,490
Regression Type	*OLS*	*Probit*	*Probit*	*OLS*	*OLS*
Year & Industry FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted (Pseudo) R^2	0.381	0.0681	0.1241	0.441	0.422

Table 5 (continued)

Panel B: Impact of target difficulty on alternative measures of firm risk		
Variable	Dep. Var = STDROA	Dep. Var = STDCFO
TGDIF	-0.000	0.001
	(-0.10)	*(0.44)*
$TGDIF^2$	0.022**	0.009*
	(2.52)	*(1.68)*
SIZE	-0.001**	-0.003***
	(-2.07)	*(-5.57)*
AGE_{t-1}	-0.002**	-0.002*
	(-2.20)	*(-1.68)*
BTM_{t-1}	0.003	-0.010***
	(0.99)	*(-4.78)*
TENURE	-0.000	-0.000
	(-0.06)	*(-0.20)*
$CASHCOMP_{t-1}$	-0.000	0.000
	(-0.10)	*(1.14)*
$DELTA_{t-1}$	-0.000	-0.000
	(-0.66)	*(-0.09)*
$VEGA_{t-1}$	0.000	-0.000
	(1.28)	*(-0.52)*
$TERMPYMT_{t-1}$	-0.000	0.000
	(-1.24)	*(0.20)*
INTERCEPT	0.031***	0.050***
	(5.45)	*(9.36)*
N	2,431	2,431
Regression Type	*OLS*	*OLS*
Year & Industry FE	*Yes*	*Yes*
Adjusted R^2	0.112	0.328

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

Panel A and B report the associations between target difficulty and firm policies on risk taking and alternative measures of firm risk respectively. Regressions are estimated using ordinary least square (OLS) and Probit models with year- and industry-fixed effects. Marginal effects and pseudo R^2 are displayed for Probit models. When the subscript is omitted, the variable is measured for fiscal year t. *t*-statistics are in parentheses and are based on standard errors clustered by firm.

Table 6
Cross-Sectional Variations in the Relation between Target Difficulty and Firm Risk

Variable	(1) Dep. Var = RETVOL	(2) Dep. Var = RETVOL
TGDIF	-0.404	-0.295***
	(-1.41)	*(-2.77)*
$TGDIF^2$	2.247***	1.540***
	(3.78)	*(7.48)*
$TGDIF^*DELTA_{t-1}$	0.033	
	(0.65)	
$TGDIF^{2*}DELTA_{t-1}$	-0.22**	
	(-2.08)	
$DELTA_{t-1}$	0.017	
	(1.01)	
TGDIF *CEOPOWER		0.096
		(0.97)
$TGDIF^{2*}$CEOPOWER		-0.56***
		(-2.95)
CEOPOWER		-0.016
		(-0.79)
INTERCEPT	-3.412***	-3.413***
	(-20.28)	*(-20.25)*
N	2,493	2,493
Controls	*Yes*	*Yes*
Year & Industry FE	*Yes*	*Yes*
Adjusted R^2	0.721	0.722

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

This table presents the cross-sectional variations in the associations between target difficulty and corporate risk taking measured as RETVOL. Regressions are estimated using ordinary least square (OLS) with year- and industry-fixed effects. Control variables include AGE_{t-1}, BTM_{t-1}, $CASHCOMP_{t-1}$, $DELTA_{t-1}$, SIZE, TENURE, $TERMPYMT_{t-1}$, $VEGA_{t-1}$. When the subscript is omitted, the variable is measured for fiscal year t. *t*-statistics are in parentheses and are based on standard errors clustered by firm.

Table 7
Ruling out Information Uncertainty as an Correlated Omitted Variable

Panel A: Control of information uncertainty proxies				
Variable	Dep. Variable = RETVOL			
TGDIF	-0.195**	-0.114	-0.177**	-0.092
	(-2.52)	*(-0.92)*	*(-2.29)*	*(-0.77)*
$TGDIF^2$	0.633***	0.737***	0.884***	0.924***
	(3.49)	*(3.09)*	*(5.57)*	*(3.91)*
AFDISP	0.481***			
	(5.05)			
MFRANGE		1.684***		
		(4.79)		
$ABSAFE_{t-1}$			0.157***	
			(6.78)	
$ABSMFE_{t-1}$				0.534***
				(6.17)
INTERCEPT	-3.438***	-3.995***	-3.555***	-4.032***
	(-20.44)	*(-18.56)*	*(-21.31)*	*(-18.52)*
N	2,455	1,649	2,472	1,603
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Year & Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.724	0.719	0.725	0.720

Table 7 (continued)

