Get the Money Somehow: The Effect of Missing Performance Goals on Insider Trading[*]

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Abstract:

This paper uses a regression discontinuity design to identify the effect of missing relative performance goals on insider trading. I find that CEOs who narrowly miss relative performance goals and hence receive a lower pay earn higher abnormal profits from their insider trades subsequent to the compensation shock than otherwise similar CEOs who narrowly beat the goals. I also find that CEOs who narrowly miss relative performance goals become less likely to provide earnings and sales guidance. These results suggest that managers can use insider trading to make up for the loss in compensation due to missing relative performance goals, which could reduce the incentive effect of performance-based pay.

Key words: Performance-based pay; executive compensation; insider trading; regression discontinuity

JEL number: G34, G14

If possible honestly, if not, somehow, make money.
Horace

1. Introduction

Tying executive pay to corporate performance has become increasingly important in creating incentives for corporate managers.[1] Theoretical models argue that compensation contracts that reward managers contingent on performance, especially performance relative to peer firms, can induce managerial effort (e.g., Holmstrom, 1979, 1982). The effectiveness of such performance-based pay in incentivizing managers, however, could be limited. Since effort exertion is privately costly, self-interested managers may take actions to "undo" the incentive effect of performance-based pay. In this paper, I investigate one such action, i.e., insider trading.

Theories suggest that insider trading may be a suboptimal way to compensate management. For instance, Fischer (1992) argues that allowing insider trading can exacerbate existing agency problems, because it expands managers' unobservable strategy space. In the context of performance-based pay, the ability of managers to earn abnormal profits from insider trading ex post after observing their performance may weaken their ex ante incentive to improve performance. In other words, if managers are able to recoup much of the loss in compensation due to missing performance goals through abnormal profits from insider trading, their ex ante incentive to beat performance goals may be limited.

[1] For example, based on data from Incentive Lab, the proportion of the largest firms in the U.S. market (roughly 1,400 firms each year) that have explicit performance-based incentives has increased from 81.9% in 2006 to 96.1% in 2016, and that with explicit relative performance incentives has increased from 19.3% to 50.5% over the same period.

In this paper, I use a regression discontinuity design (RDD) to examine whether managers use insider trading to undo some of the incentive effect of performance-based pay. I exploit discontinuity in compensation induced by missing relative performance goals in executive incentive contracts. Managers whose performance is right around a relative performance goal presumably have strong incentives to improve performance because of the convexity in the pay-for-performance structure. Yet, if managers are able to generate abnormal profits from insider trading when they miss the performance goal, they can reduce the effective convexity and hence mitigate the incentive effect. I hypothesize that missing a relative performance goal prompts managers to earn abnormal profits from insider trading to make up for the loss in performance-based compensation.[2]

Using a sample of 1,317 relative performance grants for which the payout schedule exhibits jumps around performance goals, I first show that there is no bunching on either side of the performance goals and the density function is smooth around the goals. This pattern is in contrast to that for grants based on absolute performance goals, which are subject to manipulation by managers (Bennett, Bettis, Gopalan, and Milbourn, 2017). Because the performance goals are based on the performance of a group of peer companies, which is not observed until the performance period ends, it is difficult for managers to perfectly control whether their performance is above or below a relative goal in a narrow range around the goal. I also show that firms that just beat and those that just miss a relative performance goal have balanced observable covariates. These results allow

[2] Trading on material non-public information could impose substantial costs on corporate insiders, including reputational losses, reduced career prospects, and potential legal penalties (e.g., Seyhun, 1992; Gao, Lisic, and Zhang, 2014; Dai, Parwada, and Zhang, 2015). The RD setting allows me to control for the costs faced by corporate insiders to a large extent, because managers that just miss a goal are likely to face the same costs from opportunistic insider trading as those that just beat one.

me to use missing performance goals right around the cutoff to identify the effect of compensation shocks on insider trading.

The main results of the paper can be summarized as follows. First, relative to managers that narrowly beat a relative performance goal, those that narrowly miss one suffer a loss of about 12% to 13% of their total compensation. This result suggests that missing relative performance goals has a large negative effect on CEO compensation, which might prompt managers to engage in opportunistic insider trading.

Second, relative to managers that just beat a relative performance goal, those that just miss one subsequently earn abnormal profits from insider trading that amount to about 8% of their total compensation. Combined with the above estimate on the effect of missing relative performance goals on abnormal incentive pay, this estimate suggests that managers use insider trading to make up for over half of the loss in compensation due to missing performance goals.

Third, I find that relative to managers that just beat a relative performance goal, those that just miss one are less likely to provide earnings and sales guidance, suggesting that managers strategically withhold information to increase their informational advantage. The economic magnitude of this effect is large: For example, the difference in the likelihood to make voluntary guidance disclosures between firms that narrowly miss and those that narrowly beat relative performance goals is 23.6 percentage points, which is large considering that the mean likelihood of providing guidance disclosures is 67.3% in the full sample. These results lend further support

to the interpretation that managers that miss relative performance goals act strategically to increase the gains from insider trading.

Fourth, to mitigate the concern that the observed effect on insider trading profits is driven by CEOs who receive equity (as opposed to cash) awards and hence have a diversification motive in their insider trades, I repeat the reduced-form regression on the subsample of equity awards and cash awards separately. I find that the effect of missing relative performance goals on insider trading profits holds for both subsamples, suggesting that the diversification story is not a main driver of the observed results.

This paper contributes to our understanding of the efficacy of performance-based compensation. The results that managers that miss a relative performance goal become more likely to engage in opportunistic insider trading to make up for the loss in compensation suggest that performance-based incentive awards may be limited in generating incentives for managers. Closer scrutiny of managerial actions, such as insider trades, may be necessary to improve the effectiveness of performance-based pay.

As the first to identify the effect of missing relative performance goals on managerial actions, this paper contributes to three strands of literature. The first is the literature on performance-based pay. A large number of studies examine the effects of performance goals in compensation contracts on managerial behavior (e.g., Murphy, 2000; Bettis, Bizjak, Coles, and Kalpathy, 2010, 2018). The closest study to mine is that of Bennett, Bettis, Gopalan, and Milbourn (2017), who focus on grants with absolute performance goals and show that managers manipulate reported accounting

performance to achieve such goals. My paper complements theirs by showing that managers resort to insider trading to make up for the loss in compensation due to missing relative performance goals, which are hard to manipulate.

The second strand of the literature this paper contributes to is that on insider trading. While considerable evidence shows that corporate managers make abnormal profits from opportunistic insider trading (e.g., Cohen, Malloy, and Pomorski, 2012; Ali and Hirshleifer, 2017), the motivations underlying such opportunistic behavior remain in debate. For example, Bhattacharya and Marshall (2012) show that "richer" managers (i.e., those with higher compensation) are associated with a higher likelihood of carrying out illegal insider trading, which they interpret as suggesting that insider trading is not motivated by rational monetary considerations. In contrast, using detailed Swedish data, Kallunki, Kallunki, Nilsson, and Puhakka (2018) find that insiders with a lower level of wealth and income are more likely to engage in informed insider trading. My results provide causal evidence that a negative shock to compensation induces more profitable insider trading, which is consistent with an economic motive for such opportunistic behavior (Becker, 1968).

Last, my paper contributes to the literature on insider trading as a form of executive compensation. Manne (1996) and Carlton and Fischel (1983) suggest that executive compensation contracts may explicitly or implicitly include insider trading profits as a component. They argue that allowing insider trading can be an efficient way of compensating executives because it incentivizes managers to acquire valuable information and seize valuing-increasing opportunities while decreases the cost of compensation renegotiation. Empirical studies find evidence consistent with

this idea (e.g., Roulstone, 2003; Henderson, 2011; Denis and Xu, 2013). For example, Roulstone (2003) and Denis and Xu (2013) find that firm and country level insider trading restrictions, respectively, are associated with higher executive compensation. My paper differs from these studies by focusing on managerial actions in a setting where the compensation contracts are fixed.

The rest of the paper is organized as follows. Section 2 describes the data and main variables. Section 3 discusses the identification strategy. Section 4 presents the empirical results, and Section 5 concludes.

2. Data and Variable Construction

2.1. Data and sample

I obtain data on relative performance grants from ISS Incentive Lab. The data provide detailed information on performance grants for all named executives, including metrics used, performance goals, performance periods, vesting schedule, performance benchmarks, benchmarking methods, award types, etc. Incentive Lab covers the largest 750 companies by market capitalization in each year and backfills the data for new firms that enter the database back to 1998. Since the SEC standardized the disclosure requirements for executive compensation in 2006, I confine the sample to relative performance grants with performance period ending between January 2006 and December 2016. I match relative performance grants to CRSP to obtain stock returns data and Compustat to retrieve financial statement data.

I focus on CEOs' relative performance grants, where the benchmark consists of the performance of peer companies or market indexes. The initial sample contains 8,918 unique observations of

relative performance grants to CEOs at 848 distinct firms.[3] I then exclude grants with missing information on performance metrics, performance periods, performance goals, award types, award quantities, or relative benchmarks. To minimize potential errors in estimating the running variable, i.e., the difference between actual performance and the relative performance goal, I focus on stock return metrics, i.e., total shareholder return (TSR), as well as standard accounting metrics that are available in Compustat, including the level and the growth rate of earnings[4], EBIT, EBITDA, EBT, FFO, operating income, and sales, all of which are readily available in Compustat.[5] I further exclude grants with performance metrics containing the word "adjusted" or "non-GAAP". The remaining sample consists of 3,079 observations.

