TWO ESSAYS ON PERFORMANCE MEASURE CHOICE AND INVESTMENT DECISIONS

by

BO ZHANG

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Carol Marquardt

Date

Chair of Examining Committee

Joseph Weintrop

Date

Executive Officer

Carol Marquardt

Joseph Weintrop

Rong Huang

Rajarishi Nahata

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

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Adviser: Professor Carol Marquardt

This dissertation is composed with two essays. The first essay examines whether employing sales revenue as a performance measure in CEO annual bonus contracts affects R&D expenditures. Using hand-collected data from companies' proxy statements, I find that CEOs whose annual incentive compensation is explicitly tied to revenue performance are less likely to cut R&D expenditures. In addition, the results suggest that managers who have an incentive to avoid reporting an accounting loss by cutting R&D are less likely to do so when their annual bonus contracts are tied to revenue performance. The findings are robust to controlling for endogeneity in compensation contract design and investment decisions. The study provides new evidence on the role of performance measures on R&D expenditures. Specifically, the results suggest revenue-contingent annual incentive contracts are a potential mechanism that dissuades opportunistic reduction in R&D expenditures. In addition, the findings demonstrate the importance of the role of performance measures in directing corporate investment decisions.

In the second essay, I explore whether employing sales revenue as a performance measure in CEO annual bonus contracts affects merger decisions. Using hand-collected data from companies' proxy statements, I find that CEOs whose annual incentive compensation is explicitly tied to revenue performance are more likely to pursue acquisition activities. The association between revenue-contingent bonus plans and merger decisions is stronger for conglomerate and horizontal mergers than for vertical mergers. In addition, results suggest that acquirers with revenue-contingent bonus plans do not overbid, paying significantly smaller acquisition premiums. I also find that investors do not respond differently to bid announcements of firms with revenue-contingent bonus plans. The findings are robust to controlling for endogeneity in compensation contract design. The study provides new evidence on the impact of performance measures on firms' investment decisions.

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Chapter 1

Does Performance Measure Choice Influence R&D Expenditures?

1.1 Introduction

Investments in R&D generate future benefits by allowing firms to gain competitive advantages as well as by advancing companies' growth (e.g., Hall 1993; Lev and Sougiannis 1996). R&D cuts are often perceived negatively since the action might lower firm long-term value (e.g., Lev and Thiagarajan 1993). Since firms are required to expense R&D costs in the year they are incurred, managers may fail to invest adequately in R&D especially when firms are under market pressures to meet earnings benchmarks, and when managers are close to the end of their tenure (e.g., Baber et al. 1991; Bushee 1998; Cheng 2004; Dechow and Sloan 1991).

Executive compensation contracts are designed to align the interests of shareholders to those of managers so that managers will take actions that maximize shareholder value. Nonetheless, whether "you get what you measure and reward" is an open question that has been studied extensively in the executive compensation literature (e.g., Banker et al. 2001; Larcker 1983; Larcker 1987; Wallace 1997). This study investigates whether the choice of performance measures in executive compensation contracts influences managerial decisions on R&D spending. In particular, I examine the effect of sales revenue employed in CEO annual bonus contracts on corporate R&D expenditure decisions.

Sales revenue plays an important role in firm valuation (Ertimur et al. 2003; Ghosh et al. 2005; Jegadeesh and Livnat 2006; Penman 2004; Swaminathan and Weintrop 1991). Unlike firms with cost reduction supported earnings growth, firms with top-line driven earnings growth benefit from higher future performance (Ghosh et al. 2005). The debt market also compensates high risk firms with revenue-supported earnings growth by lowering costs of debt (Ghosh et al. 2010). In addition, the frequency of analysts' revenue forecasts has been significantly increasing over time, and management revenue guidance is the most common voluntary disclosure in conjunction with earnings guidance (e.g., Han and Wild 1991; Wasley and Wu 2006).

From a managerial contracting perspective, sales revenue performance measure is frequently adopted in executive annual incentive contracts. When managerial evaluations are based upon revenue performance, managers will be more likely to concentrate on activities that ultimately contribute to revenue growth, like investing in R&D. In addition, unlike aggregated earnings performance measures, disaggregated measures such as revenue and expense metrics are considered forward-looking and thus help to reduce agency costs and to alleviate managerial myopia (e.g., Bouwens and van Lent 2007; Dikolli 2001). Consistent with these arguments, Elliott et al. (2011) document that disaggregated management earnings forecasts reduce investors' susceptibility to earnings fixation and diminish pressures for myopic behavior.

Therefore, I argue that compensation contracting on revenue performance is a mechanism that may reduce incentives to cut R&D, especially in the presence of managerial "myopia" and horizon problems. Using hand-collected data from firms' proxy statements filed with the Securities and Exchange Commission (SEC), I find that CEOs whose annual incentive compensations are explicitly linked to revenue performance are significantly less likely to cut R&D spending than other CEOs. In addition, the results show that managers who are able to avoid reporting an accounting loss by cutting R&D are significantly less likely to do so when their annual bonus contracts are tied to revenue performance. Thus, the results suggest that by choosing sales revenue as a performance measure in executive bonus contracts, firms discourage opportunistic reduction in R&D spending.

Because executive incentive compensation and investment decisions may be jointly determined (e.g., Kang et al. 2006; Smith and Watts 1992), it is important to examine the economic factors that influence the decision to reward executives on revenue performance. I provide evidence indicating that this choice is associated with value relevance of revenue, the degree of industry competition and the operating strategy of the firm. To control for potential endogeneity between incentive compensation and investment choices, I use a simultaneous bivariate probit model (Greene 2003) to jointly predict the decision to employ revenue as a performance measure in CEO annual incentive contracts and the manager's investment decisions related to R&D spending. My results are robust to this design choice.

The study makes three main contributions to the existing literature. First, critics of executive annual bonus compensations often have voiced concern that they are tied to accounting performance measures, which induce short-sighted behavior. However, the claim is silent about types of financial performance measures adopted. In this study, I find that managers are less likely to cut R&D spending when their annual incentive compensations are explicitly tied to revenue performance, especially when managers are faced with incentives of avoiding reporting small earnings losses. The results suggest that revenue-contingent annual incentive contracts are a potential mechanism that dissuades opportunistic reduction in R&D spending.

Second, the findings of this study are relevant to regulators, policy makers, and investors. In 2006, the U.S. Securities and Exchange Commission (SEC) adopted rules that require companies to provide much more detailed information about their executive compensation plans, including the performance measures and goals used in incentive compensation programs. This requirement developed from the assertion by the SEC that if performance measures and goals are central to a company's decision-making process, these measures and goals must be disclosed to investors. However, many companies have failed to comply with these requirements (Robinson et al. 2011). My findings reveal the usefulness of performance measures in affecting managerial decisions. Therefore, it underscores the importance of enforcements and compliance of the disclosure rule.

Third, recent studies have begun to examine the factors that influence the choice of performance measures employed in executive annual bonus compensation, as well as the implications of this choice on managerial decision-making (e.g., Huang et al. 2011; Marquardt and Wiedman 2005; Shalev et al. 2010; Young and Yang 2011). I extend this literature by studying the economic determinants of using sales revenue as a performance measure. My findings further our understanding of compensation contract design and its impact on the firm.

The remainder of the paper is structured as follows. In section 2, I discuss prior research and develop hypotheses. I present the research design in section 3 and discuss the sample and descriptive statistics in section 4. In section 5, I provide empirical results. Endogeneity in compensation choice is examined in section 6. In section 7, I present robustness tests. Last, I conclude in section 8.

1.2 Literature Review and Hypothesis Development

R&D spending is one of the most important managerial investment decisions, as it is a crucial determinant of firm growth and productivity. Previous studies document a positive association between R&D and firm value. For example, Chan et al. (1990) find positive market reactions to announcements of increased in R&D spending, even when the announcement accompanied with an earnings decline. Chauvin and Hirschey (1993) provide evidence that R&D expenditures have positive effects on the market value of the firm. Moreover, R&D spending is a leading indicator of operating performance and stock returns (e.g., Eberhart et al. 2004; Hsu 2009; Lev and Sougiannis 1996).

However, R&D spending is subject to managerial discretion, and previous research suggests that managers are likely to cut back R&D when they are faced with the trade-off between short-term accounting performance and long-term value. For example, Baber et al. (1991) find evidence that managers of firms with small earnings declines cut R&D to increase earnings, which is consistent with survey evidence documented in Graham et al. (2005). In addition, Dechow and Sloan (1991) find that CEOs spend less on R&D when they approach retirement.

Previous studies have also examined the factors mitigating managerial myopic behavior in R&D spending. For example, Bushee (1998) documents a positive relationship between R&D and institutional ownership, suggesting that institutional holders serve a monitoring role in easing pressures for myopic investment behavior. Dechow and Sloan (1991) find that the reductions in R&D expenditures during CEOs' final years in office are mitigated through CEO stock ownership. In addition, Cheng (2004) documents that stock option grants serve a crucial role in offsetting potential incentives to underinvest in R&D.

I extend this line of research by examining whether the use of sales revenue as a performance measure in executive annual bonus contracts affects R&D investment decisions. Sales revenue is a frequently used performance measure in executive annual incentive plans. In fact, Towers Watson surveys document that sales revenue is one of the most prevalent financial performance measures employed in executive annual incentive contracts.[1] In addition, sales revenue is considered the key driver of shareholder value (e.g., Ghosh et al. 2005; Penman 2004). Previous research has examined the vital role sales revenue plays in both equity and debt markets (Chandra and Ro 2008; Ertimur et al. 2003; Ghosh et al. 2005; Ghosh et al. 2010;

[1]Towers Watson surveys conducted in 2005 and 2010 document that sales revenue is the single most frequently used performance measure in executive annual bonus contracts, with 31% and 34%, respectively, of survey respondents reporting its use.

Jegadeesh and Livnat 2006; Swaminathan and Weintrop 1991). Managers often voluntarily disclose projected revenue performance along with earnings guidance (e.g., Han and Wild 1991; Wasley and Wu 2006). Furthermore, the frequency of issuing analysts revenue forecasts has increased dramatically overtime (Ertimur et al. 2011; Jegadeesh and Livnat 2006). Rees and Sivaramakrishan (2006) find that the market awards a distinct equity premium to firms meeting revenue forecasts.

Despite the importance of sales revenue and its prevalence in compensation contracts, prior research has not explored how the use of sales revenue as a performance measure influences firms' investment policies, nor has it examined the economic determinants of firms' decisions to use revenue-contingent compensation contracts. It is this void in the literature that I seek to address.

Using sales revenue as a performance measure in executive annual bonus contracts may positively impact R&D investment decisions. First, R&D is a key contributor to revenue growth. Managers will tend to concentrate on activities, such as investing in R&D, which can drive revenue growth when their evaluations are explicitly linked to sales performance. Second, contracting on forward-looking performance measures can address the problem of managers overemphasizing on short-term performance (Dikolli 2001). Disaggregation of earnings into revenues and costs improves the predictability of future performance; thus disaggregated measures possess forward-looking properties (Fairfield et al. 1996; Bouwens and van Lent 2007). In addition, Elliott et al. (2011) provide evidence that disaggregated management forecasts reduce earnings fixation, a key driver of managers' myopic behavior. Therefore, revenue-contingent compensation may mitigate any tendency to cut R&D expenditures, especially in the presence of “myopia” and CEO horizon problems. This logic leads to the following hypotheses:

> **H1:** Managers are less likely to cut R&D when their annual bonus contracts are explicitly tied to revenue performance.
>
> **H2:** Managers are less likely to avoid reporting an accounting loss by cutting R&D when their annual bonus contracts are explicitly tied to revenue performance.
>
> **H3:** Managers are less likely to achieve earnings growth by cutting R&D when their annual bonus contracts are explicitly tied to revenue performance.
>
> **H4:** Managers are less likely to cut R&D as they approach retirement when their annual bonus contracts tied to revenue performance.

However, several forces may work against the above arguments. First, executive annual bonus contracts are often tied to more than one performance measure, and the majority of firms use at least one measure of earnings. Firms adopting sales as a performance measure may be more likely to use other profit measures, such as EPS, so that managers are also faced with pressures to meet earnings benchmarks. The positive ramifications from the use of revenue as a performance measure may not overcome competing incentives associated with the use of alternative profit measures. Second, the transformation of R&D into future revenues is highly uncertain and may not occur immediately. Consequently, there may be no influence of sales-based annual bonus plans on managers’ behavior of cutting R&D expenditures. To the extent that one or both of these two scenarios applies, the power of the empirical tests is reduced and biases me against finding evidence consistent with the above hypotheses.

In addition, the role of bonus compensation in influencing managerial decisions has been challenged since its magnitude is often relatively small compared to equity-based compensation. However, Murphy and Jensen (2011) present various arguments to highlight the importance of annual bonus plans in rewarding and directing managerial decisions. For example, they argue that "Incentive plans are ultimately effective only if the participants understand how their actions affect the payoffs they will receive and then act on those perceptions… Therefore, because the uncertainly between the executives' actions and the effects on his or her bonus may make the links between actions and ultimate rewards more or less clear bonus plans may well provide stronger incentives then equity-based plans, even when the magnitude of the payoff is smaller." Thus, I predict that annual bonus compensation will influence R&D spending, though its magnitude is relatively small.