Panel B: Cross-sectional variations with information uncertainty proxies				
Variable	Dep. Variable = RETVOL			
TGDIF	-0.242***	-0.201	-0.187**	-0.058
	(-2.80)	*(-1.14)*	*(-2.19)*	*(-0.37)*
$TGDIF^2$	1.153***	1.127***	1.083***	1.059***
	(5.63)	*(2.88)*	*(5.67)*	*(3.32)*
TGDIF*AFDISP	1.171***			
	(3.07)			
$TGDIF^2$*AFDISP	-4.323***			
	(-4.35)			
TGDIF*MFRANGE		1.624		
		(1.02)		
$TGDIF^2$*MFRANGE		-3.91		
		(-1.53)		
TGDIF *$ABSAFE_{t-1}$			0.038	
			(0.48)	
$TGDIF^2$*$ABSAFE_{t-1}$			-0.381*	
			(-1.89)	
TGDIF *$ABSMFE_{t-1}$				-0.084
				(-0.21)
$TGDIF^2$*$ABSMFE_{t-1}$				-0.394
				(-0.53)
INTERCEPT	-3.567***	-4.015***	-3.569***	-4.035***
	(-20.68)	*(-18.62)*	*(-21.45)*	*(-18.62)*
N	2,455	1,649	2,472	1,603
Controls & Main Effects	*Yes*	*Yes*	*Yes*	*Yes*
Year & Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.730	0.719	0.726	0.719

Table 8
Heckman Two-Stage Regression to Control for
the Selected Use of EPS in Annual Cash Bonus Plans

Panel A: 1st Stage Probit Model		Panel B: 2nd Stage OLS Model	
	Dep. Var		Dep. Var
Variable	EPSUSER = 1	Variable	RETVOL
AFE_PS	-0.273***	TGDIF	-0.239***
	(-4.40)		*(-2.99)*
AFE_NG	0.251***	$TGDIF^2$	0.762***
	(6.31)		*(4.36)*
BOARDINDEP	0.651***	IMR	0.629***
	(4.00)		*(6.61)*
$DIVYLD_{t-1}$	0.101**		
	(2.02)		
ETR_{t-1}	0.161***		
	(2.75)		
$LOGSEG_{t-1}$	0.185***		
	(5.02)		
ANCOV	0.005		
	(1.47)		
$OPTIONFV_{t-1}$	-0.046**		
	(-2.35)		
$PCTFEM_{t-1}$	0.361**		
	(2.17)		
$PCTMGR_{t-1}$	0.679***		
	(6.29)		
$PCTTRA_{t-1}$	-1.027***		
	(-4.54)		
$RESAWARDFV_{t-1}$	-0.034***		
	(-2.72)		
RET_{t-1}	0.004		
	(0.09)		
$R\&D_{t-1}$	-1.713***		
	(-9.80)		
INTERCEPT	-2.777	INTERCEPT	-4.613***
	(-0.51)		*(-11.84)*
N	10,831	N	2,228
Controls	*Yes*	Controls	*Yes*
Year FE	*Yes*	Year FE	*Yes*
Industry FE	*Yes*	Industry FE	*Yes*
Adjusted R^2	0.12	Adjusted R^2	0.7359
ROC	0.73		

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

This table presents the associations between target difficulty and firm risk (RETVOL) after controlling for the selection bias due to the use of EPS metric in annual cash bonus plans. When the subscript is omitted, the variable is measured for fiscal year t. *t*-statistics are in parentheses and are based on standard errors clustered by firm.

Table 9
Heckman Two-Stage Regression to Control for
the Disclosure of EPS Target Used in Annual Cash Bonus Plans

Panel A: 1st Stage Probit Model		Panel B:2nd Stage OLS Model	
Variable	Dep. Var TGDISCLOSER = 1	Variable	Dep. Var RETVOL
AFE_PS	-0.152	TGDIF	-0.224***
	(-0.95)		*(-2.87)*
AFE_NG	0.286***	$TGDIF^2$	1.122***
	(3.19)		*(6.90)*
EXCESSCOMP	0.076	IMR	-0.087
	(1.15)		*(-0.56)*
EXPECTCOMP	0.498***		
	(3.19)		
ENTCOST	0.082		
	(1.56)		
MKTSIZE	-0.074		
	(-1.57)		
LPRXY	0.093		
	(0.99)		
PRODDIFF	-0.169		
	(-0.41)		
RET	-0.286**		
	(-2.53)		
INTERCEPT	-2.331	INTERCEPT	-2.833***
	(-0.04)		*(-11.60)*
N	2,910	N	2,463
Controls	*Yes*	Controls	*Yes*
Year FE	*Yes*	Year FE	*Yes*
Industry FE	*Yes*	Industry FE	*Yes*
Adjusted R^2	0.17	Adjusted R^2	0.7199
ROC	0.82		

***, **, * indicates that p-values (two-tailed) are less than 0.01, 0.05, and 0.10, respectively.

This table presents the associations between target difficulty and corporate risk taking (RETVOL) after controlling for selection bias due to the disclosure of EPS target used in annual cash bonus plans. When the subscript is omitted, the variable is measured for fiscal year t. *t*-statistics are in parentheses and are based on standard errors clustered by firm.