I then require that the payout schedule exhibit discontinuous jumps around performance goals. A performance grant usually has a performance target, at or above which the executive receives a target payout. Below the target goal, another performance goal, i.e., threshold goal, may be included in the grant. Below the threshold goal, the actual payout is zero. Between the threshold goal and target goal, the actual payout can stay at the threshold payout level until the performance reaches the target goal or be interpolated between the threshold payout and target payout. To focus on grants with discontinuous jumps in performance-based pay, I restrict the sample to three types

[3] I treat a grant based on a performance metric during a performance period as a unique observation.
[4] Compustat provides four EPS measures, i.e., EPSFX (diluted EPS excluding extraordinary items), EPSPX (basic EPS including extraordinary items), EPSFI (diluted EPS including extraordinary items), EPSPI (basic EPS including extraordinary items). I use the description of the metrics provided by Incentive Lab (the "metric other" field) to determine the appropriate EPS measure. I use EPSFX if the grant specifies diluted EPS and EPSPX if otherwise.
[5] Relative performance grants using stock return metrics use either a group of peer companies or a market index as the benchmark. I use stock returns of peer companies from CRSP and index returns from Compustat Index Prices file to calculate the performance goal. If the index returns are not available in the Compustat file, I manually collect the data from index providers' websites. For grants where the peer group is defined as the constituents of an index, I require that the data on the historical constituents of the index are available in Compustat Index Constituents file. Relative performance grants using accounting metrics use peer firms as benchmarks. I use accounting data from Compustat annual file to calculate the performance goal for these grants.

of relative performance goals, i.e., threshold goals, target goals only, and target goals without interpolation between the threshold and target goals. Given that my focus is on the discontinuity in compensation in a narrow range around performance goals, for grants with more than one goal (e.g., a target and a threshold goal) for the same performance metric, I follow Bennett et al. (2017) and keep only the goal closest to the actual performance. This procedure yields a sample of 1,435 relative performance grants awarded to CEOs.

I obtain data on CEO compensation from Incentive Lab and S&P ExecuComp. I rely mainly on Incentive Lab, and use ExecuComp database when the information is not available in Incentive Lab. The compensation data provide a breakdown of the components, such as salary, bonus, stock awards, non-equity incentive plan compensation, etc. After dropping observations with missing compensation information at the end of the performance period, my final sample contains 1,317 relative performance grants awarded to CEOs.

I obtain insider trading data from Thomson Reuters Insider Filing Data Feed, which contains detailed information on insider trades including the name of the insider, ticker, CUSIP, name of the company, transaction date, transaction price, and transaction quantity.[6] I match insider trading data to Incentive Lab data by CEO name and company identifier. I also match insider trading data with CRSP to retrieve data on stock returns. Following Lakonishock and Lee (2001) and Marin and Olivier (2008), I focus on CEOs' open market sales (transaction code "S") and open market purchases (transaction code "P") of non-derivative securities. To minimize data errors, I exclude

[6] Prior studies using disclosed insider trades show that insiders earn abnormal returns on their trades (e.g., Jaffe, 1974; Finnerty, 1976; Seyhun, 1986; Rozeff and Zaman, 1988; Lakonishok and Lee, 2001), suggesting that some of the trades are motivated by insiders' informational advantage over outside investors.

transactions for which the transaction price is not within 20% of the CRSP closing price on the transaction day and those for which the number of shares traded is greater than 20% of shares outstanding.

2.2. Variable construction

Performance-based grants are incentive awards of which the actual payouts are determined by one or several metrics derived from the firm's stock market or financial performance. The firm's performance is measured over a pre-defined performance period, typically one or three years. At the end of the performance period, the firm's actual performance is compared to the performance goal to determine the actual payout of the grant. Missing a performance goal, even by a small margin, could result in a large loss in compensation. I exploit the discontinuity in compensation induced by missing relative performance goals.

The running variable is *actual minus goal*, defined as the difference between a firm's actual performance and its corresponding relative performance goal. For relative performance grants based on stock return metrics, I calculate the running variable as the difference in the buy-and-hold total shareholder returns between the firm and the benchmark. For relative performance grants based on accounting metrics in the form of growth rates, I calculate the running variable as the difference in the growth rates between the firm and the benchmark. For accounting metrics in levels, the running variable is measured as the percentage difference between actual performance and the performance goal, i.e., the difference between the actual value of the performance metric of the firm under consideration and that of its benchmark divided by the benchmark.

Relative benchmarking can be broadly categorized into two forms, i.e., attaining a certain ranking among peer companies and attaining a certain level of relative performance. If a grant uses relative ranking, the running variable is calculated as the actual performance of the firm minus the performance of the peer firm whose performance rank is the specified rank in the grant. For example, for a grant that sets a performance goal of achieving the 75th percentile of TSR among a group of 100 peer companies, the running variable is the TSR of the firm minus the TSR of the company ranks 75th among the peer companies in terms of TSR. If the grant uses the level of relative performance as the goal, the running variable is calculated as the actual performance of the firm minus the specified performance goals. For example, for a grant with a performance goal of delivering a TSR of 3% above the S&P 500 total return, the running variable is calculated as the TSR of the firm minus the sum of 3% and the S&P 500 total return.

To measure the shock to compensation induced by missing performance goals, I define abnormal incentive pay as the difference between actual incentive compensation earned and the expected incentive compensation payout specified in the grant. For each performance-based grant, Incentive Lab provides the information on pre-defined payout schedules for each performance goal. However, it does not provide the actual amount of payout. I use information in the Summary Compensation table of DEF 14A filings provided by Incentive Lab to infer the actual payout. For cash awards, i.e., performance grants with cash payout, I use the CEO's non-equity incentive plan compensation in the vesting year of the grant as a proxy for the actual cash payout of the grant. For equity awards, i.e., performance grants with stock payout, I use the total number of shares vested minus the time-vested restricted stock in the grant's vesting year as a proxy for the actual

payout of the grant.[7] For grants for which the payout becomes vested over multiple years, I sum up the estimate for the actual payout across the vesting years of the grants. I define abnormal incentive pay is as the estimate for the actual payout of the grant minus the pre-defined payout for meeting the performance goal, scaled by the reported total compensation in the year ending 12 months before the performance period-end.

I measure abnormal insider trading profits of a CEO as the total dollar amount of abnormal profits of all trades placed by the CEO during a 12-month period following the performance period-end divided by the total compensation in the year ending 12 months before the performance period-end. I use lagged total compensation as the scaling factor for both abnormal incentive pay and abnormal insider trading profits to facilitate comparing the magnitude of the effects.[8] Abnormal insider trading profits of a trade are calculated as the product of the transaction value and the buy-and-hold market-adjusted stock return over the subsequent six months (i.e., 126 trading days).[9] I calculate the total abnormal trading profits by summing the abnormal profits of all trades placed by the CEO over the 12-month period. For relative performance grants with stock return metrics, the 12-month period starts immediately after the performance period-end. For relative performance grants with accounting metrics, the 12-month period starts three months after the performance

[7] For some grants, Incentive Lab does not clearly specify the grant date or the vesting date, which makes it hard for the above approach to obtain an accurate estimate of the actual payout. To obtain data on the actual payout from these grants, I check the DEF 14A filings and hand-collect information on the actual payout mentioned in the Compensation Discussion and Analysis section of the filings.

[8] The measure for abnormal insider trading profits I construct here differs from percentage returns of insider trading, which are commonly used in the literature. Since the focus of my paper is on the economic value managers extract from insider trading and its relationship with the shock to compensation, dollar profits (scaled by lagged compensation) are more relevant than percentage returns.

[9] I choose a holding period of 126 trading days, because the short-swing rule (Section 16b of the Securities Exchange Act) requires that insiders disgorge any profits made by offsetting round-trip transactions within a six-month period. For robustness, I also compute the profits over three other windows, i.e., 21, 63, and 252 trading days. I report the results using these alternative holding periods in Section 4.5.

period-end. The three-month lag allows the relative performance outcome, which is based on the financial statements of the company under consideration and those of its peer companies, to be observed.

Table 1 reports the summary statistics of the main variables for the full sample (Panel A) as well as for the ±5% sample (Panel B). *Actual minus goal* has a mean of 0.08 and a standard deviation of 0.31 in the full sample, and the corresponding numbers in the ±5% sample are 0.00 and 0.03. Abnormal incentive pay and abnormal insider trading profits as a fraction of total compensation have a mean of 5.35% and 0.56%, and a standard deviation of 21.60%% and 6.70%, respectively, in the full sample. The modest mean profitability of insider trading is consistent with Cziraki and Gider (2019), who show that the dollar profits to insider trading is on average small.

Table 1 also reports the summary statistics of various firm characteristics, including total assets, market-to-book, leverage, investments, return on asset, analyst coverage, institutional ownership, prior market-adjusted returns, share repurchase, and discretionary accruals, as well as CEO characteristics, including CEO age, tenure, total compensation, fraction of stock awards, CEO ownership, and CEO stock-based wealth. All characteristics except prior stock returns, share repurchases, and discretionary accruals are measured in the fiscal year ending 12 months before the performance period-end. Prior stock returns, share repurchases, and discretionary accruals are measured as of the end of the performance period. The full sample and the ±5% sample are generally very similar in these firm and CEO characteristics.