1.3 Research Design

To examine whether the usage of sales revenue as a performance measure has an impact on managerial myopic behavior of cutting R&D spending, I follow Bushee (1998) and estimate the following probit model:

$$\begin{aligned} P\ \ CUTRD_{i,t} &= \alpha_0 + \alpha_1 SALES_{i,t} + \alpha_2 PCHGRD_{i,t} + \alpha_3 INDCHGRD_{i,t} + \alpha_4 CHGSALES_{i,t} \\ &+ \alpha_5 CHGCAPX_{i.t} + \alpha_6 LOGMVE_{i,t} + \alpha_7 TQ_{i,t} + \alpha_8 DIST_{i,t} + \alpha_9 LEVERAGE_{i,t} \\ &+ \alpha_{10} FCF_{i,t} + \alpha_{11} AVOIDLOSS_{i,t} + \alpha_{12} AVOIDDECLINE_{i,t} + \alpha_{13} CEOHOZ_{i,t} \\ &+ \alpha_{14} SALES_{it} * AVOIDLOSS_{i,t} + \alpha_{15} SALES_{i,t} * AVOIDDECLINE_{i,t} \\ &+ \alpha_{16} SALES_{it} * CEOHOZ_{i,t} + \alpha_{17} TENURE_{i,t} + \alpha_{18} CEOSHARES_{i,t} \\ &+ \alpha_{19} EQUITYCOMP_{i,t} + \alpha_{20} INSTHOLD_{i,t} + \epsilon_{i,t} \end{aligned} \tag{1}$$

In equation (1), *CUTRD* is a dummy variable that equals one when R&D is cut relative to the prior year, and zero otherwise. Specifically, *CUTRD* is set to one if R&D expenditure is decreased relative to the previous year. Consistent with Bushee (1998), R&D expenditure is scaled by number of shares outstanding. The key variable of interest is *SALES* , which is an indicator variable that equals one when sales revenue is explicitly mentioned in the company's proxy statement as a determinant of CEO annual bonus compensation, and zero otherwise. A significantly negative (positive) coefficient on *SALES* will suggest that managers are less (more) likely to decrease R&D expenditures when their annual incentive contracts are explicitly tied to revenue performance.

Other variables are taken from previous studies to control for other factors influential in cutting R&D expenditures (Bushee 1998; Berger 1993). The prior year's change in R&D (*PCHGRD*) is used to control changes in the firm's R&D opportunity sets. *PCHGRD* can be either positively or negatively associated with reduction in R&D. A positive relation between *PCHGRD* and *CUTRD* indicates that if a firm decreased R&D in the prior year, it becomes more costly to cut R&D, and a negative relation implies a declining or increasing in R&D opportunity set overtime (Bushee 1998). Change in industry R&D (*INDCHGRD*), defined as the average change in R&D of firms in the same industry as firm *i* in year *t*, is also included in model (1) to control for the change in industry R&D intensity (Bushee 1998; Cheng 2004). Industries are defined using the Fama-French 48 classifications.[2] I expect a negative coefficient on *INDCHGR*, suggesting that firms in industries with increasing (decreasing) R&D are less (more) likely to cut R&D expenditures.

Again, following previous studies (Berger 1993; Bushee 1998), change in sales (*CHGSALES*) and change in capital expenditures (*CHGCAPX*) are used to proxy for funds available for investment. R&D spending budgets are often related to sales revenue (Berger 1993). Thus, I expect a negative relation between changes in revenue and the probability of cutting R&D. The amount of capital expenditures is often positively associated with the level of R&D spending. Therefore, I expect a negative coefficient on *CHGCAPX*, suggesting firms with increasing (decreasing) capital expenditures are less (more) likely to reduce R&D expenditures.

Consistent with the model of Bushee (1998), I include firm size (*LOGMVE*), Tobin's Q (*TQ*), leverage (*LEVERAGE*), and free cash flow (*FCF*) to control for other firm characteristics.

[2] Results are not sensitive to other industry classifications, such as four-digit SIC industry codes.

Firm size is measured by log of market value of equity. Tobin's Q, measured as the market value of the firm's equity and debt over the book value of assets, is included in equation (1) to capture the marginal benefit-to-cost ratio of taking new investments (Berger 1993; Bushee 1998). I predict a negative coefficient on *TQ* since firms with higher Tobin's Q face higher costs of cutting R&D. *LEVERAGE* is defined as the ratio of book value of total debt (the sum of short-term debt and long-term debt) over total assets. Bushee (1998) suggests a positive coefficient on *LEVERAGE* since the leverage ratio represents potential debt covenant incentives to manage earnings. Therefore, the likelihood of cutting R&D to avoid debt covenant violation might be increasing in leverage ratio. In addition, free cash flow (*FCF*), defined as operating cash flow minus capital expenditures deflated by total assets, is included in equation (1) to proxy for possible financing needs or reduced funds available for investment (Bushee 1998). A negative relation with *CUTRD* suggests that firms with higher (lower) level of free cash flow are less (more) likely to cut R&D expenditures.

Following Bushee (1998), I include *DIST*, the distance between current year and prior year earnings, in equation (1) to capture the percentage of R&D that would need to be cut to achieve earnings growth. It is measured as the change in pre-tax, pre-R&D earnings over prior year's R&D. Firms with less negative (high) values of *DIST* (i.e., when firms experience reductions in pre-tax, pre-R&D earnings) are more likely to cut R&D to achieve meet earnings target. Therefore, I expect a positive coefficient on *DIST*.

Previous studies have documented that managerial behavior of cutting R&D expenditures is more likely to occur when firms are under market pressures to meet earnings benchmarks and when managers approach retirement (e.g., Baber et al. 1991; Bushee, 1998; Cheng 2004; Dechow and Sloan 1991). Therefore, I construct three variables to capture managerial incentives to cut R&D spending. First, *AVOIDLOSS* is an indicator variable that equals one if pre-tax earnings before R&D spending in the current year ($EBTRD_t$) is larger than zero but smaller than R&D spending in the prior year (RD_{t-1}), and zero otherwise. Firms with *AVOIDLOSS* equal to one would report losses if they kept R&D spending at the prior year's level but would report profits by cutting R&D spending. Therefore, I expect the coefficient on *AVOIDLOSS* to be positive, suggesting that firms are more likely to cut R&D when they face the incentive of avoiding losses.[3]

Second, *AVOIDDECLINE* is a dummy variable that equals one if pre-tax earnings before R&D in the current year is less than or equal to the prior year's but greater than prior year's earnings before taxes (i.e., $EBT_{t-1} < EBTRD_t \leq EBTRD_{t-1}$), and zero otherwise. Firms with *AVOIDDECLINE* equal to one would fail to achieve non-negative earnings growth without R&D cuts, but could meet the goal by cutting R&D. Therefore, I expect the coefficient on *AVOIDDECLINE* to be positive, indicating that firms are more likely to cut R&D when they face the incentive of achieving earnings growth.[4]

More importantly, I examine the interaction terms between the sales performance measure and the above two incentive variables, defined as *SALESAVOIDLOSS* and *SALESAVOIDDECLINE*, respectively, to shed light on H2 and H3. A significantly negative (positive) coefficient on the two interactions indicate that when managers' annual incentive compensations are explicitly tied to revenue performances, they are less (more) likely to cut R&D expenses when firms are faced with reporting small earnings losses and small earnings declines.

[3] In contrast to firms in the *AVOIDLOSS* group, firms with $EBTRD_t < 0$ show losses even before considering R&D cuts and firms with $EBTRD_t > RD_{t-1}$ show profits even if current year R&D is maintained at the prior year's level; both of these groups of firms have less incentives to cut R&D.

[4] In contrast to firms in the *AVOIDDECLINES* group, firms with $EBTRD_t \geqslant EBTRD_{t-1}$ show growth even before considering R&D cuts, and firms with $EBTRD_t < EBT_{t-1}$ have no way to meet the reporting goal by cutting R&D.

Third, *CEOHOZ* is an indicator variable that equals one if the CEO is at least 63 years old, and zero otherwise (Cheng 2004). I expect the coefficient on *CEOHOZ* to be positive since prior research suggests that managers are more likely to engage in R&D cuts when they approach retirement (Dechow and Sloan 1991). To shed light on H4, I include the interaction term between sales performance measure and horizon variable, *SALESCEOHOZ*, in equation (1). A significantly negative (positive) coefficient on the interaction term indicates that when managers' annual incentive compensations is explicitly tied to revenue performance, they are less (more) likely to cut R&D expenses in the presence of the horizon problem.

Previous research suggests that CEO characteristics explain a substantial proportion of the sample variance in firm R&D spending (e.g., Baker and Mueller 2002). CEO tenure (*CEOTENURE*), which is defined as the length of time that the CEO has held the position, is included in equation (1). Dechow and Sloan (1991) find cutting of R&D spending becomes more likely when the CEO is close to retirement. This argument suggests a positive coefficient on *CEOTENURE*. On the other hand, shorter-tenured CEOs might face more career concerns and therefore may focus excessively on short-term results; i.e., they might be more likely to cut R&D spending to boost short-term earnings performance. Therefore, *CEOTENURE* can be either positively or negatively associated with the probability of cutting R&D. I also control for CEO stock ownership (*CEOSHARES*) and option holdings (*EQUITYCOMP*) since managers with greater share ownership and equity holdings are more likely to undertake risky investments. In addition, Bushee (1998) finds that managers are less likely to cut R&D to affect short-term earnings performance when institutional ownership is high, suggesting that institutions serve a monitoring role in reducing pressures for myopic behavior. Therefore, I include the level of institutional holdings (*INSTHOLD*) in model (1) and expect a negative relation between *INSTHOLD* and the probability of cutting R&D.

1.4 Sample and Descriptive Statistics

To identify firms in which CEO bonus compensation contracts are explicitly based on revenue, I hand-collect performance measure data from firms' proxy statements filed with U.S. Securities and Exchange Commission (SEC) over the years 1993 to 2007. Hand-collecting data necessarily limits my sample size; I therefore focus on firms in the Standard & Poor (S&P) 500. S&P 500 firms are identified by using the Compustat S&P Index Constituent Identifier. Firms included in the sample need to fulfill the following requirements: (1) The firm is identified as an S&P 500 firm in December of any year over the period 1993-2007; (2) the firm's proxy statement is available on the SEC website; (3) the firm has an annual bonus plan; (4) executive bonus compensation is explicitly based on at least one performance measure; and (5) the firm discloses the explicit performance measures employed in the bonus plan.

Consistent with previous studies, I exclude firms in financial industries (SIC codes 6000-6999) and utilities (SIC codes 4900-4999). The sample selection process yields 4,769 firm-years with performance measure data over the fifteen-year sample period. In addition, firms with zero or missing R&D are deleted, resulting in 2,607 firm-year observations.

To better understand the use of sales revenue as a performance measure, I first compile descriptive data on the variety of performance measures used in annual bonus contracts for years 1993 to 2007. Panel A of Table 1 shows that EPS is the most commonly used measure (39%), but sales revenue is the second-most popular performance measure used in CEO annual incentive compensation contracts, with 936 (36%) of firms explicitly mentioning its use. In order of frequency, the other financial performance measures mentioned include operating income/pretax income/EBITDA (22%); net income (21%); cash flow/free cash flow (20%); accounting returns (16%); economic profits (10%); return on shareholders' equity (10%); operating margin (7%); stock returns (5%); and cost controls (3%). Regarding qualitative performance measures, individual performance measures are most often used in annual bonus compensation, with 30% of firms using it, followed by measures of strategic performance (16%), customer relations (9%), managerial leadership (5%), human resource issues (5%), and safety, environment, and health (3%). In addition, firms often employ more than one performance measures: the mean (median) number of measures used is 2.90 (2.00).

Panel B of Table 1 reports the use of other performance measures, conditional on the usage of sales revenue as a performance measure. I find that firms that use revenue as a performance measure are significantly more likely to also adopt EPS, operating income/pretax income/EBITDA, cash flow/free cash flow, operating margin, stock return, strategic, customer, and human resource performance measures than other firms. Firms that use sales revenue are significantly less likely to use ROE, EVA/Economic profit, and safety, environment, and health performance measures in CEO annual incentive contracts than other firms. In addition, firms that adopt sales revenue as a performance measure also use more performance measures than other firms.

In Panel C of Table 1, I split the sample into two groups – firms that cut R&D (*Cut R&D=1*) and firms that do not (*Cut R&D=0*) – to examine the differences in performance measures employed. I find that firms that cut R&D are significantly less likely to use EPS, sales revenue, and operating margin but more likely to employ net income performance measure than firms do not cut R&D.

I obtain financial data from Compustat, stock price information from CRSP, and CEO information, such as CEO age, from ExecuComp. Table 2 shows univariate tests of differences in means and medians of the variables used to examine the probability of cutting R&D expenditures. Mean (median) *SALES*, an indicator variable set to one if CEO annual bonus compensation is explicitly tied to revenue performance, is 0.331 (0.000) for the *Cut R&D=1* group versus 0.379 (0.000) for the *Cut R&D=0* category; both differences are significant at p=0.01.[5]

The two groups are different in previous year's changes in R&D (*PCHGRD*). The *Cut R&D=0* group has smaller (i.e., more negative) value of *PCHGRD*, indicating that firms in the *Cut R&D =0* group had more reductions in R&D in the prior year. The difference is significant in mean but not in median. Table 2 shows no significant difference between mean industry changes in R&D (*INDSTRYCHGRD*) across the two groups (p=0.91), but median *INDSTRYCHGRD* is marginally significantly larger for the *Cut R&D=0* group. I find that the *Cut R&D=1* group has significantly lower level of sales growth (*CHGSALES*) and changes in capital expenditures (*CHGCAPX*), suggesting that firms in the *Cut R&D=1* group have less funds available for investment. The *Cut R&D=1* group has smaller value of Tobin's Q *(TQ)* compared to the other group, and the difference is significant in median but not in mean.

DIST is significantly larger for firms in the *Cut R&D=0* group and differences are significant in both median and in mean (p<0.01), indicating that the group that cuts R&D has decreasing pre-tax-and-R&D earnings while firms that do not cut R&D have increasing pre-tax

[5] The Wilcoxon test does not test whether the medians for the two groups are different. The test examine whether the observations in the two groups are from populations with different medians. Therefore, it shows a significant difference although the medians for the two groups are the same in value.

and R&D earnings. The *Cut R&D=1* group has a significantly lower level of free cash flow (*FCF*) compared to the *Cut R&D=0* subsample.

Turning to incentive variables, *AVOIDLOSS* and *AVOIDDECLINE* are both significantly larger for the *Cut R&D=1* group, consistent with managers tend to cut R&D to avoid reporting earnings losses and earnings declines. On the other hand, there are no significant differences in terms of CEO horizon (*CEOHOZ*) between two groups.