[Insert Table 1 about here]

3. Empirical Strategy

3.1. Regression discontinuity approach

I exploit a fuzzy regression discontinuity design to identify the effect of compensation shocks induced by missing relative performance goals on insider trading.[10] The identification assumption is that, except for a discontinuous jump in incentive compensation, there is no other discontinuity in firm or CEO characteristics around the relative performance goals. In other words, beating or missing the performance goals cannot impact CEOs' insider trading behavior except through its effect on CEO compensation. Since relative performance goals are based on the performance of peer companies during the same performance period and become known only after the end of the performance period, it is plausible that corporate managers cannot precisely control their performance relative to their peers within a narrow band around the goals. Thus, whether a firm beats or misses its relative performance goals is "as good as randomized" around the cutoff of the performance goals (Lee and Lemieux, 2010).

I implement a regression discontinuity design to examine the effect of compensation shocks induced by missing relative performance goals on insider trading. In my baseline regressions, I use the sample of relative performance grants with the running variable, i.e., *actual minus goal*, within 5% around zero. I first test the effect of missing a relative performance goal on abnormal incentive compensation by running the following regression,

$$Abnormal\ incentive\ pay_{i,t} = c + \alpha_1 I_{i,j,t}^{miss} + \alpha_2 Actual\ minus\ goal_{i,j,t} + \alpha_3 I_{i,j,t}^{miss} \times Actual\ minus\ goal_{i,j,t}\left[+\boldsymbol{\gamma} X_{i,t-1}\right] + \varepsilon_{it}, \quad (1)$$

[10] Some contracts explicitly state that the performance grants are under the discretion of the compensation committee, in which case the actual payout may not strictly follow the pre-defined payout schedule.

where $Abnormal\ incentive\ pay_{i,t}$ is the abnormal incentive pay received by the CEO of firm *i* in year *t*, $I_{i,j,t}^{miss}$ is an indicator that equals one if firm *i*' actual performance on metric *j* at performance period end *t* is below its corresponding performance goal and zero otherwise, $Actual\ minus\ goal_{i,j,t}$ is the difference between firm *i*' actual performance on metric *j* at performance period end *t* and its corresponding performance goal, and $X_{i,t-1}$ is a vector of firm and CEO characteristics. I measure prior stock returns, share repurchases, and discretionary accruals as of the end of the performance period. All other characteristics are measured in year *t* – 1, i.e., the fiscal year ending 12 months before the performance period-end. Under the random assignment assumption of RDD, it is not necessary to control for the term in brackets, i.e., firm and manager characteristics. Including these controls, however, could help reduce the sampling variability in the estimator (Lee and Lemieux, 2010). I thus run the regression with and without the term in brackets. I cluster standard errors at the firm level. The coefficient of interest, α_1, measures the local average treatment effect of missing a relative performance goal on CEO compensation.

I then use a reduced-form model to test the impact of missing a relative performance goal on insider trading. I run the following regression,

$$Abnormal\ insider\ trading\ profit_{i,t+1} = c + \beta_1 I_{i,j,t}^{miss} + \beta_2 Actual\ minus\ goal_{i,j,t} + \beta_3 I_{i,j,t}^{miss} \times Actual\ minus\ goal_{i,j,t}\left[+\boldsymbol{\theta} X_{i,t-1}\right] + \epsilon_{it}, \quad (2)$$

where $Abnormal\ insider\ trading\ profit_{i,t+1}$ is the abnormal profits the CEO of firm *i* earns from insider trading in a 12-month period following the performance period-end, i.e., year *t* +1, scaled by the CEO's total compensation in year *t* – 1, and $I_{i,j,t}^{miss}$, $Actual\ minus\ goal_{i,j,t}$, and $X_{i,t-1}$ are as defined above. I cluster standard errors at the firm level. The coefficient of interest,

β_1, measures the local average treatment effect of missing a relative performance goal on subsequent insider trading profitability.

3.2. Validity of the RDD

There are two primary concerns regarding the validity of regression discontinuity approach (Imbens and Lemieux, 2008), the first of which is the manipulation of the running variable around the cutoff. If a firm can precisely manipulate its performance metric to beat the performance goal right around the cutoff, it violates the quasi-experimental assumption that the assignment of the treatment group should be "as good as randomized". I test whether actual performance exhibits bunching on one side of performance goals. The second concern is the presence of differences other than the treatment effect around the cutoff. I compare various firm and CEO characteristics between CEOs that narrowly miss and those that narrowly beat their relative performance goals.

A. Continuity of the density of the running variable

The underlying assumption of RDD is that the running variable cannot be precisely manipulated to be just above or below the performance cutoff. The relative performance metric used in the CEO incentive grant is determined by other firms' performance during the same performance period. Because of the contemporaneous feature of this benchmark, it is plausible that managers cannot perfectly control whether their performance is above or below a relative goal in a narrow range around the goal. McCrary (2008) develops a test for continuity of the running variable density function to detect manipulation of the running variable around the cutoff point. I implement this density test and plot the estimated density function of *actual minus goal* in a bandwidth of 10%. Figure 1 shows that there is no bunching on either side of the cutoff and the density function is

smooth at the cutoff. The McCrary test statistics is -0.11, which fails to reject the null hypothesis of continuity. This result is consistent with Bennet et al. (2017), who find no evidence of performance bunching around relative performance goals.

[Insert Figure 1 about here]

B. Continuity of other covariates

One of the important implications of the RDD identification assumption is that there are no discontinuous characteristics directly affecting the outcome variable around the cutoff other than the treatment effect. If any discontinuity in covariates is detected, it would imply a failure of the underlying assumption of RDD. Although not all covariates are observable, I follow the standard analysis in RDD framework and test the continuity in the distribution of observable covariates around the cutoff. I consider various firm characteristics, including total assets, market-to-book, leverage, investments, return on asset, analyst coverage, institutional ownership, prior market-adjusted returns, share repurchase, and discretionary accruals, as well as CEO characteristics, including CEO age, tenure, total compensation, fraction of stock awards, CEO ownership, and CEO stock-based wealth. I run a linear regression of each characteristic on the indicator for missing performance goals, the running variable, and an interaction term combining the two variables, with industry and year fixed effects using a 5% bandwidth around the cutoff. The first column of Table 2 shows that none of the coefficients on the indicator for missing relative performance goals are statistically significant, suggesting that the distribution is smooth around the cutoff. Notably, prior one- and three-year abnormal stock returns do not exhibit discontinuity at the cutoff, mitigating the concern that missing a performance goal might induce negative wealth effects due to the loss in the value of CEOs' existing stock holdings. Also, there is no discontinuity in discretionary

accruals or share repurchases around the cutoff, suggesting that CEOs that beat relative performance goals do not systematically manage earnings or repurchase shares. These results confirm that managers cannot precisely manipulate their performance. I then compare these characteristics in a narrow range of 5% on each side of the performance cutoff. The second through fourth columns of Table 2 report the means of each characteristic for the two groups as well as a *t*-test on the difference between the means. The *p*-values in the last column shows that none of the characteristics are significantly different between CEOs that just beat and those just miss relative performance goals, suggesting that the two groups of CEOs have balanced observable covariates. Thus, I fail to reject the assumption of randomization in the data. This allows me to use missing performance goals right around the cutoff to identify the effect of compensation shocks on insider trading.

[Insert Table 2 about here]

4. Empirical Results

4.1. The effect of missing relative performance goals on CEO compensation

I first present the graphical evidence of discontinuity in the abnormal incentive pay by plotting the means for each bin of the running variable, i.e., the difference between actual performance and performance goals, together with fitted lines on both sides of the cutoff. The sample is restricted to grants for which the running variable is within narrow bands of 10% on both sides of the cutoff. Figure 2 shows a strong discontinuity in the abnormal incentive pay at the cutoff. The jump in the abnormal incentive compensation at the cutoff is about 15% of total compensation, suggesting that missing performance goals has a large impact on abnormal incentive pay.

[Insert Figure 2 about here]

I estimate Eq. (1) to formally test the effect of missing a relative performance goal on CEO compensation. Table 3 reports the results. I start from a specification that includes only the indicator for missing performance goals, the running variable, and their interaction term as regressors. Column 1 shows that the coefficient on the indicator for missing performance goals is -0.130, suggesting that abnormal incentive pay as a fraction of total compensation drops by 13.0% at the cutoff. This number is similar in magnitude to the estimate presented in the graphical analysis. I then include year fixed effects, contract type fixed effects, and firm and CEO characteristics as controls in the regression. Year fixed effects absorb variation in abnormal incentive compensation over time. I sort compensation contracts into four types along two dimensions, i.e., whether a threshold or target goal is used as the performance benchmark and whether it is a stock or cash award. The inclusion of contract type fixed effects allows me to control for heterogeneity across different types of compensation contracts. Columns 2 and 3 show that the estimate of the coefficient on the miss indicator is largely unchanged, again confirming that missing a relative performance goal is independent of these observable characteristics.

[Insert Table 3 about here]

The economic magnitude of the effect of missing performance goals on abnormal incentive pay is large. For example, since the mean for total compensation in my sample is $9.7 million, a 13% loss amounts to a pay cut of $1.3 million. This number is about one third of the total dollar value of stock awards for the average CEO, which is around $3.8 million.[11] Thus, missing relative

[11] A CEO's compensation package commonly contains more than one incentive award and hence more than one performance goal. Therefore, missing one performance goal only affects part of the total incentive payout. Also, incentive awards are often designed to have staggered payouts at discrete values of the performance metric. Missing one performance goal makes the CEO lose one portion of the incentive awards.

performance goals has a large negative impact on executive compensation, which may lead managers to take actions to make up for the loss in compensation.

4.2. The effect of missing relative performance goals on abnormal insider trading profits

There are at least two reasons why missing relative performance goals could prompt CEOs to earn abnormal profits from insider trading. The first is diminishing marginal utility of income, which is a standard assumption in economics. Specifically, because of the large negative shock to their compensation, CEOs who narrowly miss a relative performance goal would, relative to those who narrowly beat one, derive a higher marginal utility from an additional dollar of abnormal profits from insider trading. The second reason is reference point and loss aversion. In particular, CEOs whose actual performance is close to a relative performance goal may treat the compensation associated with meeting the goal as a reference point and exhibit loss aversion when they narrowly miss the goal. In other words, CEOs derive utility from gains and losses relative to an expected level of compensation and the negative effect of losses in compensation on utility is larger in magnitude than the positive effect of gains (Kahneman and Tversky, 1979).[12] This suggests that CEOs who narrowly miss a performance goal and hence suffer a loss in compensation would derive a higher marginal utility from an additional dollar of insider trading profits than otherwise similar CEOs who narrowly beat the goal. Importantly, the cost of exploiting private information in insider trading is arguably the same between CEOs who narrowly miss a goal and those who narrowly beat one, because they are equally likely to get caught and face the same penalties,

[12] A number of studies find evidence consistent with loss aversion in various settings. For example, Coval and Shumway (2005) show that professional traders that lose money in the morning take on more risk in the afternoon. Rizzo and Zeckhauser (2003) find that physicians whose income falls short of their reference points take unappealing actions to boost their income. Camerer, Babcock, Loewenstein, and Thaler (1997) find that taxi drivers work longer hours on low-wage days and quit early on high-wage days, suggesting that they are averse to falling below a target income.

including the present value of future compensation and benefits forfeited. Therefore, missing relative performance goals may induce CEOs to earn abnormal profits from insider trading.

I first present the graphical evidence of discontinuity in abnormal insider trading profits by plotting the means for each bin of the running variable, i.e., the difference between actual performance and performance goals, together with fitted lines on both sides of the cutoff. The sample is again restricted to grants for which the running variable is within narrow bands of 10% on both sides of the cutoff. Figure 3 shows a strong discontinuity in abnormal insider trading profits at the cutoff. The jump in abnormal insider trading profits at the cutoff is about 8% of total compensation, suggesting that missing performance goals induces corporate managers to exploit insider information in their trades.

[Insert Figure 3 about here]

I estimate Eq. (2) to formally test the effect of missing relative performance goals on the profitability of insider trading. Table 4 reports the regression results. I again start from a specification without any controls and add year and contract type fixed effects as well as firm and CEO characteristics in steps. The coefficient of the indicator for missing relative performance goals ranges from 0.077 to 0.082, suggesting that CEOs who just miss a relative performance goal earn significantly higher abnormal profits from insider trading than otherwise similar CEOs who just beat one.

[Insert Table 4 about here]

In the fuzzy RDD framework, the causal effect of compensation shocks on abnormal insider trading profits is the ratio of the discontinuity in abnormal insider trading profits at the cutoff obtained from the reduced-form regression to the discontinuity in abnormal incentive pay at the cutoff obtained from the first-stage regression.[13] Using the estimates from the regressions with (without) fixed effects and controls, the causal effect of compensation shocks on abnormal insider trading profits is 0.681 (0.592). This suggests that CEOs use insider trading to make up for about 60% to 70% of the loss in compensation, which is economically substantial.

4.3. Cash vs. equity awards

In an equity award, CEOs who beat their performance goals will receive shares in their own firms and hence might have an increased incentive to trade for diversification purposes, which may explain the lower insider trading profits for these CEOs. In contrast, this diversification story would not play a role in cash-based incentive awards, because the payouts from these awards are cash and thus do not change the need for diversification. If the diversification channel drives the results on abnormal insider trading profits, the effect should be present only for equity awards, but not for cash awards. To test this prediction, I repeat the reduced-form regression on the subsamples of equity awards and cash awards separately. The results, reported in Table 5, show that the effect holds for both subsamples. The coefficient of interest for cash and stock awards in regressions with year and contract type fixed effects and the full set of controls is 0.106 (significant at the 10%

[13] OLS regressions of insider trading profits on *actual minus goal* suffer from omitted variable bias, because *actual minus goal* could be correlated with a number of factors that can directly affect abnormal profits from insider trading. For example, a higher *actual minus goal* could be due to a relatively low goal and hence may indicate weak corporate governance, which can positively impact insider trading profitability. Also, a more positive *actual minus goal* could increase the value of the CEO's holdings in the company, which could reduce the incentive to engage in opportunistic insider trading. Because of these confounding factors, regressing abnormal insider trading profits on *actual minus goal* would produce biased estimates.

level) and 0.070 (significant at the 5% level), respectively, suggesting that the diversification story is not a main driver of the observed results.

[Insert Table 5 about here]

4.4. The effect of missing relative performance goals on management disclosure choices

So far, the results suggest that missing relative performance goals induces CEOs to make abnormal profits from insider trading. In order to exploit their private information, corporate managers may withhold information from outside investors by reducing voluntary guidance disclosures. Since the release of earnings forecasts by management tends to decrease information asymmetry between managers and outside shareholders (e.g., Trueman, 1986), managers who receive a negative compensation shock may strategically reduce the release of information to gain an informational advantage in trading their firms' stocks.

To test this, I retrieve data on earnings and sales guidance issued by management from I/B/E/S. I construct two measures for management earnings and sales guidance. The first is the logarithm of one plus the number of earnings and sales guidance disclosures issued during a 12-month period following a performance period-end, and the second is an indicator for whether the firm issues earnings and sales guidance in the 12-month period. Table 6 shows that, relative to managers that just beat a relative performance goal, those that just miss one are less likely to provide earnings and sales guidance, suggesting that managers strategically withhold information to increase their informational advantage. The economic magnitude of this effect is large. For example, the difference in the likelihood of making voluntary guidance disclosures between firms that narrowly miss and those that narrowly beat relative performance goals is 23.6 percentage points, which is

large given that the mean likelihood of providing guidance disclosures is 67.3% in my sample. These results lend further support to the interpretation that managers that miss relative performance goals act strategically to increase the gains from insider trading.

[Insert Table 6 about here]

4.5. Robustness checks

A. Pre-existing differences in abnormal insider trading profits

If for some reason CEOs with a greater tendency to exploit private information in their insider trades happen to have a higher likelihood of narrowly missing relative performance goals, the observed results on abnormal insider trading profits might be spurious. The insignificant differences in firm and CEO characteristics between CEOs who narrowly miss performance goals and those who narrowly beat them (discussed in Section 3.2) suggest that this is unlikely to be the case. Nevertheless, to rule out the possibility that the results on insider trading profits are driven by pre-existing differences between the two groups of CEOs, I examine discontinuities in abnormal insider trading profits around the cutoff during the periods prior to the performance period-end. I replace the dependent variable in Eq. (2) with abnormal insider trading profits earned during periods before the performance period-end. I consider three 12-month periods before the performance period-end. Year t is the 12-month period that ends in the same month as the performance period-end. Years $t - 1$ and $t - 2$ are 12-month periods that end 12 and 24 months before the performance period-end, respectively. Table 7 shows that the coefficient of interest is insignificant and close to zero.[14] This result further strengthens the validity of the RDD assumption that there is no discontinuity around the performance cutoff other than the compensation shock.

[14] I conduct similar tests for guidance disclosures and find that there is no discontinuity around the cutoff in guidance disclosures during the period prior to the compensation shock.

[Insert Table 7 about here]

B. Alternative bandwidths

The choice of bandwidths in RDD involves a trade-off between bias and variance (Roberts and Whited, 2013). If there are sufficient data close enough to the cutoff on both sides, comparing the average of the outcomes of those to the left of the cutoff and those to the right will yield the treatment effect. In practice, a wider bandwidth around the cutoff may be necessary to ensure reasonable statistical power. To check the sensitivity of my results to the choice of bandwidths, I repeat the first-stage and reduced-form regressions using different bandwidths ranging from 3% to 15%. For bandwidths of 3% and 5%, I use a piecewise linear function in the running variable. For bandwidths greater than 5%, I use piecewise cubic polynomials, because Figures 2 and 3 suggest that higher order polynomials are necessary to fit the observations. The results, reported in Table 8, show that the coefficient of interest is significant and relatively stable across different bandwidths.