Changes in R&D (*CHGRD*) and changes in long-term debt (*CHGLTD*) is significantly lower for firms cut R&D compared to firms in the other group and both differences are significant at $p<0.01$. I further find that the *Cut R&D=1* group has significantly higher level of changes in cash (*CHGCASH*) and that Changes in financing cash flow (*CHGFINCF*) is significantly smaller for firms cut R&D. I find no significant differences between mean market to book ratio (*MB*) and changes in SG&A expenditures across the two groups (p=0.63 and p=0.35, respectively), but medians *MB* and *SG&A* are significantly lower for the *Cut R&D* group.

Regarding to the variables of CEO characteristics, CEOs for the *Cut R&D=1* group are shorter-tenured (*TENURE*) and receive less equity compensation (*EQUITYCOMP*). In addition, the *Cut R&D=1* group has a significantly lower level of institutional holdings. There are no significant differences in terms of log of market value of equity (*LOGMV*), leverage ratio (*LEVERAGE*), and CEO shareholdings (*CEOSHARES*) across the two groups.

1.5 Empirical Results

Table 3 shows the estimation results from the probit model of R&D cuts presented in equation (1). First, the estimated coefficient of -0.126 on *SALES* is negative and significant (p=0.04). This finding suggests that CEOs are less likely to cut R&D when their annual bonus compensations are revenue-contingent, consistent with H1.

Turning to the control variables, the estimated coefficient of 0.199 on changes in prior year R&D (*PCHGRD*) is positive and significant (p=0.02), suggesting that if a firm decreased R&D in the prior year, it is less likely to cut R&D again in year t. Consistent with expectations, results show a significantly negative association between changes in capital expenditures (*CHGCAPX*) and the probability of reducing in R&D, suggesting that firms with increasing (decreasing) capital expenditures are less (more) likely to cut R&D. The coefficient on *LOGMVE* is positive and significant (p=0.07), which indicates that larger firms are more likely to cut R&D in my sample. However, after adding CEO characteristic variables, the coefficient loses its significance. The estimated coefficient of -0.314 on free cash flow (*FCF*) is negative and significant (p=0.04); however, the coefficient becomes insignificant after controlling CEO related characteristics.

Consistent with expectations, results show that managers are more likely to cut R&D when they can achieve their reporting incentives by doing so. The coefficients on both *AVOIDLOSS* and *AVOIDDECLINE* are positive and significant with p<0.01. However, results show that *CEOHOZ* is not related to the probability of cutting R&D spending within my sample.

The middle columns present results with three interaction terms between incentive variables and revenue performance measure. The coefficient of -0.473 on the interaction term between *AVOIDLOSS* and *SALES* (*SALESAVOIDLOSS*) is significantly negative (p=0.06), suggesting that firms with incentives of cutting R&D to avoid reporting losses are less likely to cut R&D when CEO annual bonus contracts are tied to revenue performance. However, the interaction term between *SALES* and *AVOIDDECLINE*, is not significantly different from zero, and there is no relation between *SALESHOZ* (i.e., the interaction term between revenue performance measure and CEO horizon variable) and the probability of cutting R&D . Therefore, the results are consistent with H2, but not H3 and H4.

Next, I add variables related CEO characteristics and institutional holding (*INSTHOLD*) to the model. The rightmost column presents the results. The coefficient of -0.142 on *SALES* remains significant (p=0.06) and the coefficient of -0.559 on *SALESAVOIDLOSS* is still significant (p=0.05). The coefficient on CEO tenure (*CEOTENURE*) is significant and negative (p<0.01), indicating that CEOs with shorter (longer) tenure are more (less) likely to cut R&D expenditures. The coefficients on CEO shareholdings (*CEOSHARES*), equity compensation (*EQUITYCOMP*), and institutional ownership (*INSTHOLD*) are not significant.

Overall, the results of Table 3 provide evidence that managers are less likely to engage in myopic R&D investment choices when their annual incentive compensations are explicitly linked to revenue performance. In addition, I find that managers who are faced with an incentive to cut R&D to avoid reporting accounting losses are less likely to do so when their annual bonus contract is explicitly tied to revenue performance.

1.6 Endogeneity in Compensation Choice

1.6.1 Revenue Model

The previous test treats compensation contracts as an exogenous variable. However, executive incentive compensation and company investment decisions may be simultaneously determined (e.g., Kang et al. 2006; Smith and Watts 1992). I address potential endogeneity by first examining the economic factors influencing firms' decisions to choose sales revenue as a performance measure in CEO incentive contracts, and then estimating the compensation decision and investment decisions simultaneously using a bivariate probit model.

First, I estimate the following probit model related to the decision of choosing sales as a performance measure in CEO annual incentive contracts:

$$\begin{aligned} P(SALES)_{i,t} = {} & \beta_0 + \beta_1 SALESVR_{i,t-1} + \beta_2 HHI_j + \beta_3 SALESPERSISTENCE_i + \beta_4 RD_{i,t-1} \\ & + \beta_5 MB_{i,t-1} + \beta_6 LOGTA_{i,t-1} + \beta_7 ROA_{i,t-1} + \beta_8 CASH_{i,t-1} + \beta_9 PPE_{i,t-1} \\ & + \beta_{10} FIRMAGE_{i,t-1} + \beta_{11} EQUITYCOMP_{i,t-1} \\ & + \beta_{12} EQUITYCOMP * SALESVR_{i,t-1} + \beta_{13} EARNINGSVR_{i,t-1} \\ & + \beta_{14} ROAPERSISTENCE_{i,t-1} + \delta_{i,t-1} \end{aligned} \tag{2}$$

In equation (2), *SALES* is a dummy variable that equals one when CEOs' annual bonus contracts are explicitly tied to sales performance. Previous studies find that more relative weights are placed on the performance measures that are more value relevant to investors (e.g., Banker et al. 2009). Therefore, I include *SALESVR* in equation (2) to proxy for the value relevance of revenue in year t-1. I obtain this measure by using an 8-quarter rolling window estimation of the following model:

$$CAR_{i,q} = a_0 + a_1 \Delta RPS_{i,q} + a_2 \Delta EPS_{i,q} + \varepsilon_{i,q} \tag{3}$$

CAR is the raw stock return minus the CRSP value-weighted market portfolio return for firm *i* in quarter *q*. *ΔRPS* (*ΔEPS)* is changes in revenue per share (changes in earnings per share) from the same quarter of the prior year. The estimated coefficient on *ΔRPS* is used as a proxy for the value relevance of revenue. I expect β_1 to be significantly positive, suggesting a positive association between revenue and equity valuation. In addition, I include the estimated coefficient on *ΔEPS* as an additional control for the value relevance of earnings (*EARNINGSVR*).

Defond and Park (1999) suggest that industry competition affects the use of accounting measures to evaluate executives. Because retaining and gaining market share might be crucial for firms operating in a more competitive industry, I expect firms in more competitive industries to be more likely to evaluate their managers on revenue performance I measure industry competition using the Herfindahl-Hirschman Index (*HHI*), which decreases in industry competition. *HHI* is estimated by the sum of squares of the market share, measured by sales, of all firms in an industry (based on 2-digit SIC codes). Since HHI decreases in industry competition, I expect β_2 to be significantly negative suggesting a positive association between the use of revenue as a performance measure and the degree of industry competition.

Previous studies suggest that compensation committees assign more relative weights to performance measures that are more persistent, as more persistent accounting measures are more informative and the persistent propriety also can encourages managers to look beyond current period accounting performance (e.g., Baber et al. 1998). Therefore, I control for *SALESPERSISTENCE*, estimated by regressing future revenue on current revenue as follows:

$$REVENUE_{q+1} = \alpha + \gamma REVENUE_q + \epsilon \quad (4)$$

The closer γ is to 1, the more persistent is revenue. I expect a positive association between the use of revenue as a performance measure and *SALESPERSISTENCE*.

Furthermore, Ittner et al. (1997) suggest that business strategy plays an important role in the choice of performance measures used to evaluate corporate executives. Firms having greater growth potential and more investment opportunities are hungry for more revenue growth. Market-to-book ratio (*MB*) and R&D expenditures (*R&D*) are used as strategy proxies. A higher market-to-book ratio and R&D expenditure represents more growth potentials and investment opportunities. I thus expect both to be positively associated with *SALES*.

The value relevance of earnings (*EARNINGSVR*) and earnings persistence (*ROAPERSISTENCE*) are also included in equation (2) since firms tend to use sales in tandem with some form of profit measures. I include firm age (*FIRMAGE)* to control for firms' life cycles. Since equity compensation is more sensitive to the value relevance of performance measure, I expect the effect of value relevance of revenue on the choice of using sales as a performance measure to be reduced when there are more equity compensations. Therefore, I include equity compensation (*EQUITYCOMP*) and its interaction with value relevance of revenue in equation (2). Last, I also include firm size (*LOGTA*), profitability (*ROA*), cash holdings (*CASH)*, and tangible assets (*PPE*) to control for other firm characteristics which might influence compensation policies. I have no prior expectations on the sign of those variables.

1.6.2 Descriptive Statistics

Table 4 shows differences in firm characteristics on whether sales revenue is used as a performance measure in CEO annual bonus contracts. The leftmost column of Table 4 shows descriptive statistics for the whole sample. I further split the entire sample into two groups, where firms with annual incentive compensations are explicitly tied to revenue (*SALES=1*) and firms where CEO bonus contracts are not based on revenue performance (*SALES=0*). Table 4 shows that revenue is more value relevant and more persistent for firms where annual bonus compensation is based on sales performance. Firms in which CEO bonus compensation is tied to sales revenue operate in more competitive industries (*HHI*) than the other group of firms: mean (median) of *HHI* is 0.040 (0.036) for the *SALES=1* group versus 0.055 (0.041) for the *SALES=0* subsample; and the differences are significant for both means and medians ($p<0.01$).

Firms that reward CEOs on revenue performance have higher growth opportunities than firms that do not: the *SALES=1* group has significantly larger market to book value (*MB*); and the difference is significant in both mean and median. I find that firms in the *SALES=1* group has significantly less tangible assets (*PPE*) than other firms and that firms with CEO bonus compensation that is tied to revenue performance are relatively smaller (*LOGTA*), more profitable (*ROA*), and have a higher level of cash (*CASH*) than other firms. In addition, CEOs whose annual bonus compensations are explicitly linked to revenue receive more equity-based compensation (*EQUITYCOMP*) than other managers; and both differences in mean and median are significant at p-value<0.01.

I further find that firms in the *SALES=1* group are with a higher level of earnings persistence; and difference is significant in mean (p=0.04) but not in median (p=0.69). Earnings persistence (*ROAPERSISTENCE*) is also different across the two groups. Taken together, Table 4 shows the differences in firm characteristics between two groups of firms, suggesting the importance of controlling factors, which might affect the decision to use revenue as a performance measure in CEO annual incentive contracts.

1.6.3 Simultaneous Bivariate Probit Regression Results

Next, I simultaneously estimate equation (1) and equation (2). Results are presented in Table 5. The positive coefficient of 0.387 on value relevance of sales revenue (*SALESVR*) is significant (p=0.08), suggesting that the decision of using sales revenue as a performance measure is positively associated with value relevance of revenue. The Herfindahl-Hirschman Index (*HHI*) decreases in industry competition. The significant and negative coefficient of -0.656 (p-value<0.01) on *HHI* indicate that firms operating in more competitive industries are more likely to use sales as a performance measure. Firms with greater growth potential and more investment opportunities (*MB* and *R&D*) are more likely to use sales as a performance measure. In addition, profitability (*ROA*) is positively associated with the probability of employing sales as a performance measure, but the level of tangible assets (*PPE*) is negatively related to the decision. The coefficient of -0.003 on firm age (*FIRMAGE*) is significant (p-value=0.10) suggesting younger firms tend to use revenue performance measure. However, coefficients on other variables in equation (3) are not significant.

The coefficient of -1.120 on *SALES* is negative and significant (p<0.01), suggesting managers are less likely to cut R&D when their annual incentive compensations are explicitly tied to revenue performance, consistent with H1. Consistent with results reported in Table 3, changes in prior year R&D (*PCHGRD*) is positive and significant associated with the probability of cutting R&D and changes in capital expenditures (*CHGCAPX*) is significantly negatively related to the propensity of decreasing in R&D expenditures. After controlling for endogeneity in compensation contract design, the coefficient of 0.299 on *CHGSALES* turns marginal significant (p=0.10). In addition, the coefficient of -0.519 become significant (p=0.02), suggesting firms are less likely to cut R&D when they have more free cash flow.

In addition, contrary to the prediction, the coefficient on Tobin's Q (*TQ*) is positive and significant, suggesting firms with higher Tobin's Q are more likely to cut R&D in my sample after controlling for endogeneity in compensation contracts. The coefficient of -0.009 on *DIST* is significant (p=0.04).[6]

Coefficients on both *AVOIDLLOSS* and *AVOIDDECLINE* are positive and significant, suggesting firms are more likely to cut R&D when they face reporting incentives. The coefficient of -0.532 on *SALESAVOIDLOSS* is significant (p=0.04), indicating the effect of small earnings losses on managerial myopic behavior might be attenuated in firms with revenue based managerial compensation contracts. Similar to results reported in Table 3, coefficients on

[6] I predict a positive coefficient on *DIST* since when firms with less negative (high) values of *DIST* are more likely to cut R&D to achieve meet earnings target. However, the significant negative coefficient on *DIST* might be due to the fact that firms are less likely to cut R&D when they already experienced earnings growth (i.e., positive changes in pre-tax R&D earnings).

SALESAVOIDDECLINE and *SALESCEOHOZ* are not significant. Therefore, after controlling endogeneity in compensation contracts, results are consistent with H2, but not H3 and H4.

The coefficient of -0.017 on CEO tenure (*CEOTENURE*) is still significant at p<0.01, suggesting that longer-tenured CEOs are less likely to cut R&D expenditures. Consistent with results in Table 3, CEO shareholding, equity compensation, and institutional ownership are not related to the probability of R&D cuts. Overall, the main results on the R&D spending are robust after controlling endogeneity in compensation contract design.