[Insert Table 8 about here]

C. Nonparametric estimation

Since there is no particular reason to assume that abnormal incentive pay and abnormal insider trading profits are linear functions of the running variable, for robustness I use a nonparametric approach. Specifically, I follow Calonico, Cattaneo, and Titiunik (2014) and use local linear regression to estimate the discontinuity in abnormal incentive pay and abnormal insider trading profits at the cutoff. This approach uses mean squared error optimal bandwidth selector of Imbens and Kalyanaraman (2012) and improves the bandwidth selector with a bias-corrected procedure. I

perform non-parametric estimations using three different procedures, i.e., conventional RD estimates with a conventional variance estimator, bias-corrected RD estimates with a conventional variance estimator, and bias-corrected RD estimates with a robust variance estimator, all with triangular kernel functions. To minimize the influence of extreme values and errors in the data on performance goals, I restrict the sample to incentive grants for which the running variable falls within the 10th and 90th percentile. The sample includes 1,051 grants. The optimal bandwidth estimated following Calonico et al. (2014) is 7.5% for the first stage and 5.5% for the reduced form, which are close to the bandwidth I use in the baseline regressions.

Table 9 reports the results from the nonparametric estimation. The magnitude of the coefficient of interest is very similar to that obtained using the baseline regressions. For example, the discontinuity in abnormal incentive pay ranges from -0.152 to -0.162, and that in abnormal insider trading profits ranges from 0.080 to 0.094.

[Insert Table 9 about here]

D. Alternative measures of abnormal insider trading profits

For robustness, I use alternative measures of abnormal insider trading profits. First, I use three alternative benchmarks to adjust returns. Specifically, I use DGTW characteristics-adjusted returns, size-adjusted returns, and industry-adjusted returns as measures of abnormal returns in the calculation of abnormal insider trading profits. Panel A of Table 10 shows that the results using these alternative measures are largely similar to those obtained using the baseline measures.

Second, I consider three alternative holding periods for measuring trading profits, i.e., 1 month (21 trading days), 3 months (63 trading days), and 12 months (252 trading days). Panel B of Table 10 shows that, across all three alternative holding periods, CEOs who just miss their performance goals consistently earn higher abnormal insider trading profits than those who just beat their performance goals. The magnitude of profits as a fraction of lagged total compensation increases as the holding horizon is extended, from 1.6% over a one-month holding period to 15.0% over a one-year holding period. This result suggests that missing relative performance goals induces CEOs to exploit relatively long-lived information about their companies' fundamentals.

[Insert Table 10 about here]

4.6. Discussion of results

A. Alternative interpretations

Managerial effort allocation. Missing a relative performance goal might induce CEOs to shift their effort away from improving their firms' performance and towards other activities such as insider trading. This effort allocation story might drive the observed difference in abnormal insider trading profits at the cutoff. To test this, I run RD regressions similar to Eq. (2) with firm performance in the year immediately following the performance period-end as the dependent variable. I consider three performance measures, i.e., market-adjusted stock returns (over the next 12 and 36 months), return on assets, and profit margin. The results, reported in Table 11, show that the coefficient on the indicator for missing performance goals is insignificant across all performance measures. In particular, the abnormal stock returns over a one- and three-year period do not exhibit discontinuities at the cutoff. These results suggest that the observed results are unlikely to be driven by managerial effort allocation.

[Insert Table 11 about here]

Liquidity constraint. If CEOs that just miss a relative performance goal and hence receive a pay cut happen to be liquidity constrained, they might sell their stock holdings to raise cash to make up for the shortfall in liquidity.[15] I estimate RD regressions with the dollar value of CEOs' insider sales during the one-year period following the performance period-end divided by lagged total compensation as the dependent variable. In untabulated results, I find no discontinuity in insider selling around the cutoff.[16] This result casts doubt on the liquidity constraint story.

Tax-loss selling. Compared to CEOs that just miss a relative performance goal, those that just beat one receive a higher compensation and hence might have an incentive to engage in tax-loss selling of their stock holdings. Such tax-loss motivated trading might reduce the informativeness of trades placed by CEOs that just beat a relative performance goal and thereby drive the observed discontinuity in abnormal insider trading profits at the cutoff. To rule out this possibility, I test for discontinuity in tax-loss selling following the performance period-end. I use the dollar value of stock sold in December with negative 12-month past returns to approximate tax-loss selling (Grinblatt and Keloharju, 2001). I scale the number by lagged total compensation. I run RD regressions similar to Eq. (2) with the scaled tax-loss selling as the dependent variable. In untabulated results, I find that there is no discontinuity around the cutoff in tax-loss selling. Thus, tax-loss motivated trades seem unlikely to explain the observed results.

[15] For this story to explain the finding that CEOs that just miss their goals earn higher abnormal insider trading profits, the stock of the firms with such CEOs would have to underperform subsequently. However, as discussed above, there is no discontinuity in subsequent abnormal stock returns between CEOs who narrowly miss and those who narrowly beat their goals.

[16] In fact, the sign of the coefficient on the missing indicator is negative (although statistically insignificant), which is opposite to what one might expect under the liquidity constraint hypothesis.

B. External validity

While the RD design has strong internal validity, its external validity is generally limited because the estimation is based on a narrow bandwidth around the cutoff. Thus, while the firms/CEOs in the ±5% sample are very similar to those in the full sample of firms with relative performance goals (as Table 1 shows), my findings on the effect of compensation shocks on insider trading profits may not generalize to similar firms away from the cutoff. Nevertheless, since firms with relative performance benchmarks tend to be better governed than those without such benchmarks, one might speculate that the effect of compensation shocks on abnormal insider trading profits might be stronger among firms that do not use relative performance goals in their compensation contracts.

5. Conclusion

In this paper, I examine the effect of negative compensation shocks induced by missing relative performance goals on insider trading. Exploiting discontinuity in the payout schedule of grants based on relative performance goals, I first show that CEOs that just miss a relative performance goal, relative to those that just beat one, suffer a loss in incentive pay that is roughly 12% to 13% of their total compensation. I then show that CEOs that just miss a relative performance goal make abnormal profits from their insider trades following the performance period-end, amounting to around 8% of their total compensation. Thus, managers use insider trading to make up for over half of the loss in compensation due to missing performance goals. I also find evidence that managers that narrowly miss a relative performance goal become less likely to make voluntary guidance disclosures, suggesting that they strategically withhold information to increase their informational advantage.

My paper contributes to our understanding of the efficacy of performance-based compensation. Performance-based awards are designed to incentivize executives to improve shareholder value by increasing the pay-performance sensitivity. If managers can make up their compensation loss due to missing performance goals through abnormal profits from insider trading, it could mitigate the incentive effect of performance-based pay. Therefore, closer scrutiny of managerial actions, such as insider trades, may be necessary to improve the effectiveness of performance-based pay.

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Figure 1. Distribution of relative performance grants around the cutoff

This figure plots the number of relative performance grants as a function of the running variable, i.e., the difference between actual performance and the corresponding relative performance goal, in a 10% bandwidth around the cutoff of zero. Positive (negative) numbers on the horizontal axis indicate CEOs that beat (miss) their relative performance goals.

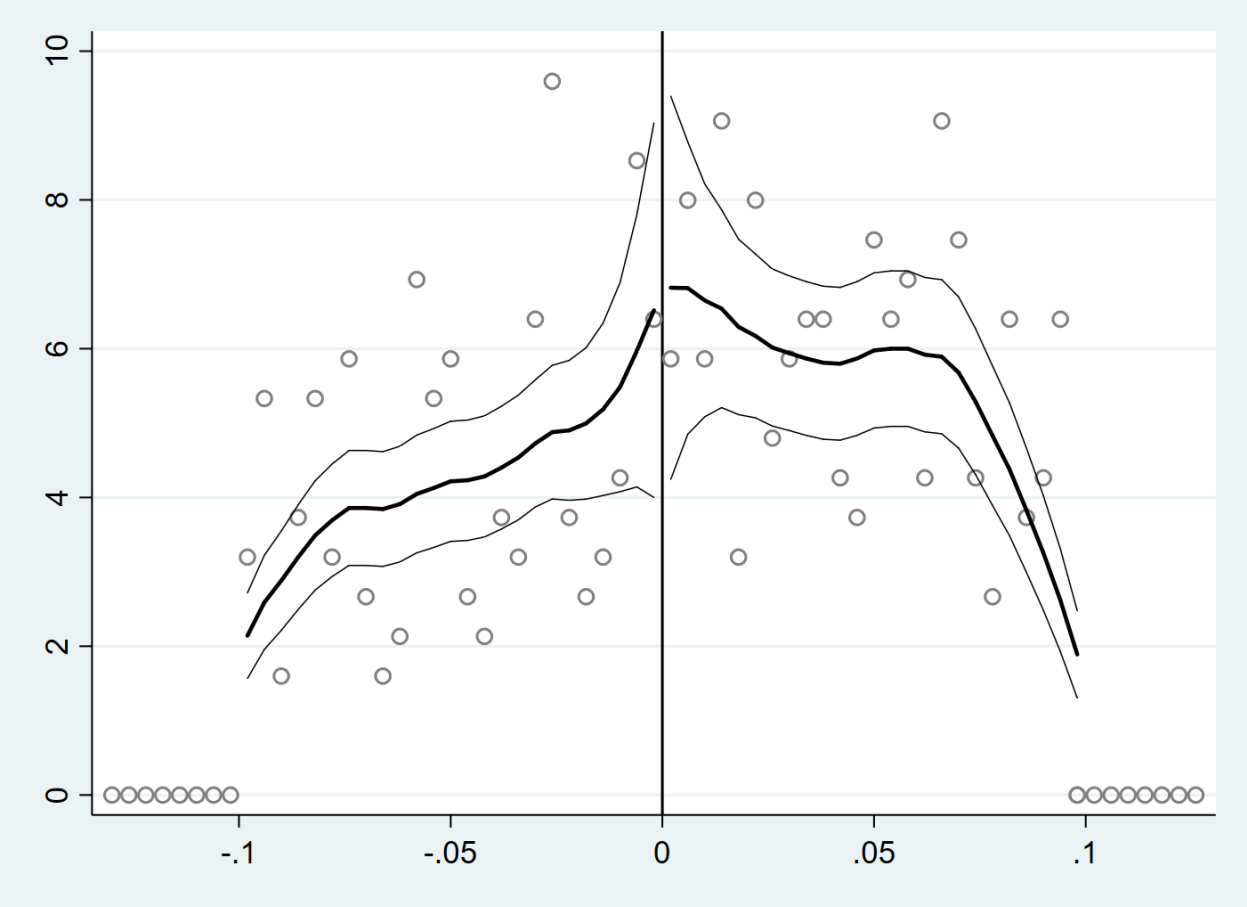

Figure 2. Abnormal performance-based compensation around the cutoff

This figure plots abnormal incentive pay as a function of the running variable, i.e., the difference between actual performance and the corresponding relative performance goal, in a 10% bandwidth around the cutoff of zero. Positive (negative) numbers on the horizontal axis indicate CEOs that beat (miss) their relative performance goals.