1.7 Robustness Tests

1.7.1 Changes in R&D and Revenue-contingent Annual Incentive Contracts

Instead of following the prior research that models the probability of cutting R&D spending, as a sensitivity test I construct the dependent variable as changes in R&D (*CHGRD*) and estimate the following OLS regression, which includes the inverse Mills ratio (*IMR*) estimated from equation (2) to control for endogeneity in compensation contracts:

$$\begin{aligned} CHGRD_{it} = \gamma_0 &+ \gamma_1 SALES_{it} + \gamma_2 LAGCHGRD_{it} + \gamma_3 CHGSALES_{it} + \gamma_4 CHGCAPX_{it} + \gamma_5 CHGLTD_{it} \\ &+ \gamma_6 CHGFCF_{it} + \gamma_7 CHGCASH_{it} + \gamma_8 CHGFINF_{it} + \gamma_9 CHGSGA_{it} + \gamma_{10} INDCHGRD_{it} \\ &+ \gamma_{11} MB_{it} + \gamma_{12} AVOIDLOSS_{it} + \gamma_{13} SALESAVOIDLOSS_{it} + \gamma_{14} AVOIDDECLINE_{it} \\ &+ \gamma_{15} SALESAVOIDDECLINE_{it} + \gamma_{16} CEOHOZ_{it} + \gamma_{17} SALESCEOHOZ_{it} + \gamma_{18} IMR_{it} \\ &+ \epsilon_{it} \end{aligned} \quad (5)$$

As in equation (1), I include prior year changes in R&D (*LAGCHGRD*), changes in sales (*CHGSALES*), changes in capital expenditure (*CHGCAPX*), changes in free cash flow (*CHGFCF*), market to book ratio (*MB*) and changes in industry R&D (*INDUSTRYCHGRD*) as control variables in equation (5).

In addition, following Darrough and Rangan (2005), I include changes in long-term debt (*CHGLTD*), changes in cash (*CHGCASH*), changes in financing cash flow (*CHGFINCF*), and changes in SG&A expense (*CHGSGA*) in equation (5). I expect the coefficient on *CHGLTD* to be negative since long-term debt contracts may reduce funds available for R&D investment. *CHGCASH* and *CHGFINCF* are used to measure firm liquidity, and I expect both *CHGCASH* and *CHGFINCF* to be positively associated with changes in R&D. In addition to capital expenditures, SG&A is another alternative use of funds.[7] The coefficient on *SG&A* can be either positive or negative since SG&A and *R&D* can be either substitutes or complements (Darrough and Rangan 2005). I also include the three incentive variables (*AVOIDLOSS*, *AVOIDDECLINE* and *CEOHOZ*) and interact those with revenue performance measure (*SALES*) in equation (5).

Results are shown in Table 6. I find a significant positive relation between using revenue as a performance measure and changes in R&D: the coefficient of 0.002 on *SALES* is significant with p-value of 0.01, suggesting that changes in R&D are significantly more positive when firms employ revenue as a performance measure. Coefficients on change in sales (*CHGSALES*) and market to book ratios (*MB*) are positive and significant, suggesting a positive relation between firms' growth opportunities and R&D spending. Consistent with expectations, the coefficient of 0.011 on *CHGFINCF* is significant (p=0.010), suggesting a positive relation between changes in firm liquidity and changes in R&D. In addition, firm-level R&D changes are positively associated with industry changes in R&D; the coefficient of 0.369 on *INDCHGRD* is significant (p<0.01). Contrary to expectations, however, the results show a positive relation between changes in long-term debt and changes in R&D with coefficient of 0.015 (p=0.04) and a negative relation between changes in free cash flow and changes in R&D with coefficient of -0.018 (p<0.01).

Next, I add variables related to reporting incentives to decrease R&D spending (*AVOIDLOSS*, *AVOIDDECLINE* and *CEOHOZ*) and interact those with the revenue

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[7] Compustat includes R&D in the SG&A category so I exclude R&D from SG&A to calculate changes in SG&A.

performance measure in equation 5. The rightmost column of Table 6 shows the results. The coefficient of 0.002 on *SALES* remains marginally significant (p=0.06). In addition, consistent with results from Table 3, I find a significantly negative association between *AVOIDLOSS* and changes in R&D, suggesting that firms in *AVOIDLOSS* group are more likely to decrease R&D. However, the coefficient on the interaction term, *SALESAVOIDLOSS,* is negative and significant. Thus, I do not find evidence of revenue performance measure influencing managerial incentives of cutting R&D when firms face with reporting small earnings losses.

On the other hand, the coefficient of 0.005 on *SALESAVOIDDECLINE* is marginally significant (p=0.06), indicating that firms with revenue-contingent compensation contracts might choose to increase R&D even when faced with small earnings declines. Similar to the results from Table 6, I find no association between CEO horizon (*CEOHOZ*) and changes in R&D, and the coefficient on *SALESHOZ* is insignificant. Last, the estimated coefficient on *IMR* is significant (p<0.01) suggesting that compensation contract design and R&D spending are endogenously determined.

1.7.2 Software Industries

The accounting treatment of R&D is different for software industry --R&D costs may be capitalized after technological feasibility is established. Thus, as a robustness check, I exclude firms from the software industry (SIC 7370-7340); the results remain unchanged.

1.7.3 Other Performance Measures

Previous research suggests that nonfinancial performance measures are leading indicators of financial performance (Ittner et al. 1997; Ittner and Larcker 1998). Therefore, managers evaluated on nonfinancial performance measures may be less likely to cut R&D expenses. I include a nonfinancial performance measure indicator variable in the main test (equation 1), and the results are qualitatively unchanged.

1.8 Conclusions

In this paper, I explore whether the choice of performance measures impacts R&D spending. Specifically, I examine the effect of using sales revenue as a performance measure in CEOs annual incentive contracts on R&D investment behavior for a sample of S&P 500 firms over the time period 1993-2007. Using hand-collected data from firms' proxy statements filed with the Securities and Exchange Commission (SEC), I find that managers whose annual bonuses are explicitly tied to revenue performances are less likely to cut R&D spending than other managers. I also find that managers who face financial reporting incentives to cut R&D to avoid accounting losses are less likely to cut R&D when their annual bonus contracts tied to revenue performance compared to other managers. In the changes regression, I find a significantly positive relation between changes in R&D and revenue-contingent bonus plans. I further document evidence indicating that firms might choose to increase R&D when faced with small earnings declines.

There are limitations underlying the study. First the sample consists of S&P 500 firms, excluding utilities and financial institutions. Therefore, the results may not be generalizable to other firms. However, evidence based on the S&P 500 is important in its own right since those firms are the leading companies that are crucial to the US economy. Second, my study is based on hand-collect data from firms' proxy statements filed to the SEC about performance measures used in CEOs annual incentive contracts. Firms may have disclosure defects over executive compensations to avoid public attentions to the huge managerial payments (Robinson et al.

2011). However, any noise from compensation disclosure biases the results against main findings. Overall, the results should be interpreted with these caveats in mind. The paper contributes to several steams of literature, including the literature on executive compensation and R&D expenditure. The study suggests revenue-contingent annual incentive contracts are a potential mechanism that dissuades opportunistic reduction in R&D expenditures. In addition, the findings demonstrate the importance of the role of performance measures in directing corporate investment decisions.

Table 1.1 Performance Measures Used in CEO Annual Incentive Plans

Panel A: Frequency of firms using each performance measure (n=2,607)

	N	%
Earnings per share	1,024	39%
Revenue	936	36%
Operating income/pretax income/EBITDA	570	22%
Net income	540	21%
Cash flow/Free cash flow	514	20%
ROA/ROC/ROI	422	16%
EVA/Economic profit	264	10%
ROE	257	10%
Operating margin	188	7%
Share price/Total shareholder return	129	5%
Cost control	68	3%
Others (financial)	361	14%
Individual	795	30%
Strategic	418	16%
Customer	224	9%
Leadership	142	5%
Human resource	121	5%
Safety, environment and health	67	3%
Others (non-financial)	351	13%
N	2,607	

	Mean	Q1	Median	Q3
Number of measures used	2.90	2.00	2.00	4.00

Panel B: Chi-squared tests of differences in frequencies of reported performance measures, conditional on the use of revenue

	SALES=1 (n=936)		*SALES*=0 (n=1,671)		p-value
Earnings per share	391	42%	633	38%	0.05
Operating income/pretax income/EBITDA	244	26%	326	20%	<0.01
Net income	205	22%	335	20%	0.26
Cash flow/Free cash flow	231	25%	283	17%	<0.01
ROA/ROC/ROI	141	15%	281	17%	0.24
EVA/Economic profit	28	3%	236	14%	<0.01
ROE	41	4%	216	13%	<0.01
Operating margin	145	15%	43	3%	<0.01
Share price/Total shareholder return	63	7%	66	4%	<0.01
Cost control	29	3%	39	2%	0.24
Others (financial)	180	19%	181	11%	<0.01
Individual	275	29%	520	31%	0.35
Strategic	179	19%	239	14%	<0.01
Customer	134	14%	90	5%	<0.01
Leadership	42	4%	100	6%	0.11
Human resource	66	7%	55	3%	<0.01
Safety, environment and health	10	1%	57	3%	<0.01

Others (non-financial)	162	17%	189	11%	<0.01

	Mean	Q1	Median	Q3
Number of measures, revenue not used	2.37	1.00	2.00	3.00
Number of measures, revenue used	3.85	3.00	4.00	5.00

Panel C: Chi-squared tests of differences in frequencies of reported performance measures, conditional on R&D cut

	Cut R&D=1 (n=1,086)		*Cut R&D*=0 (n=1,521)		p-value
Earnings per share	371	34%	653	43%	<0.01
Revenue	359	33%	577	38%	0.01
Operating income/pretax income/EBITDA	248	23%	322	21%	0.16
Net income	247	23%	293	19%	0.03
Cash flow/Free cash flow	226	21%	288	19%	0.24
ROA/ROC/ROI	188	17%	234	15%	0.19
EVA/Economic profit	114	10%	150	10%	0.60
ROE	100	9%	157	10%	0.35
Operating margin	66	6%	122	8%	0.06
Share price/Total shareholder return	53	5%	76	5%	0.89
Cost control	29	3%	39	3%	0.87
Others (financial)	145	14%	216	14%	0.54
Individual	342	31%	453	30%	0.35
Strategic	159	15%	259	17%	0.10
Customer	101	9%	123	8%	0.28
Leadership	67	6%	75	5%	0.17
Human resource	49	5%	72	5%	0.79
Safety, environment and health	34	3%	33	2%	0.13
Others (non-financial)	156	14%	195	13%	0.25

	Mean	Q1	Median	Q3
Number of measures, *Cut R&D=1*	2.89	2.00	2.00	4.00
Number of measures, *Cut R&D=0*	2.92	2.00	3.00	4.00

Panel A of Table 1.1 presents the frequency of firms using each performance measure in CEO annual bonus contracts. Panel B of Table 1.1 shows the use of other performance measures, conditional on the usage of sales revenue as a performance measure**.** Panel C of Table 1.1 shows the use of performance measures, conditional on whether R&D is cut**.** *CUT R&D =1* when firms cut R&D spending (if (RDS_t - RDS_{t-1}) <0), and zero otherwise. *RDS* is defined as R&D expenditures deflated by numbers of shares outstanding (Bushee 1998). Other financial performance measure include performance measures such as working capital turnover, inventory turnover, book value per share, dividend payout ratio, divisional financial performance measures (like divisional earnings; divisional revenue), capital expenditure, and some performance measures specific to certain industries (like underwriting margin and combined ratio for firms from insurance industry) etc. Other non-financial performance measures include performance measures such as credit rating changes and corporate objectives etc. P-values are based on two-tailed tests.

Table 1.2 Summary Statistics for the Variables Used in R&D Tests

	Combined Sample (N=2,607)		*Cut R&D=1* (N=1,086)		*Cut R&D=0* (N=1,521)		T-test for difference in means	Wilcoxon test for difference in medians
	Mean	Median	Mean	Median	Mean	Median	p-value	p-value
SALES	0.359	0.000	0.331	0.000	0.379	0.000	0.01	0.01[a]
PCHGRD	-0.024	0.032	-0.006	0.019	-0.037	0.040	0.02	0.29
INDUSTRYCHGRD	0.290	0.068	0.294	0.060	0.287	0.076	0.91	0.10
CHGSALES	0.097	0.078	0.080	0.055	0.108	0.088	<0.01	<0.01
CHGCAPX	-0.041	0.004	-0.212	-0.147	0.080	0.088	<0.01	<0.01
LOGMVE	9.011	8.890	9.002	8.913	9.017	8.879	0.79	0.88
TQ	2.198	1.625	2.249	1.453	2.163	1.730	0.24	<0.01
DIST	0.199	0.290	-0.554	-0.324	0.736	0.539	<0.01	<0.01
LEVERAGE	0.207	0.204	0.208	0.204	0.207	0.204	0.87	0.67
FCF	0.020	0.039	-0.006	0.013	0.038	0.053	<0.01	<0.01
AVOIDLOSS	0.061	0.000	0.110	0.000	0.026	0.000	<0.01	<0.01
AVOIDDECLINE	0.181	0.000	0.238	0.000	0.139	0.000	<0.01	<0.01
CEOHOZ	0.138	0.000	0.145	0.000	0.134	0.000	0.42	0.42
CEOTENURE	6.719	5.000	6.220	5.000	7.076	5.000	<0.01	<0.01
CEOSHARES	0.008	0.001	0.008	0.001	0.007	0.001	0.28	0.39
EQUITYCOMP	4.451	2.304	5.025	2.280	4.041	2.325	<0.01	0.68
INSTHOLD	0.693	0.706	0.678	0.696	0.703	0.712	<0.01	<0.01
CHGRD	0.005	0.001	-0.002	-0.001	0.011	0.003	<0.01	<0.01
CHGLTD	0.013	0.000	0.004	0.000	0.019	0.000	<0.01	<0.01
CHGCASH	0.016	0.004	0.023	0.005	0.011	0.004	<0.01	0.01
CHGFINCF	0.000	-0.002	-0.008	-0.007	0.006	0.000	<0.01	<0.01
MB	4.849	3.369	4.940	3.193	4.783	3.474	0.63	<0.01
CHGSGA	0.012	0.001	0.011	0.005	0.012	0.010	0.35	<0.01

Table 1.2 shows univariate tests of differences in means and medians of the variables used to examine R&D expenditures. *SALES* is an indicator variable that equals one when sales revenue is explicitly mentioned in company's proxy statement as a determinant of CEO annual bonus contracts, and zero otherwise. *PCHGRD* is prior year's change in R&D, defined as ln (RDS_{t-1}) – ln (RDS_{t-2}), where

RDS is defined as R&D expenditures deflated by number of shares outstanding (Bushee 1998). *INDUSTRYCHGRD* is changes in industry R&D expenditures and industries are defined as 48 Fama-French industry classifications. *CHGSALES* is changes in sales, defined as ($SALES_t$ - $SALES_{t-1}$)/ $SALES_{t-1}$. *CHGCAPX* is changes in capital expenditures, defined as ln($CAPX_{t)}$ – Ln($CAPX_{t-1}$)$_;$ *CAPX* is capital expenditures deflated by number of shares. *LOGMVE* is log of market value of equity. TQ is Tobin's Q, defined as (market value of equity + book value of preferred stock + short-term debt + long-term debt)/total assets). *DIST* is distance from last year's pre-tax and R&D earnings, measured as ($EBTRD_t$ – $EBTRD_{t-1}$)/RD_{t-1}. *LEVERAGE* is leverage ratio, defined as (short-term debt + long-term debt)/total assets. *EBTRD* is pre-tax and R&D earnings, deflated by number of shares. *FCF* is free cash flow, defined as operating cash flow minus capital expenditures. *AVOIDLOSS* is an indicator variable equals one if $0 < EBTRD_t < RDS_{t-1}$, zero otherwise. *AVOIDDECLINE* is an indicator variable equals one if $EBT_{t-1} < EBTRD_t \leq EBTRD_{t-1,}$ zero otherwise. *EBT* is pre-tax earnings, deflated by number of shares. *CEOHOZ* is a variable to proxy CEO horizon problem, which is an indicator variable that equals one if the CEO is at least 63 years old and zero otherwise. *CEOTENURE* is CEO tenure, defined as the length of time that the CEO held the position. *CEOSHARES* is CEO shareholdings, defined as number of company shares held by CEO deflated by numbers of shares outstanding. *EQUITYCOMP* is CEO equity compensation defined as new grants of stock options and restricted stocks deflated by CEO salary. *INSTHOLD* is shares held by institutional investors over numbers of shares outstanding. *CHGRD* is changes in R&D expenditures deflated by total assets (Darrough and Rangan 2005). *CHGLTD* is changes in long-term debt deflated by total assets. *CHGCASH* is changes in cash and marketable securities deflated by total assets. *CHGFINCF* is changes in financing cash flow deflated by total assets. *MB* is market-to-book ratio, defined as (total assets- book value of equity + market value of equity)/total assets. *CHGSGA* is changes in SG&A expenditures. Compustat includes R&D in the SG&A category so I exclude R&D from SG&A to calculate changes in SG&A. P-values are based on two-tailed tests.

Table 1.3 Probit Regression of Cutting R&D Expenditures

Variables	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
INTERCEPT	-0.788	<0.01	-0.769	<0.01	-0.587	0.11
SALES	-0.126	0.04	-0.145	0.04	-0.142	0.06
PCHGRD	0.199	0.02	0.194	0.02	0.202	0.03
INDUSTRYCHGRD	-0.019	0.30	-0.020	0.29	-0.032	0.13
CHGSALES	0.133	0.41	0.121	0.45	0.358	0.06
CHGCAPX	-1.240	<0.01	-1.242	<0.01	-1.238	<0.01
LOGMVE	0.045	0.07	0.045	0.07	0.037	0.20
TQ	0.002	0.91	0.001	0.97	0.004	0.84
DIST	-0.003	0.39	-0.003	0.41	-0.007	0.13
LEVERAGE	-0.021	0.93	-0.047	0.83	-0.142	0.55
FCF	-0.314	0.04	-0.322	0.04	-0.176	0.31
AVOIDLOSS	0.694	<0.01	0.866	<0.01	0.931	<0.01
AVOIDDECLINE	0.322	<0.01	0.243	0.01	0.267	0.01
CEOHOZ	-0.002	0.98	-0.011	0.91	0.110	0.28
*SALES *AVOIDLOSS*			-0.473	0.06	-0.559	0.05
*SALES *AVOIDECLINE*			0.203	0.16	0.168	0.28
SALES CEOHOZ*			0.031	0.87	0.020	0.92
TENURE					-0.024	<0.01
CEOSHARES					1.332	0.29
EQUITYCOMP					-0.003	0.63
INSTHOLD					0.058	0.78
Pseudo R^2	14.26%		14.41%		14.74%	
N	2,479		2,479		2,134	
N (*Cut R&D=1*)	1,027		1,027		861	

Table 1.3 presents results from probit estimations of cutting R&D expenditures, where the dependent variable equals 1 for firms with annual incentive contracts that are explicitly tied to revenue and zero for firms with incentive contracts that are not. *SALES*AVOIDLOSS* (*SALES*AVOIDDELIBE*) is an interaction term between *SALES* and *AVOIDLOSS (AVOIDDECLINE)*, and *SALES*CEOHOZ* is an interaction term between *SALES* and *CEOHOZ.* Other variables are defined in Table 1.2. Year dummies are included in the regression.

Table 1.4 Descriptive Statistics on Variables of Revenue-contingent Model

	Combined Sample (N=2,731)		*SALES=1* (N=953)		*SALES=0* (N=1,778)		T-test for difference in means	Wilcoxon test for difference in medians
	Mean	Median	Mean	Median	Mean	Median	p-value	p-value
$SALESVR_{t-1}$	0.008	0.002	0.013	0.012	0.005	0.001	0.24	<0.01
HHI_{t-1}	0.050	0.040	0.040	0.036	0.055	0.041	<0.01	<0.01
$SALESPERSISTENCE_{t-1}$	0.783	0.845	0.790	0.852	0.779	0.836	0.14	<0.01
$R\&D_{t-1}$	0.053	0.035	0.076	0.063	0.041	0.027	<0.01	<0.01
MB_{t-1}	2.570	1.939	3.296	2.638	2.181	1.698	<0.01	<0.01
$LOGTA_{t-1}$	8.625	8.507	8.516	8.315	8.684	8.575	<0.01	<0.01
ROA_{t-1}	0.069	0.069	0.085	0.089	0.061	0.060	<0.01	<0.01
$Cash_{t-1}$	0.135	0.072	0.208	0.141	0.096	0.053	<0.01	<0.01
PPE_{t-1}	0.279	0.248	0.213	0.182	0.314	0.284	<0.01	<0.01
$FIRMAGE_{t-1}$	40.377	36.000	33.350	29.000	44.143	40.000	<0.01	<0.01
$EQUITYCOMP_{t-1}$	4.400	2.101	6.277	3.500	3.393	1.656	<0.01	<0.01
$EARNINGSVR_{t-1}$	0.028	0.003	0.049	0.004	0.017	0.002	0.04	0.69
$ROAPERSISTENCE_{t-1}$	0.402	0.403	0.418	0.402	0.394	0.403	0.02	0.02

Table 1.4 presents descriptive statistics for variables used in sales revenue model. *SALEVR* is value relevance of revenue, obtained from using an 8-quarter rolling window estimation of the equation: $\mathrm{CAR}_{i,q} = a_0 + a_1\Delta\mathrm{RPS}_{i,q} + a_2\Delta\mathrm{EPS}_{i,q} + \varepsilon$, where *CAR* is the raw stock returns minus the CRSP value-weighted market portfolio return for firm i in quarter q. *ΔRPS (ΔEPS)* is changes in revenue per share (changes in earnings per share) from the same quarter of prior year. The estimated coefficient on ΔRPS is used as a proxy for value relevance of revenue, and the estimated coefficient on *ΔEPS* is used as a proxy for value relevance of earnings (*EARNINGSVR*).*R&D* is R&D expenditures deflated by total assets. *LOGTA* is log of total assets. *ROA* is earnings before extraordinary items over book value of assets. *CASH* is cash and marketable securities deflated by total assets. *PPE* is plans, property, and equipment over total assets. *FIRMAGE* is firm age. *SALESPERSISTENCE* is sales persistence, defined as γ estimated by regressing future revenue on current revenue: $REVENUE_{q+1} = \alpha_t + \gamma REVENUE_q + \zeta_q$. *ROAPERSISTENCE* is ROA persistence, defined as γ estimated by regressing future revenue on current revenue: $ROA_{q+1} = \alpha_t + \gamma ROA_q + \zeta_q$. Other variables are defined in Table 1.2. P-values are based on two-tailed tests.

Table 1.5 Simultaneous Bivariate Probit Estimation of Revenue-contingent Annual Incentive Contracts and R&D cut

Two-equation system estimated using a seemingly unrelated bivariate probit model

Sales Model		Cut R&D Model	
	Coefficient (p-value)		Coefficient (p-value)
INTERCEPT	0.072 (0.82)	*INTERCEPT*	-0.059 (0.86)
SALESVR	0.387 (0.08)	*SALES*	-1.120 (<0.01)
HHI	-0.656 (<0.01)	*PCHGRD*	0.244 (<0.01)
SALESPERSISTENCE	0.039 (0.81)	*INDUSTRYCHGRD*	-0.029 (0.12)
R&D	4.863 (<0.01)	*CHGSALES*	0.299 (0.10)
MB	0.059 (0.03)	*CHGCAPX*	-1.042 (<0.01)
LOGTA	-0.009 (0.78)	*LOGMVE*	0.019 (0.50)
ROA	2.918 (<0.01)	*TQ*	0.073 (<0.01)
Cash	-0.048 (0.84)	*DIST*	-0.009 (0.04)
PPE	-1.712 (<0.01)	*LEVERAGE*	-0.519 (0.02)
FIRMAGE	-0.003 (0.10)	*FCF*	-0.058 (0.73)
EQUITYCOMP	0.007 (0.15)	*AVOIDLOSS*	0.889 (<0.01)
EQUITYCOMP SALESVR*	-0.017 (0.44)	*AVOIDDECLINE*	0.325 (<0.01)
EARNINGSVR	0.138 (0.11)	*CEOHOZ*	0.101 (0.27)
ROAPERSISTENCE	0.189 (0.12)	*SALES*AVOIDLOSS*	-0.532 (0.04)
		*SALES *AVOIDECLINE*	0.091 (0.52)
		*SALES *CEOHOZ*	-0.046 (0.80)
		CEOTENURE$_t$	-0.017 (<0.01)
		CEOSHARES	0.798 (0.48)

		EQUITYCOMP	0.002 (0.74)
		INSTHOLD	0.050 (0.79)
N	2,081	N	2,081

Table 1.5 presents results from simultaneous bivariate probit estimation of revenue-contingent annual incentive contracts and R&D cut. *EQUITCOMP*SALESVR* is an interaction terms between *EQUITYCOMP* and *SALESVR*. In the sales model, dependent variable is a dummy variable that equals one when firms use sales revenue as a performance measure, and zero otherwise. In the cut R&D model, dependent variable is an indicator variable that equals one when R&D is cut, and zero otherwise. Independent variables are defined in Table 1.2 and Table 1.4. Year dummies are included in both regressions.

Table 1.6 OLS Estimation of Changes in R&D

Variables	Coefficient	p-value	Coefficient	p-value
INTERCEPT	0.005	<0.01	0.007	<0.01
SALES	0.002	0.01	0.002	0.06
LAGCHGRD	-0.044	0.37	-0.041	0.37
CHGSALES	0.050	<0.01	0.047	<0.01
CHGCAPX	0.066	<0.01	0.067	<0.01
CHGLTD	0.015	0.04	0.017	0.02
CHGFCF	-0.018	<0.01	-0.017	<0.01
CHGCASH	0.003	0.75	0.003	0.72
CHGFINCF	0.011	0.01	0.011	0.01
CHGSGA	-0.185	<0.01	-0.193	<0.01
INDCHGRD	0.369	<0.01	0.343	<0.01
MB	0.000	<0.01	0.000	0.002
AVOIDLOSS			-0.009	<0.01
*SALES*AVOIDLOSS*			-0.008	0.08
AVOIDDECLINE			0.000	0.98
*SALES*AVOIDDECLINE*			0.005	0.06
CEOHOZ			-0.001	0.50
*SALE*CEOHOZ*			-0.000	0.98
IMR	-0.009	<0.01	-0.009	<0.01
R^2	32.69%		35.69%	
N	2,426		2,305	

Table 1.6 presents results OLS regression of changes in R&D, controlling for endogeneity in compensation structure. *IMR* is the inverse Mills ratio estimated from equation (2). All variables are defined in Table 1.2. Year dummies are included in the regressions.

Chapter 2

The Role of Performance Measure Choice in Promoting Merger Activities

2.1 Introduction

Agency theory suggests that executive compensation contracts are designed to align the interests of shareholders to those of managers so that managers take actions that maximize shareholder value. Unlike equity-based compensation, executive annual bonus contracts are usually explicitly linked to performance measures. Performance measures employed should be closely tied to corporate strategy to ensure that managerial incentives are aligned with the corporation strategies (Ittner et al. 1997). Studies from the strategy literature have also recognized the "congruency" property between executive pay systems and corporate strategies, suggesting that corporate strategy play a crucial role in setting executive reward systems (e.g., Balkin and Gomez-Mejia 1987; Balkin and Gomez-Mejia 1990; Dow and Raposo 2005; Gomez-Mejia 1992; Sanders and Carpenter 1998). In this paper, I extend this literature by examining whether the use of sales revenue as a performance measure in CEO annual bonus contracts promotes merger and acquisition (M&A) activities.