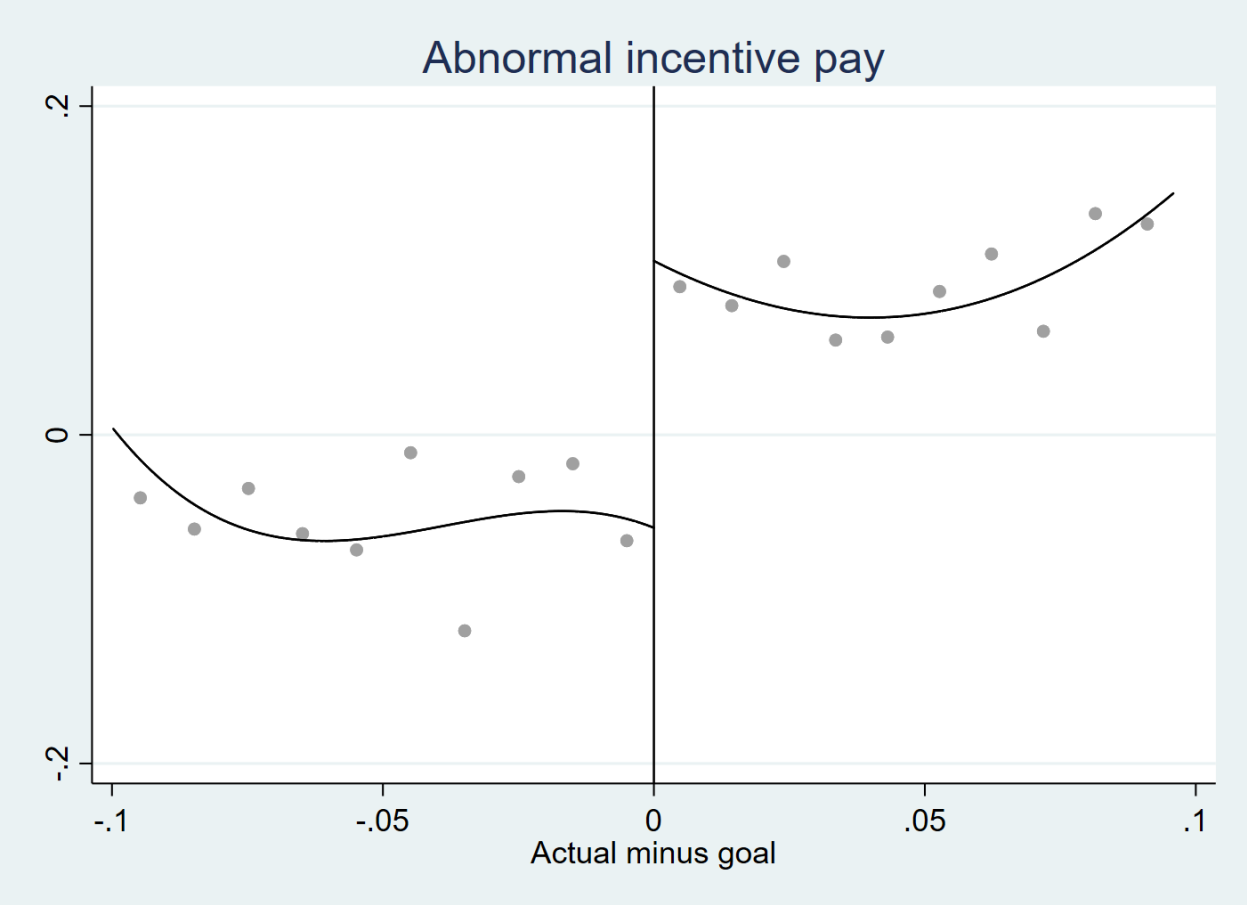

Figure 3. Abnormal insider trading profits around the cutoff

This figure plots abnormal insider trading profits as a function of the running variable, i.e., the difference between actual performance and the corresponding relative performance goal, in a 10% bandwidth around the cutoff of zero. Positive (negative) numbers on the horizontal axis indicate CEOs that beat (miss) their relative performance goals.