M&A is viewed as one of firms' most crucial investment decisions and is often cited as an activity to fuel revenue growth. In fact, sales revenue growth is listed as one of the primary goals in 80% of acquisition announcements (McKinsey 2002). Previous research has examined the impact of executive compensation on M&A activities (e.g., Bliss and Rosen 2001; Datta et al. 2001; Minnick et al. 2011), with most of the prior studies focusing on how executive compensation structure influences merger decisions. For example, using bank merger data, Bliss and Rosen (2001) document that CEOs with more stock-based compensation are less likely to make an acquisition, suggesting that increased cash-based compensation may induce bad acquisitions. However, to my knowledge, there is no research on the role of performance measures employed in compensation contracts in directing merger activities. Using hand-collected performance measure data from companies' proxy statements, I address this void in the literature by examining the impact of employing revenue as a performance measure in executive bonus contracts on merger decisions.

Sales revenue is a frequently used performance measure in executive annual bonus plans. In fact, Towers Watson surveys document that sales revenue is one of the most prevalent financial performance measure employed in executive annual incentive contracts.[8] Despite its prevalence in compensation contracts, prior research has not explored the question that why firms choose to reward executives on revenue, nor has it examined how sales performance measure influences managerial decisions. These are the questions that I seek to address in this study.

Because the choice of performance measure and merger decisions may be jointly determined (e.g., Kang et al. 2006; Smith and Watts 1992), it is important to control for potential endogeneity between the two decisions. Therefore, I first examine the economic determinants of firms' decisions to choose sales as a performance measure in CEO annual bonus contracts. Drawing upon prior literature, I model the use of revenue performance measure as functions of organizational strategy, as well as the value relevance and informativeness of sales revenue (e.g., Banker, Huang, and Natarajan 2009; Bushman et al. 2006; Ittner et al. 1997; Sloan 1993). I document that using revenue as a performance measure is significantly associated with corporate strategy, industry competition, and persistence of revenue.

I then use a simultaneous bivariate probit model (Greene 2003) to jointly test performance measure choice and merger bidding decisions. I find that firms are significantly more likely to make acquisition attempts when CEO annual bonus contracts are revenue-

[8] Towers Watson surveys conducted in 2005 and 2010 document that sales revenue is the single most frequently used performance measure in executive annual bonus contracts, with 31% and 34%, respectively, of survey respondents reporting its use.

contingent.[9] I also explore whether the use of revenue as a performance measure influences the choice among horizontal, vertical, or conglomerate mergers. Horizontal mergers occur when two firms compete in the same market and merged firms are able to gain market power to achieve higher revenue growth.[10] Conglomerate mergers occur when acquirers and targets are from two different industries, allowing firms to diversify revenue streams. Alternatively, in vertical mergers, the two firms have a customer-supplier relationship, and gains from such mergers are mainly from reductions in transaction costs. Consistent with my expectations, I find that the relation between revenue-contingent bonus plans and merger bidding decisions is significantly stronger for conglomerate and horizontal mergers than for vertical mergers.

In addition, I examine whether there are costs associated with this compensation choice. Jensen (1986) argues that personal gains from managing larger firms may induce managers to pursue value-destroying acquisitions. Overpayments and negative announcement returns documented by prior studies are sometimes interpreted as evidence of empire-building by acquiring CEOs (e.g., Lang et al. 1991). Managers of larger firms are often awarded greater compensations. Prior studies document that executive compensation significantly increases with company size (e.g., Murphy 1985; Murphy 1999). Because sales revenue will be mechanically increased after a successful acquisition, managers may pursue mergers purely to achieve a size effect. Therefore, I study acquisition premiums and acquirers' announcement returns to examine whether firms with revenue-contingent bonus plans offer higher premiums and whether market perceives these acquisitions differently. My results suggest that acquirers with revenue-

[9] I study the probability of making acquisition attempts (i.e., acquisition bids) since it is directly related to managerial incentives. Whether bids are eventually completed or not might depend on many other factors, such as financial advisors and transaction complexity etc. I use the terms "acquisition bids" and "acquisition attempts" interchangeably throughout the paper.

[10] Revenue growth may not be the only objective of horizontal mergers. Horizontal mergers may generate economies of scale so to reduce average production costs.

contingent bonus plans do not overbid but instead pay significantly lower premiums to target firm shareholders. In addition, I find results indicating that market does not perceive acquisition decisions differently for firms with revenue-contingent bonus plans. Overall, the results suggest that merger decisions motivated by this compensation choice might not incur more costs than other acquisitions.

The study makes several contributions to the existing literature. First, the paper adds to the M&A literature by linking performance measures to firms' bidding activity. While prior research has examined potential motives that encourage managers to undertake M&A deals (e.g., Harford 1999; Malmendier and Tate 2008; Cai and Vijh 2007), to my knowledge, no paper has explored the role of performance measures in influencing corporate acquisition decisions. My findings indicate that the choice of performance measures play a crucial role in affecting merger decisions.

Second, the findings of this study are relevant to regulators, policy makers, and investors. In 2006, the U.S. Securities and Exchange Commission (SEC) adopted rules that require companies to provide much more detailed information about their executive compensation plans, including performance measures and goals used in incentive compensation programs. This requirement resulted from the assertion by the SEC that if performance measures and goals are central to a company's decision-making process, these measures and goals must be disclosed to investors. However, many companies have failed to comply with these requirements (e.g., Robinson et al. 2011). My findings reveal the importance of performance measures in affecting managerial decisions, thereby underscoring the need for adequate enforcement of and compliance with the disclosure rule.

Third, the study contributes to the strategy literature. Studies from strategy literature suggest that corporate strategy plays crucial role in setting executive reward system (e.g., Balkin and Gomez-Mejia 1987; Balkin and Gomez-Mejia 1990; Dow and Raposo 2005; Gomez-Mejia 1992; Sanders and Carpenter 1998). My study extends this line of literature by documenting that managers take corresponding actions to support organization strategy. My findings are consistent with the "congruency" property between executive compensation and corporate strategies.

Last, recent studies have begun to examine the choice of certain performance measure and its impact on managerial decisions (e.g., Huang et al. 2011; Marquardt and Wiedman 2005; Shalev et al. 2010; Young and Yang 2011). By studying the economic determinants of using sales revenue as a performance measure, the paper helps us better understand the choice of sales performance measure and its impact on managerial decisions.

The remainder of the paper is structured as follows. In section 2, I discuss prior research and develop hypothesis. I describe sample and data in section 3, and present empirical analyses in section 4. Additional analyses are provided in section 5. Last, I conclude in section 6.

2.2 Literature Review and Hypothesis Development

Unlike equity-based compensation, executive annual bonus contracts are often explicitly tied to performance measures, which are important in communicating corporate objectives to managers and evaluating their performance. Previous studies show that corporate strategy is a potential determinant of executive compensation design (e.g., Balkin and Gomez-Mejia 1987; Balkin and Gomez-Mejia 1990; Dow and Raposo 2005; Gomez-Mejia 1992; Ittner et al. 1997; Sanders and Carpenter 1998). For example, Sanders and Carpenter (1998) study the relationship between globalization strategy and executive compensation and show that firms engaging a global diversification strategy adopted CEO compensation contacts that are high level and long-term oriented. Ittner et al. (1997) find that firms pursing innovation-oriented and quality-oriented strategy place more weight on non-financial metrics, suggesting that firms link compensation policies to strategic objectives to ensure that managerial incentives and corporate objectives are aligned.

The question of whether "you get what you measure and reward" is an open question that has been studied extensively in the executive compensation literature (e.g., Banker et al. 2001; Larcker 1983; Larcker 1987; Wallace 1997). In this study, I empirically examine whether managers' actions are motivated by compensation contracts. Specifically, I study the use of sales revenue as a performance measure in CEO annual bonus contracts and its effect on merger activities.

Sales revenue is a frequently used performance measure in executive annual incentive plans. In fact, Towers Watson surveys document that sales revenue is one of the most prevalent financial performance measures employed in executive annual incentive contracts.[11] In addition, sales revenue is considered the key driver of shareholder value (e.g., Ghosh et al. 2005; Penman 2004). Previous research has examined the vital role sales revenue plays in both equity and debt markets (Chandra and Ro 2008; Ertimur et al. 2003; Ghosh et al. 2005; Ghosh et al. 2010; Jegadeesh and Livnat 2006; Swaminathan and Weintrop 1991). Managers often voluntarily disclose projected revenue performance along with earnings guidance (e.g., Han and Wild 1991; Wasley and Wu 2006). Furthermore, the frequency of issuing analyst revenue forecasts has increased dramatically overtime (Ertimur et al. 2011; Jegadeesh and Livnat 2006). Rees and Sivaramakrishan (2006) find that the market awards a distinct equity premium to firms meeting

[11] Towers Watson surveys conducted in 2005 and 2010 document that sales revenue is the single most frequently used performance measure in executive annual bonus contracts, with 31% and 34%, respectively, of survey respondents reporting its use.

revenue forecasts. Despite the importance of sales revenue and its prevalence in compensation contracts, prior research has not examined the economic determinants of firms' decisions to use revenue-contingent compensation contracts, nor has it explored how the use of sales revenue as a performance measure influences merger activities.

M&A activity represents a substantial portion of corporate investment events. Compared to total capital expenditure activity of $1.85 trillion by Compustat firms in 2007, the aggregate deal value for acquisitions of U.S. targets was $1.37 trillion (Garfinkel and Hankins 2010). M&A activity plays a crucial role at the company level by adding capital to firms, at the industry level by facilitating consolidation and reduction of the asset base, and in the economy as a whole by leading to more productive firms (e.g., Andrade and Stafford 2004; Maksimovic and Philips 2002).

Acknowledging its importance, researchers have studied M&A activity from various angles for decades. Previous research suggests that there is a close link between managerial compensation and M&A decision. For example, Cai and Vijh (2007) document that CEOs with greater stock and option holdings are more likely to make acquisitions, indicating that equity compensation motivates CEOs to engage in M&A to improve company long-term value. Similarly, Datta et al. (2001) and Denis et al. (1997) find that equity-based compensation and increased ownership provide effective motivation for managers to engage in value-maximizing acquisitions.

However, previous research makes no assertions regarding the role of performance measures employed in managerial compensation contracts in M&A decisions. M&A is often perceived as a vehicle for boosting top-line revenue growth through various avenues, such as cross-selling, expansion to additional geographies, and bundling of services and products.

Companies often clearly assert that enlarging market share and fueling revenue growth are the prime motivation to acquire. A study from McKinsey reveals that increasing sales revenue is listed as one of the primary goals in 80% of acquisition announcements. In addition, Grinstein and Hribar (2004) show that CEOs receive bonuses for completing M&A, and the resulting increase in revenues is the most frequent motivation of providing such bonuses.

By choosing sales as a performance measure in managerial compensation plans, companies communicate the importance of revenue performance to their executives. Therefore, I argue that managers whose annual incentive compensations are explicitly linked to sales performance are more likely to pursue M&A activities. This logic leads to the following hypothesis:

> **H1**: Managers are more likely to pursue M&A activities when their annual bonus contracts are explicitly tied to revenue performance.

However, several factors may work against the above argument. First, if boards of directors adjust compensation for the revenue growth achieved via acquisition strategies, then revenue-contingent bonus compensation will not motivate managers to pursue acquisitions. In addition, revenue growth achieved through M&A may be highly uncertain and difficult to accomplish. Furthermore, the board of directors (and not managers) may have ultimate control over the M&A decision, resulting in no relation between revenue-contingent bonus plans and M&A decisions. Last, acquisition decisions might impose large risks to CEOs. Both anecdotal and empirical evidences suggest that “bad” acquisitions lead to subsequent CEO turnover (e.g., Lehn and Zhao 2006). In the case that any or all of these arguments applies, the power of the empirical tests is reduced and biases against finding evidence consistent with H1.

In addition, the role of bonus compensation in influencing managerial decisions has been challenged since its magnitude is often relatively small compared to equity-based compensation.

However, Murphy and Jensen (2011) present various arguments to highlight the importance of annual bonus plans in rewarding and directing managerial decisions. For example, they argue that "Incentive plans are ultimately effective only if the participants understand how their actions affect the payoffs they will receive and then act on those perceptions… Therefore, because the uncertainly between the executives' actions and the effects on his or her bonus may make the links between actions and ultimate rewards more or less clear bonus plans may well provide stronger incentives then equity-based plans, even when the magnitude of the payoff is smaller." Thus, whether bonus compensation influences M&A decisions ultimately becomes an empirical question.

2.3 Sample and Data

To identify firms in which CEO bonus compensation contracts are explicitly based on revenue, I hand-collect performance measure data from firms' proxy statements filed with U.S. Securities and Exchange Commission (SEC) over the years 1993 to 2007. Hand-collecting data necessarily limits my sample size; I therefore focus on firms in the Standard & Poor (S&P) 500. S&P 500 firms are identified by using the Compustat S&P Index Constituent Identifier. Firms included in the sample need to fulfill the following requirements: (1) The firm is identified as an S&P 500 firm in December of any year over the period 1993-2007; (2) the firm's proxy statement is available on the SEC website; (3) the firm has an annual bonus plan; (4) executive bonus compensation is explicitly based on at least one performance measure; and (5) the firm discloses the explicit performance measures employed in the bonus plan.

Consistent with previous studies, I exclude firms in financial industries (SIC codes 6000-6999) and utilities (SIC codes 4900-4999). I obtain financial data from Compustat and stock price information from CRSP. M&A data is obtained from the Securities Data Corporation (SDC). Consistent with prior research, I exclude merger activities with total deal values less than $1 million and where the percentage of shares held by acquirers after the merger is less than 50%. The sample selection process yields 4,310 firm-years observations.

2.4 Empirical Analyses

2.4.1 Revenue Model

To better understand the use of sales revenue as a performance measure, I first compile descriptive data on the variety of performance measures used in CEO annual bonus contracts for years 1993 to 2007. Panel A of Table 1 shows that EPS is the most commonly used measure (39%), but sales revenue is the second-most frequently employed measure in CEO annual incentive compensation, with 1,298 (30%) of firms explicitly mentioning its use. In order of frequency, the other financial performance measures mentioned include operating income/pretax income/EBITDA (26%); net income (20%); cash flow/free cash flow (18%); accounting returns (17%); return on shareholders' equity (9%); economic profits (8%); stock returns (7%); operating margin (6%) and cost controls (3%). Regarding qualitative performance measures, individual performance measures are most often used in annual bonus compensation, with 28% of firms using it, followed by measures of strategic performance (14%), customer relations (8%), managerial leadership (5%), human resource issues (4%), and safety, environment, and health (3%). In addition, firms often employ more than one performance measures. The mean (median) number of measures used is 2.82 (2.00).

Panel B of Table 1 reports the use of other performance measures, conditional on the usage of sales revenue as a performance measure. I find that firms that use revenue as a performance measure are significantly more likely to also adopt EPS, operating income/pretax income/EBITDA, cash flow/free cash flow, operating margin, strategic, customer, and human resource performance measures than other firms. Firms that use sales revenue are significantly less likely to use ROE, EVA/Economic profit, and safety, environment, and health performance measures in CEO annual incentive contracts than other firms. In addition, firms that adopt sales revenue as a performance measure also use more performance measures than other firms.

Drawing upon prior studies, I develop an empirical model of the decision to use revenue performance measure in annual bonus contracts. I define the dependent variable, *SALES,* as a dummy variable that equals one when CEOs' annual bonus contracts are explicitly tied to sales performance. Because previous studies suggest that more relative weight is placed on the performance measures that are more value relevant to investors (e.g., Banker et al. 2009; Bushman et al. 2006). I predict that the value relevance of sales revenue (*SALESVR*) is positively associated with *SALES*. *SALESVR* is measured using an 8-quarter rolling window estimation of the following model:

$$CAR_{i,q} = a_0 + a_1 \Delta RPS_{i,q} + a_2 \Delta EPS_{i,q} + \varepsilon \quad (1)$$

CAR is the raw stock return minus the CRSP value-weighted market portfolio return for firm *i* in quarter q. *ΔRPS* (*ΔEPS)* is the change in revenue (earnings) per share from the same quarter of the prior year. The estimated coefficient on *ΔRPS* is used as a proxy for the value relevance of revenue and is expected to be significantly positive. In addition, I include the estimated coefficient on *ΔEPS* as an additional control for the value relevance of earnings (*EARNINGSVR*).

Defond and Park (1999) suggest that industry competition affects the use of accounting measures in evaluating executives. Because retaining and gaining market share might be crucial for firms operating in a more competitive industry, I expect firms in more competitive industries to be more likely to evaluate their managers on revenue performance. I measure industry competition using the Herfindahl-Hirschman Index (*HHI*), which is defined as the sum of squares of market share, using sales revenue, of all firms in an industry (based on 2-digit SIC codes). As such, the *HHI* ranges from 0 to 1.0, moving from a huge number of very small firms to a single monopolistic producer. Since *HHI* decreases in industry competition, I expect *HHI* to be significantly negatively associated with *SALES*; i.e., the use of revenue as a performance measure will be positively associated with the degree of industry competition.

Previous studies suggest that compensation committees assign more relative weight to performance measures that are more persistent, as more persistent accounting measures are more informative to investors, and persistent propriety helps to attenuate managerial horizon problem (e.g., Baber et al. 1998). Therefore, I include *SALESPERSISTENCE*, estimated by regressing future revenue on current revenue as follows:

$$REVENUE_{q+1} = \alpha + \gamma REVENUE_q + \varepsilon \qquad 2$$

The closer γ is to one, the more persistent is revenue. I expect a positive association between *SALES* and *SALESPERSISTNCE*.

Ittner et al. (1997) suggest that business strategy plays an important role in the choice of performance measures. In terms of competitive strategy, firms can be broadly characterized as "prospectors" or "defenders" (Miles and Snow 1978). Prospectors are firms that always search for new markets, seek out new opportunities, and emphasize firm growth. Parnell and Wright (1993) document that prospector business experience revenue growth rates significantly higher than that of other businesses. On the other hand, defenders are firms that exhibit a cost leader strategy and that emphasize activities to lower costs. Therefore, I expect prospectors are more likely than defenders to use revenue as a performance measure. I use market to book ratio (*MB*) and R&D expenditures (*R&D*) to measure the organization's competitive strategy, and regard firms with high *MB* and *R&D* as representing prospectors (Ittner et al. 1997). I thus expect both variables to be positively associated with *SALES*.

Since equity compensation may be more sensitive to the value relevance of performance measures than is bonus compensation as equity compensation rely more on price performance measures. I expect the effect of value relevance of revenue on the choice of using sales as a performance measure to be reduced when there is more equity compensation. Therefore, I include equity compensation (*EQUITYCOMP*) and its interaction with value relevance of revenue in the model. In addition, I also control for the value relevance of earnings (*EARNINGSVR*) and earnings persistence (*ROAPERSISTENCE*) since firms tend to use sales in tandem with some form of profit measures.

Last, I also include firm age (*FIRMAGE)* to control for firms' life cycles, firm size (*LOGTA*), profitability (*ROA*), cash holdings (*CASH)*, and tangible assets (*PPE*) to control for other firm characteristics which may influence compensation policies. I have no predictions regarding the expected sign of these variables. The final model is as follows:

$$\begin{aligned} PSALES_{i,t} = {} & \beta_0 + \beta_1 SALESVR_{i,t-1} + \beta_2 HHI_j + \beta_3 SALESPERSISTENCE_i + \beta_4 RD_{i,t-1} \\ & + \beta_5 MB_{i,t-1} + \beta_6 LOGTA_{i,t-1} + \beta_7 ROA_{i,t-1} + \beta_8 CASH_{i,t-1} + \beta_9 PPE_{i,t-1} \\ & + \beta_{10} FIRMAGE_{i,t-1} + \beta_{11} EQUITYCOMP_{i,t-1} \\ & + \beta_{12} EQUITYCOMP * SALESVR_{i,t-1} + \beta_{13} EARNINGSVR_{i,t-1} \\ & + \beta_{14} ROAPERSISTENCE_{i,t-1} + \delta_{i,t-1} \end{aligned} \quad (3)$$

Table 2 presents descriptive statistics for the independent variables from equation (3). The leftmost column of Table 2 reports means and medians for the whole sample. I also compare firm characteristics for firms that explicitly tie annual incentive compensation to sales revenue (*SALES*=1) versus firms that do not (*SALES*=0).

As expected, revenue is more value relevant, and sales revenue is more persistent for *SALES=1* firms-mean (median) *SALESPERSISTENCE* is 0.779 (0.849) versus 0.719 (0.815). The *SALES=1* firms operate in more competitive industries than other firms- mean (median) *HHI* is 0.049 (0.037) versus 0.067 (0.045). Firms that are closer to the prospector strategy (i.e., having high *MB* and *R&D*) are more likely to use revenue performance measure-mean (median) *MB* is 3.109 (2.441) versus 2.097 (1.711) and mean (median) *R&D* is 0.055 (0.036) versus 0.023 (0.004). *SALES*=1 firms are younger firms suggesting firms tend to emphasize growth strategy in the early stage of their life cycles-mean (median) *FIRMAGE* is 32.464 (28.000) versus 37.590 (33.000). Also, firms with CEO bonus compensation that is tied to revenue performance are relatively smaller (*LOGTA*), but they are more profitable (*ROA*) and richer (*CASH*). Firms with CEO bonus compensation tied to revenue have lower level of tangible assets (*PPE*).

In addition, CEOs whose annual bonus compensations are explicitly linked to revenue receive more equity-based compensation. Mean (median) of *EQUITYCOMP* is 9.218 (3.053) for *SALES=1* group, and they are significantly different from the other group with mean (median) of 4.328 (1.644). Earnings are more value relevant for *SALES*=1 firms: the difference of *EARNINSGVR* is significant for mean (p=0.03) but not median (p=0.14). Persistence of earnings is also different across the two groups: *SALES*=1 firms exhibit more persistent of earnings. The differences in earnings properties across two groups might be due to usage of revenue measure accompanied by profit measures. Taken together, Table 2 shows the differences in firm characteristics between the two groups, suggesting the importance of controlling factors affecting the decision of using revenue as a performance measure in CEO annual incentive contracts.

Table 3 shows results from the probit estimation of equation (3). The findings are generally consistent with the univariate results in Table 2. The probability of using revenue as a performance measure is significantly positively associated with industry competition (*HHI*), revenue persistence (*SALESPERSISTENCE*), and organizational strategy (*MB* and *R&D*). Profitable (*ROA*), cash-rich (*CASH*), younger (*FIRMAGE*), and larger (*LOGTA*) firms are also significantly more likely to use revenue-contingent annual bonus plans, and the probability of using revenue as a performance measure is significantly negatively associated with level of tangible assets (*PPE*).

However, after controlling for other variables, the value relevance of revenue (*SALESVR*) is not significantly associated with *SALES*, although both the value relevance of earnings (*EARNINGSVR*) and earnings persistence (*ROAPERSISTENCE*) are both positively associated. The latter finding may be due to the fact that, as indicated in Table 1, firms that employ revenue as a performance measure are also more likely to explicitly reward earnings performance than other firms.

In summary, my results suggest that using revenue as a performance measure is significantly related to corporate strategy, industry competition, and revenue persistence. Next, I use a simultaneous bivariate probit model to jointly test performance measure choice and merger decision.

2.4.2 Merger Decisions and Revenue-contingent Annual Incentive Contracts

To test H1 --managers whose annual incentive contracts are explicitly tied to revenue performance are more likely to pursue acquisitions than other managers --I estimate the following probit regression, which is similar to Harford (1999):

$$\begin{aligned} \mathrm{P}(BID_{i,t}) = {} & \alpha_0 + \alpha_1 SALES_{i,t} + \alpha_2 RETURN_{i,t-1} + \alpha_3 CHGSALES_{i,t-1} \\ & + \alpha_4 NONCASHWC_{i,t-1} + \alpha_5 LEVERAGE_{i,t-1} + \alpha_6\, MB_{i,t-1} + \alpha_7\, PE_{\ i,t-1} \\ & + \alpha_8\, LOGTA_{i,t-1} + \alpha_9 CASH_{i,t-1} + \alpha_{10} ROA_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{4}$$

In equation (4), the dependent variable (*BID*) is an indicator variable that equals one if a firm announces at least one bid in year t and zero otherwise. The key variable of interest is *SALES*, which, as defined above, indicates that CEO annual incentive compensations is revenue-contingent. A significant and positive (negative) coefficient on *SALES* suggests that managers are more (less) likely to pursue M&A deals when their annual bonus plans are explicitly tied to sales performance.

Prior year's abnormal return (*RETURN*), market to book ratio (*MB*), and price to earnings ratio (*PE*) are included to capture market timing motivations. *MB* is the ratio of market value of equity over book value of the equity. *PE* is defined as the stock price divided by earnings per share. Market timing refers to the hypothesis of stock valuation driven merger activity (e.g., Shleifer and Vishny 2003). Specifically, it suggests that firms with overvalued stocks tend to use shares to buy undervalued targets through M&A. Therefore, I expect positive coefficients on *RETURN*, *MB*, and *PE*.

Revenue growth (*CHGSALES*) is included in model (4) to capture growth opportunities. Firms with high growth opportunities are more likely to pursue M&A to expand their businesses. On the other hand, it is possible that firms that have difficulty in fueling growth are more likely to engage in M&A. Therefore, I make no prediction regarding the sign of the coefficient on *CHGSALES*. In addition, Harford (1999) documents that cash-rich firms are more likely to attempt acquisitions. Therefore, I include the level of cash holding *(CASH)* in equation (4) and expect it to be positively related to the probability of making an acquisition bid.

I also control for firm size (*LOGTA*), measured by log of total assets. Larger firms are more likely to be acquirers so I expect *LOGTA* to be positively related to probability of making acquisition bids (Harford 1999). Firms with more debt receive more monitors from creditors on the usage of funds; thus I predict that leverage ratios (*LEVERAGE*), defined as book value of debt (book value of long-term and short-term debt) over total assets, to be negatively related to probability of acquisitions. Noncash working capital (*NONCASHWC*) is defined as the net working capital (current assets minus current liabilities) minus cash and cash equivalents, deflated by total assets. Harford (1999) documents a significantly positive association between *NONCASHWC* and the probability of acquisitions since noncash working capitals represent highly liquid internal assets similar to cash. Return on assets (*ROA*) is defined as EBITDA over average total assets. Prior research documents that acquirers often over-performed prior to acquisitions (e.g., Rau and Vermaelen 1998). Therefore, I expect both *NONCASHWC* and *ROA* to be positively associated with probability of bids.

Table 4 shows descriptive statistics and univariate comparisons for the variables used to estimate equation (4). I find that firms that make at least one acquisition bid (*BID=1)* firms are significantly more likely to have revenue-contingent annual bonus contracts (*SALES*) than other firms (*BID=0*). Also consistent with expectations, *BID=1* firms have significantly higher stock returns (*RETURNS*), higher revenue growth (*CHGSALES*), and larger market to book (*MB*) and PE ratios (*PE ratio*) than *BID*=0 firms. I further find that the *BID*=1 firms are significantly less leveraged (*LEVERAGE*), larger (*LOGTA*), more cash-rich (*CASH*), and more profitable (*ROA*) than *BID=0* firms. Last, I find no significant difference in non-cash working capital (*NONCASHWC*) between the two groups.

Next, I simultaneously estimate equation (3) and equation (4) using a bivariate probit model to examine the effect of revenue-contingent compensation plans on the likelihood of bidding activity. Results are presented in Table 5. The estimated coefficient of 0.854 on *SALES* is positive and significant ($p<0.01$), which suggests that managers whose annual incentive compensations are based on sales performance are more likely to pursue M&A deals. Therefore, I find evidence consistent with H1.

Turning to the control variables, the marginally significant and positive coefficient of 0.170 (p-value=0.09) on changes in sales (*CHGSALES*) suggests that firms with high growth opportunities are more likely to engage in M&A activities in hopes of expanding their business. In addition, PE ratio (*PE*) is marginally significantly and positively associated with the probability of bidding, consistent with the market timing motivation for acquisitions. Similar to the findings from univariate tests, firms that are less-leveraged (*LEVERAGE*), larger (*LOGTA*), and more profitable (*ROA*) are significantly more likely to engage in M&A. However, after controlling for other variables and endogeneity in compensation contracts, I find no evidence suggesting that stock return performance (*RETURN*), non-cash working capital (*NONCASH WC*), market to book ratio (*MB*), and level of cash holdings (*CASH*) are related to the probability of acquisition bids in my sample.[12]

Regarding the sales model, the results in Table 5 are very similar to those presented in Table 3. Using revenue as a performance measure is increasing in industry competition, revenue persistence, and organizational strategy. Overall, I find results consistent with revenue-contingent compensation contracts playing a significant role in merger decisions.