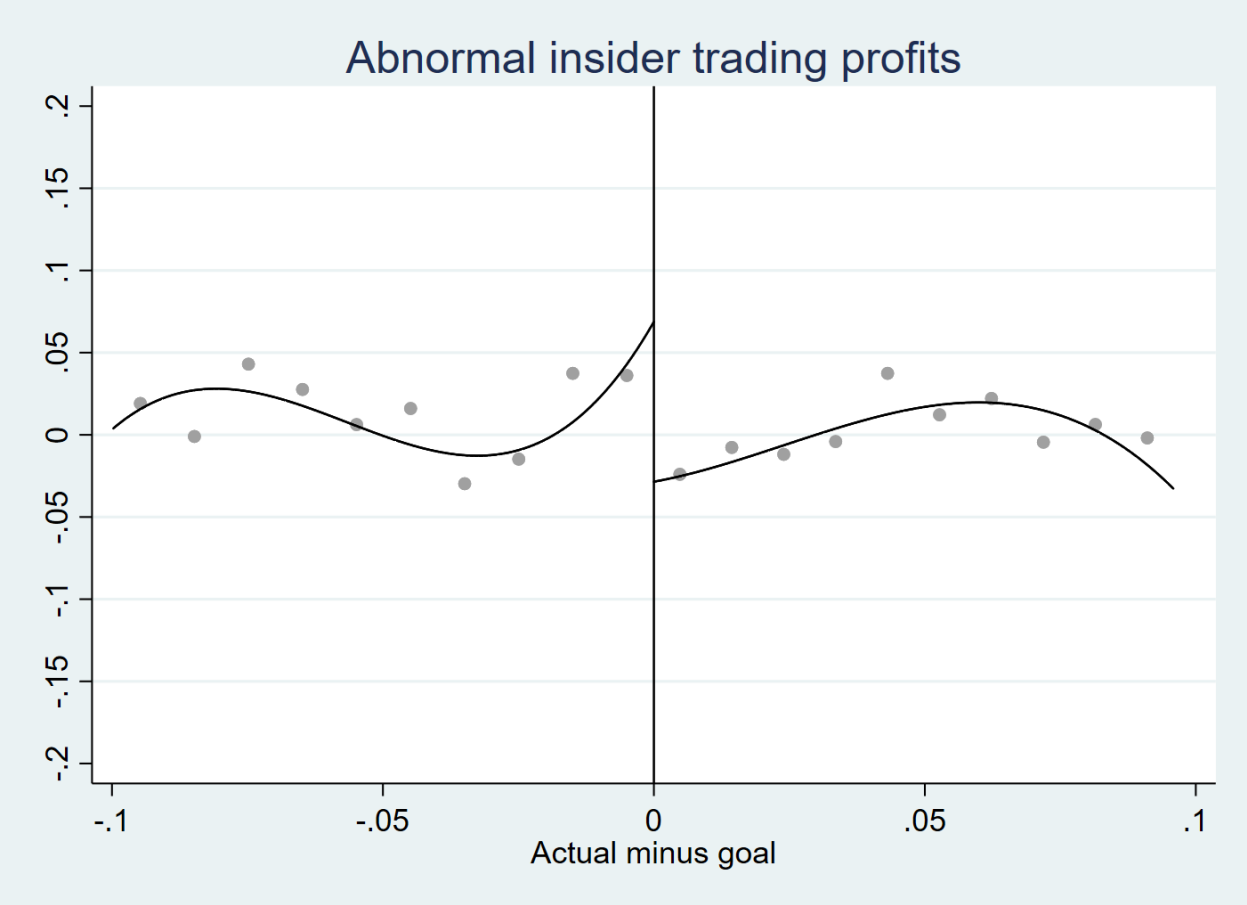

Table 1: Summary statistics

This table reports the summary statistics of main variables and control variables for the full sample (Panel A) and the ±5% sample (Panel B). *Actual minus goal* is the difference between the firm's actual performance and the corresponding relative performance goal. *Abnormal incentive pay* is the difference between actual incentive compensation earned and the expected incentive compensation payout specified in the grant, divided by the total compensation in the year ending 12 months before the performance period-end. *Abnormal insider trading profits* is the total dollar amount of abnormal profits of all trades took place during a 12-month period following the performance period-end divided by the total compensation in the year ending 12 months before the performance period-end. Abnormal insider trading profits of a trade are calculated as the product of the transaction value and the buy-and-hold market-adjusted stock return over the subsequent six months (i.e., 126 trading days). *Total assets* is the book value of total assets of the firm. *Market-to-book* is the market value of common equity divided by the book value of common equity. *Leverage* is the ratio of total assets minus book value of common stock and deferred taxes to total assets. *Return on assets* is the ratio of income before extraordinary items to book value of total assets. *Investment/Assets* is the ratio of the sum of capital expenditure and R&D expenses to total assets. *Number of analysts* is the number of analysts making quarterly forecasts for earnings per share of the firm's stock. *Institutional ownership* is the number of shares held by institutional investors as a fraction of the number of shares outstanding. *Prior* 1*-year (*3*-year) abnormal stock return* is the cumulative market-adjusted stock return in the 12-month (36-month) period ending on the performance period-end date. *Repurchase/Assets* is the dollar value of repurchase during fiscal year ending on or immediately before the performance period end divided by lagged total assets. Repurchase is defined following Fama and French (2001). *Discretionary accruals* is calculated using modified Jones model with ROA (following Kothari *et al*., 2005). *CEO Tenure* is the number of years since the individual became CEO. *Total compensation* is the total compensation as reported in SEC filings. *Stock awards* is the dollar value of stock-based compensation divided by the reported value of total compensation. *CEO ownership* is the ratio of total number of shares owned by the CEO to the total number of shares outstanding. *Stock-based wealth* is the sum of the dollar value of common stock holdings. All firm and CEO characteristics except prior stock returns, share repurchases, and discretionary accruals are measured in the fiscal year ending 12 months before the performance period-end. I measure prior stock returns, share repurchases, and discretionary accruals as of the end of the performance period. I winsorize the control variables at the 2.5% and 97.5% levels to minimize the effect of outliers.

Panel A. Full sample

	N	Mean	SD	P10	P50	P90
Main variables						
Actual minus goal	1,314	0.08	0.31	-0.28	0.04	0.53
Abnormal incentive pay	1,317	5.35%	21.60%	-20.65%	1.51%	37.83%
Abnormal insider trading profits	1,316	0.56%	6.70%	-6.92%	0.00%	8.49%
Control variables						
Total assets ($ millions)	1,317	27,390	43,905	2,249	9,676	67,801
Market-to-book	1,317	1.23	0.73	0.54	1.02	2.17
Leverage	1,317	0.59	0.17	0.38	0.59	0.86
Return on assets	1,317	0.04	0.05	0.00	0.04	0.11
Investment/Assets	1,317	0.07	0.06	0.00	0.06	0.15
Analyst coverage	1,317	9.23	7.71	2.00	7.00	21.00
Institutional ownership	1,317	0.73	0.24	0.46	0.79	0.96
Prior 1-year abnormal stock return	1,317	0.03	0.25	-0.27	0.03	0.33
Prior 3-year abnormal stock return	1,317	0.10	0.40	-0.41	0.10	0.60
Repurchase/Assets	1,317	0.02	0.03	0.00	0.00	0.07
Discretionary accruals	1,317	-0.02	0.14	-0.16	0.00	0.12
CEO age	1,302	56.42	5.25	49.00	57.00	63.00
CEO tenure (years)	1,303	5.87	4.67	1.00	5.00	13.00
Total compensation ($ thousands)	1,317	9,686	7,227	2,801	7,718	20,700
Stock awards/Total comp.	1,315	0.39	0.20	0.13	0.39	0.66
CEO ownership (%)	1,299	0.73	1.26	0.00	0.00	0.02
Stock-based wealth ($ thousands)	1,299	58,600	76,700	4,172	27,700	175,000

Panel B. ±5% sample

	N	Mean	SD	P10	P50	P90
Main variables						
Actual minus goal	245	0.00	0.03	-0.03	0.01	0.04
Abnormal incentive pay	245	2.32%	15.84%	-14.63%	0.46%	22.75%
Abnormal insider trading profits	245	0.00%	14.76%	-8.42%	0.00%	6.72%
Control variables						
Total assets ($ millions)	245	35,981	53,809	3,567	12,671	102,908
Market-to-book	245	1.14	0.58	0.54	1.05	1.90
Leverage	245	0.60	0.17	0.39	0.58	0.88
Return on assets	245	0.04	0.04	0.00	0.04	0.10
Investment/Assets	245	0.07	0.06	0.00	0.06	0.14
Analyst coverage	245	8.98	7.59	2.00	7.00	21.00
Institutional ownership	245	0.72	0.23	0.46	0.75	0.97
Prior 1-year abnormal stock return	245	-0.01	0.18	-0.23	-0.02	0.21
Prior 3-year abnormal stock return	245	0.08	0.31	-0.26	0.06	0.49
Repurchase/Assets	245	0.01	0.02	0.00	0.00	0.04
Discretionary accruals	245	-0.01	0.11	-0.10	0.00	0.09
CEO age	245	56.44	5.18	49.00	57.00	63.00
CEO tenure (years)	245	5.81	4.61	0.00	5.00	13.00
Total compensation ($ thousands)	245	10,300	8,063	2,629	7,774	25,000
Stock awards/Total comp.	245	0.37	0.20	0.11	0.35	0.65
CEO ownership (%)	245	0.64	1.13	0.00	0.00	0.02
Stock-based wealth ($ thousands)	245	68,700	85,600	4,245	31,400	216,000

Table 2: Distribution of firm and CEO characteristics around the cutoff

This table shows the distribution of firm and CEO characteristics is smooth in a narrow range of 5% on each side of the zero-cutoff for the running variable, i.e., *Actual minus goal*. *Actual minus goal* is the difference between the actual performance of stock or accounting metrics and the corresponding performance threshold or target from the relative performance awards. The first column reports the coefficient on the indicator for missing relative performance goals, i.e., I_{miss}, and the corresponding standard errors (in parentheses) from a linear regression of each characteristic on I_{miss}, *Actual minus goal*, I_{miss}×*Actual minus goal*, and industry and year fixed effects using a 5% bandwidth. The second and third columns report the means of each characteristic for firms that are to the left of the cutoff and those that are to the right within the 5% bandwidth, and the last column reports the *p*-values for the difference in the means between the two groups.

	RD estimate	[-5%, 0) Mean	[0, +5%] Mean	Diff. in means *p*-value
Log(Total assets)	-0.13 (0.26)	23.42	23.51	0.60
Market-to-book	0.13 (0.10)	1.10	1.17	0.40
Leverage	0.03 (0.03)	0.60	0.60	1.00
Return on assets	0.00 (0.01)	0.04	0.05	0.40
Investment/Assets	0.00 (0.01)	0.07	0.06	0.30
Log(1+Number of analysts)	-0.08 (0.15)	2.06	2.00	0.52
Institutional ownership	0.03 (0.05)	0.71	0.72	0.67
Prior 1-year abn. stock return	0.02 (0.04)	-0.03	0.00	0.28
Prior 3-year abn. stock return	-0.05 (0.06)	0.04	0.10	0.13
Repurchase/Assets	0.00 (0.00)	0.01	0.01	0.37
Discretionary accruals	0.00 (0.03)	0.00	-0.01	0.22
CEO age	-1.79 (1.11)	56.28	56.56	0.63
CEO tenure	-0.18 (1.17)	6.04	5.63	0.49
Stock awards/Total comp.	-0.14 (0.17)	15.77	15.90	0.19
CEO ownership	-0.02 (0.05)	0.36	0.39	0.25
Log(Stock-based wealth)	0.21 (0.16)	0.51	0.54	0.72

Table 3: The impact of missing relative performance goals on abnormal incentive pay

This table reports the regression results estimating Eq. (1) on the discontinuity in abnormal incentive pay around relative performance goals with a bandwidth of 5%. The variable of interest is the I_{miss} indicator, which equals one for CEOs who miss their relative performance goals and zero otherwise. See Table 1 for the definition of other variables. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Dependent =	*Abnormal incentive pay*		
	(1)	(2)	(3)
I_{miss}	-0.130	-0.130	-0.119
	(0.03)***	(0.03)***	(0.04)***
Actual minus goal	-0.206	-0.164	-0.482
	(0.81)	(0.85)	(0.82)
I_{miss} × Actual minus goal	0.282	0.128	1.015
	(1.06)	(1.10)	(1.13)
Log(Total assets)			0.005
			(0.01)
Market-to-book			-0.003
			(0.03)
Leverage			0.033
			(0.03)
Return on assets			0.486
			(0.36)
Investments/Assets			-0.254
			(0.18)
Institutional ownership			0.009
			(0.02)
Log(1+Number of analysts)			-0.032
			(0.06)
Prior 1-year abn. stock return			0.120
			(0.06)*
Prior 3-year abn. stock return			-0.090
			(0.05)*
Repurchase/Assets			-0.046
			(0.43)
Discretionary accruals			-0.005
			(0.08)
CEO age			0.003
			(0.00)
CEO tenure			-0.002
			(0.00)
Log(Total compensation)			-0.007
			(0.02)
Stock awards/Total comp.			0.122
			(0.07)*
CEO ownership			0.313
			(1.15)
Log(Stock-based wealth)			0.012
			(0.02)
Year FEs	No	Yes	Yes
Contract type FEs	No	Yes	Yes
No. of observations	245	245	245
R^2	0.16	0.23	0.29

Table 4: The effect of missing relative performance goals on abnormal insider trading profits

This table reports the regression results estimating Eq. (2) on the discontinuity in abnormal insider trading profits around relative performance goals with a bandwidth of 5%. The variable of interest is the I_{miss} indicator, which equals one for CEOs who miss their relative performance goals and zero otherwise. See Table 1 for the definition of other variables. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Dependent =	*Abnormal insider trading profits*		
	(1)	(2)	(3)
I_{miss}	0.077	0.082	0.081
	(0.03)**	(0.03)***	(0.03)***
Actual minus goal	1.135	1.379	1.326
	(0.67)*	(0.70)*	(0.77)*
I_{miss} × Actual minus goal	0.549	0.128	0.150
	(1.20)	(1.06)	(0.92)
Log(Total assets)			0.013
			(0.01)
Market-to-book			0.052
			(0.02)**
Leverage			-0.013
			(0.03)
Return on assets			-0.315
			(0.23)
Investments/Assets			0.164
			(0.12)
Institutional ownership			0.008
			(0.02)
Log(1+Number of analysts)			-0.014
			(0.03)
Prior 1-year abn. stock return			-0.039
			(0.06)
Prior 3-year abn. stock return			0.043
			(0.05)
Repurchase/Assets			-0.272
			(0.16)*
Discretionary accruals			-0.026
			(0.04)
CEO age			-0.002
			(0.00)
CEO tenure			0.000
			(0.00)
Log(Total compensation)			-0.034
			(0.02)*
Stock awards/Total comp.			0.055
			(0.07)
CEO ownership			-0.422
			(0.30)
Log(Stock-based wealth)			0.015
			(0.01)
Year FEs	No	Yes	Yes
Contract type FEs	No	Yes	Yes
No. of observations	245	245	245
R^2	0.02	0.11	0.18

Table 5: Cash versus equity awards

This table presents the regression results estimating Eq. (2) on the effect of missing relative performance goals on abnormal insider trading profits for the subsample of cash awards and that of equity awards separately using a bandwidth of 5%. The variable of interest is the I_{miss} indicator, which equals one for CEOs who miss their relative performance goals and zero otherwise. The coefficient estimates for the control variables are omitted for brevity. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Dependent =	*Abnormal insider trading profits*			
	Cash Awards		Equity Awards	
	(1)	(2)	(3)	(4)
I_{miss}	0.084	0.106	0.069	0.070
	(0.06)	(0.06)*	(0.03)**	(0.03)**
Controls	No	Yes	No	Yes
Year FEs	Yes	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes	Yes
No. of observations	59	59	186	186
R^2	0.25	0.63	0.12	0.20

Table 6. The effect of missing relative performance goals on manager disclosure choices

This table reports the regression analysis of the effect of missing relative performance goals on earnings and sales guidance disclosures by management. The dependent variable in the first two columns is the logarithm of one plus the number of guidance disclosures issued during a 12-month period following a performance period-end, and that in the last two columns is an indicator for whether the firm issues guidance disclosures in the 12-month period. The coefficient estimates for the control variables are omitted for brevity. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Dependent =	*Log*(1+*No. of guidance disclosures*)		*Indicator for guidance disclosures*	
	(1)	(2)	(3)	(4)
I_{miss}	-0.586 (0.28)**	-0.553 (0.28)*	-0.280 (0.12)**	-0.236 (0.12)**
Controls	No	Yes	No	Yes
Year FEs	Yes	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes	Yes
No. of observations	245	245	245	245
R^2	0.08	0.21	0.08	0.23

Table 7: Pre-existing differences in abnormal trading profits as a function of performance outcomes

This table reports regression analysis of pre-existing differences in abnormal insider trading profits. I use a regression specification similar to Eq. (2), replacing abnormal insider trading profits in year t + 1 with those in years t, $t-1$, and $t-2$, respectively. The variable of interest is the I_{miss} indicator, which equals one if the CEO misses relative performance goals in year t and zero otherwise. All regressions include year fixed effects and contract type fixed effects. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Dependent =	*Abnormal insider trading profits*		
	t	$t-1$	$t-2$
I_{miss}	-0.020	0.022	-0.015
	(0.02)	(0.02)	(0.02)
Year FEs	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes
No. of observations	244	242	234
R^2	0.06	0.09	0.07

Table 8: Alternative bandwidths

This table presents the regression analysis of the effect of missing relative performance goals on abnormal incentive pay (Panel A) and abnormal insider trading profits (Panel B) using alternative bandwidths. All regressions include the full set of fixed effects and control variables as in the last column of Tables 3 and 4. I use piecewise linear polynomials for bandwidths of 3% and 5%, and piecewise cubic polynomials for bandwidths greater than 5%. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

	[-0.03, +0.03]	[-0.05, +0.05]	[-0.07, +0.07]	[-0.09, +0.09]	[-0.15, +0.15]
	(1)	(2)	(3)	(4)	(5)
Panel A: Abnormal incentive pay					
I_{miss}	-0.102	-0.119	-0.136	-0.112	-0.087
	(0.04)**	(0.04)***	(0.05)***	(0.04)**	(0.04)**
Controls	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes	Yes	Yes
No. of observations	166	245	352	432	631
R^2	0.33	0.29	0.23	0.22	0.14
Panel B: Abnormal insider trading profits					
I_{miss}	0.082	0.081	0.079	0.087	0.058
	(0.03)**	(0.03)***	(0.05)*	(0.04)**	(0.03)**
Controls	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes	Yes	Yes
No. of observations	166	245	352	432	631
R^2	0.27	0.18	0.15	0.15	0.10

Table 9. Nonparametric regressions

This table reports nonparametric regressions of the effect of missing relative performance goals on abnormal incentive pay and abnormal insider trading profits. Following Calonico, Cattaneo, and Titiunik (2014), I perform nonparametric estimations using three different procedures, i.e., conventional RD estimates with a conventional variance estimator, bias-corrected RD estimates with a conventional variance estimator, and bias-corrected RD estimates with a robust variance estimator, all with triangular kernel functions. To minimize the influence of extreme values and errors in the data on performance goals, I restrict the sample to incentive grants for which the difference between actual performance and performance goal is between the 10^{th} and 90^{th} percentile of *Actual minus goal*. The sample includes 1,051 grants. The optimal bandwidth estimated following Calonico et al. (2014) is 7.5% for the first stage and 5.5% for the reduced form, which is close to the baseline bandwidth.

Panel A. Abnormal incentive pay

Dependent =	*Abnormal incentive pay*			
Method	Coef.	Std. Err.	z	P>z
Conventional	-0.152	0.027	-5.709	0.000
Bias-corrected	-0.162	0.027	-6.099	0.000
Robust	-0.162	0.031	-5.273	0.000

Panel B. Abnormal insider trading profits

Dependent =	*Abnormal insider trading profits*			
Method	Coef.	Std. Err.	z	P>z
Conventional	0.080	0.040	2.035	0.042
Bias-corrected	0.094	0.040	2.387	0.017
Robust	0.094	0.046	2.068	0.039

Table 10. Alternative measures of abnormal insider trading profits

This table presents the regression analysis of the effect of missing relative performance goals on abnormal insider trading profits using alternative benchmarks to adjust returns (Panel A) and alternative windows for measuring trading profits (Panel B). All regressions include year fixed effects, contract type fixed effects, and the full set of control variables as in the last column of Tables 3 and 4. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Panel A: Alternative benchmarks to adjust returns

	DGTW	Size-adjusted	Industry-adjusted
I_{miss}	0.071 (0.04)*	0.081 (0.03)***	0.115 (0.05)**
Controls	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes
No. of observations	244	245	245
R^2	0.20	0.18	0.18

Panel B: Alternative windows for measuring trading profits

	21 days	63 days	252 days
I_{miss}	0.016 (0.01)*	0.031 (0.02)*	0.150 (0.04)***
Controls	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes
No. of observations	245	245	245
R^2	0.14	0.13	0.21

Table 11. Subsequent stock and operating performance

This table reports regression analysis of the impact of missing relative performance goals on firms' subsequent stock and operating performance using a bandwidth of 5%. 1-*year (*3-*year) abnormal return* is the market-adjusted stock return in the 12 (36) months immediately following the performance period-end. *ROA* is income before extraordinary items divided by the book value of total assets in the fiscal year subsequent to the performance period-end. *Profit margin* is earnings before interest and taxes divided by sales in the fiscal year following the performance period-end. All regressions include year fixed effects, contract type fixed effects, and the full set of control variables as in the last column of Tables 3 and 4. Numbers in parentheses are standard errors clustered by firm. Significance at the 10% (*), 5% (**), or 1% level (***) is indicated.

Dependent =	*1-year abnormal return*	*3-year abnormal return*	*ROA*	*Profit margin*
I_{miss}	-0.060	-0.007	0.004	0.001
	(0.05)	(0.08)	(0.01)	(0.02)
Controls	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Contract type FEs	Yes	Yes	Yes	Yes
No. of observations	245	245	241	241
R^2	0.18	0.35	0.44	0.33