2.5 Additional Analyses

2.5.1 Merger Types and Revenue-contingent Annual Incentive contracts

Mergers may be classified as horizontal, vertical or conglomerate. Horizontal mergers occur when two firms operate and compete in the same market, thereby allowing acquirers to

[12] I also include CEO equity compensation, CEO ownership, and CEO tenure variables in equation 4. However, I find they are not associated with the probability of making acquisition attempts in my sample. Including CEO related variables significantly drops my sample size so I report the results without those variables.

gain market power and achieve revenue growth. Acquirers can diversify their revenue stream through conglomerate mergers, where acquirers and targets are from two different industries. In contrast, vertical mergers, where two firms have a customer-supplier relationship, are more directly related to cost reduction objectives since such mergers allow firms to reduce transaction costs. Therefore, vertical mergers may result increasing in margins but may have less obvious effects on revenue. Therefore, I expect a stronger impact of revenue-contingent bonus plans on horizontal and conglomerate mergers.

To test this proposition, I use a bivariate ordered probit regression that simultaneously estimates an ordered probit model of bidding choice and a probit model of performance measure choice. In the ordered probit model, the dependent variable is coded as "2" for conglomerate or horizontal mergers; a "1" for vertical mergers; or "0" for no bidding activity. Horizontal mergers are defined as those in which acquirers and targets have the same 4-digit SIC code; conglomerate mergers are those where the two firms have different 2-digit SIC codes; and vertical mergers are those where targets have the same 2-digit SIC code as the acquirer but a different 4-digit code.

Table 6 presents the results. In the bidding model, the estimated coefficient of 0.556 on *SALES* is positive and significant ($p<0.01$), consistent with a stronger effect for firms that pursue conglomerate or horizontal mergers. However, in contrast to the results in Table 5, the estimated coefficients on revenue growth (*CHGSALES*) and PE ratio (*PE)* have lost their significance, while the estimated coefficient of 0.320 on cash holdings (*CASH*) is now marginally significantly, with $p=0.09$. I interpret these results as indicating that differences in *CHGSALES* and *PE* do not help distinguish between conglomerate/horizontal and vertical mergers, but that firms with higher cash holdings are more likely to pursue conglomerate/horizontal mergers than vertical mergers. In addition, the results from the sales model are similar to those documented in Tables 3 and 5.

2.5.2 Premium Analysis

The main results suggest that revenue-contingent bonus plans encourage managers to pursue M&A with the intention to drive revenue growth. However, there may be significant costs associated with this compensation choice. For example, if managers whose performance is explicitly tied to sales revenue are more eager to grow revenue through acquisitions, they might offer higher premiums in order to increase their chances of completing deals. Therefore, I empirically examine whether revenue-contingent bonus plans are associated with acquisition premium. Following prior studies, I estimate the following OLS regression:

$$
\begin{aligned}
PREMIUM_{j,t} = \alpha_{j,t} &+ \beta_1 SALES_{i,t} + \beta_2 STKPAY_{j,t} + \beta_3 TENDER_{j,t} + \beta_4 HOSTILE_{j,t} \\
&+ \beta_5 RSIZE_{i,t-1} + \beta_6 ACQMB_{i,t-1} + \beta_7 ACQCASH_{i,t-1} + \beta_8 ACQLEV_{i,t-1} \\
&+ \beta_9 TARMB_{i,t-1} + \beta_{10} TARREVGROWTH_{i,t-1} + \beta_{11} ACQEQUITYCOMP_{i,t-1} \\
&+ \beta_{12} ACQCEOSHARES_{i,t-1} + \beta_{13} IMR_{i,t} \\
&+ \delta_{j,t} \qquad (5)
\end{aligned}
$$

PREMIUM is the offer price in excess of the target closing stock price obtained from SDC database. In the premium tests, all targets are public firms so my sample size drops to 416 bid-years observations. The key variable of interest is *SALES*, which is defined earlier. A significantly positive (negative) estimated coefficient would suggest that managers with revenue-contingent bonus plans pay more (less) bid premiums.

Drawing on prior research, I control for other variables that might affect the premium paid. I include the percentage of the acquisition price paid in stock (*STKPAY*), noting that its predicted sign may be either negative or positive. Prior research suggests that acquirers usually overpay for cash acquisitions since capital gains are taxed immediately for cash acquisitions (e.g., Huang and Walking 1987; Wansley et al. 1983; Savor and Lu 2009), leading to a negative relation between *STKPAY* and *PREMIUM*. On the other hand, acquirers may prefer to use stock payments when they are overvalued so might result higher premium paid to targets (e.g., Dong et al. 2006; Martin 1996). Therefore, I make no prediction regarding the sign of the coefficient on *STKPAY*. *TENDER* is a dummy variable that equals one if bids are tender offers and zero otherwise. Bidders usually pay sizeable premiums in tender offers, so I expect a positive relation between *TENDER* and *PREMIUM* (e.g., Fowler and Schmidt 1988; Moeller et al. 2004). I include *HOSTILE*, which equals one if deals are classified as hostile and zero otherwise, to control for bid attitude. Schwert (2000) documents a positive relation between acquisition premium and the level of hostility, so I expect β_4 to be significantly positive.

Relative size (*RSIZE*) is defined as the ratio of the acquirer's total assets to the target's total assets (Louis 2005). Prior studies suggest that relative size influences the acquisition premium, with bidders often paying smaller premium for bigger targets since larger targets are associated with higher integration costs (e.g., Comment and Schwert 1995; Moeller et al. 2004; Schwert 2000). Therefore, I expect a positive relation between *RSIZE* and *PREMIUM*.

Market to book ratio is a proxy for growth opportunities. In the case that acquirer firms already had ample investment opportunities, they would less likely to overpay for acquisitions. This argument leads a negative relation between acquirers' market to books ratio (*ACQMB*) and premium (*PREMIUM*). However, market to book ratio also captures overvaluation, and overvalued bidders tend to pay a larger premium (Dong et al. 2006). Similar arguments can be applied to the association between targets' market to book ratio (*TARMB*) and *PREMIUM*. Bidders might be willing to pay more for firms with more investment opportunities, resulting in a positive relation between *TARMB* and *PREMIUM* (e.g. Crawford and Lechner 1996). On the other hand, Comment and Schwert (1995) find an inverse relation between target market to book ratio and premium, suggesting that undervalued firms are more attractive to bidders. Therefore, I make no prediction regarding the sign of the coefficients on *ACQMB* and *TARMB*.

Harford (1999) finds that cash-rich firms tend to engage in value-decreasing acquisitions. Therefore, I also control for acquirers' cash holdings (*ACQCASH*) and expect it to be significantly positively related to the premium. Uysal (2011) documents that capital structure affects bidding behavior in acquisitions. The study documents over-leveraged bidders pay significantly less premiums, suggesting financing constraints limit the ability of overpaying. I thus control for acquirers' leverage ratio (*ACQLEV*) and expect it to be significantly negatively related to the premium. In addition, previous studies suggest that the past performance of targets affects the bid premium. Following previous studies (e.g., Bange and Mazzeo 2004; Schwert 2000), I use sales growth (*TARREVGROWTH*) as a proxy for past performance. The coefficient on *TARREVGROWTH* can be either positive or negative. Bidders might be willing to pay more for firms with better past performance so lead to a positive relation between *PREMIUM* and *TARREVGROWTH*. On the other hand, Dionne et al. (2010) find that *TARREVGROWTH* is negatively associated with the premium, suggesting that poorly performed targets might be attracted to bidders since gains could be realized after removing current managers. Therefore, I make no prediction regarding the sign of the coefficients on *TARREVGROWTH*.

Previous research suggests that managerial compensation influences acquisition decisions. For example, Datta et al. (2001) find that managers with low equity compensation are more likely to overpay for targets, suggesting equity-based compensation helps to mitigate overpayment problem. Therefore, I control for CEO equity compensation (*ACQEQUITYCOMP*) and ownership (*ACQCEOSHARE*), and expect those two variables to be negatively associated with *PREMIUM*. I also include the inverse Mills ratio (*IMR*) estimated from equation (3) to control for potential endogeneity between compensation structure and bidding activity.

Panel A of Table 7 shows descriptive statistics for the variables included in premium tests. First, it shows that in general acquirers pay an acquisition premium: mean premium one day (*PREMIUM1DAY*), one week (*PREMIUM1WK*), and four weeks (*PREMIUM4WK*) prior to announcement dates are all positive. Mean (median) *STKPAY* is 34.53% (0.00%), and mean (median) *TENDER* is 0.286(0.000). Panel A shows that there are relatively few hostile acquisitions in my sample: mean (median) *HOSTILE* is 0.048(0.000). In addition, acquirers are larger relative to target firms: mean (median) relative size (*RSIZE*) is 1.734 (1.574). Panel B of Table 7 shows univariate comparisons for the premiums. Premiums paid to targets are positive for firms with revenue-contingent bonus plans (*SALES=1*), but these firms appear to pay less than other firms – mean (median) *PREMIUM1DAY* is 0.319(0.273) versus 0.405 (0.273); mean (median) *PREMIUM1WK* is 0.358 (0.306) versus 0.457(0.323); mean (median) *PREMIUM4WK* is 0.437(0.344) versus 0.526(0.394). However, differences between the two groups are not significant for both means and medians.

Panel C of Table 7 presents the regression results. The first column shows the results where the dependent variable is *PREMIUM1DAY*. The estimated coefficient of -0.204 on *SALES* is negative and significant (p=0.03). The result suggests that, after controlling for other factors that might affect bid premium, firms with revenue-contingent bonus plans pay significantly lower premiums than other firms. Consistent with my expectations, acquirers' market to book ratio and level of cash holdings are positively related to premiums. The estimated coefficient of -0.052 on *TARMB* is negative and significant (p=0.05), indicating that acquirers tend to pay less for overvalued targets. In addition, acquirers' leverage ratio (*ACQLEV*) is significantly positive associated with the premium, suggesting that over-leveraged acquirers pay more. The significantly positive coefficient on *ACQLEV* is surprising in light of Uysal (2011), which documents that over-leveraged bidders pay significantly less premiums. The other control variables are not significantly related to premium paid in my sample.

Columns 2 and 3 present results using *PREMIUM1WK* and *PREMIUM4WK* as dependent variable, respectively. Results are fairly consistent across all three specifications. Overall, the results from Table 7 indicate that, compared to other firms, firms that use revenue performance measure do not appear to overpay for acquisitions but instead pay significantly lower premiums to their targets.

2.5.3 Market Reactions to Bidding Announcements

Prior research documents that abnormal stock returns around bidding announcements are typically negative or insignificant (e.g., Jensen and Ruback 1983; Jennings and Mazzeo 1991), suggesting that the market perceives most acquisitions as not value-maximizing. Sales revenue will be mechanically increased after successful acquisition and empire building by acquiring CEOs is often considered as value-destroying. Investors may react more negatively to the bid announcement of firms with revenue-contingent bonus plans if they review these plans as encouraging empire-building. Therefore, I also examine whether revenue-contingent plans are associated with bidding announcement returns. Following prior studies, I estimate the following OLS regression:

$$\begin{aligned} CAR_{j,t} = {} & \alpha_{j,t} + \beta_1 SALES_{i,t} + \beta_2 STKPAY_{j,t} + \beta_3 RSIZE_{i,t-1} + \beta_4 ACQCASH_{i,t-1} \\ & + \beta_5 ACQLEV_{i,t-1} + \beta_6 SAMEIND_{j,t} + \beta_7 ACQMB_{i,t-1} \\ & + \beta_8 ACQEQUITYCOMP_{i,t-1} + \beta_9 ACQCEOSHARES_{i,t-1} + \beta_{10} IMR_{i,t} \\ & + \delta_{j,t} \end{aligned} \tag{6}$$

CAR is defined as acquirers' cumulative abnormal returns surrounding announcement dates. I examine 3-day (*CAR* (-1,+1)) return windows. In addition to the key variable of interest, *SALES*, I include control variables based on the prior literature. Prior studies suggest that the method of payment provides valuable signals to the market and that announcement returns are significantly lower when acquirers choose to use stock payments because of overvaluation concerns (e.g., Wansley et al. 1983; Travlos 1987). I include the percentage of the purchase price paid in stock (*STKPAY)* in equation (6) and expect it to be significantly negatively associated with announcement returns. In addition, relative size of acquirers to targets (*RSIZE*) plays a significant role in determining how market perceives acquisition activities.[13] Smaller targets are more manageable so increase the acquirers' ability of integration with targets (e.g., Chatterjee 1986; Louis 2004). Consistent with the argument, prior research documents a positive association of *RSIZE* with bidding announcement returns (e.g., Scanlon et al. 1989; Louis 2004).

Harford (1999) finds that cash-rich firms tend to engage in value-decreasing acquisitions due to the free cash flow problem. Acquirers' level of cash holdings (*ACQCASH*) is included in equation (6), and I expect the coefficient on this variable to be significantly negative. Debt is an effective mechanism in reducing free cash flow agency problems (Jensen 1986). Consistent with Harford (1999), Maloney et al. (1993) find that acquirer announcement returns are increasing with acquirer leverage ratios. Therefore, I include acquirer leverage ratio (*ACQLEV*) and expect it to be positively associated with announcement returns.

Prior research documents a positive announcement returns for "related" mergers since synergies may be easier to achieve (e.g., Moeller et al. 2004). Thus, I include a dummy variable that equals one when acquisitions involve a target in the same industry as the acquirer, based on 2-digit SIC codes (*SAMEIND*); I expect a positive coefficient on this variable. In addition, I control for acquirers' market to book ratio (*ACQMB*); the coefficient on this variable could be

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[13] Targets need to be public firms to calculate *RSIZE* so my sample size drops to 416 bid-years observations as in premium tests.

either positive or negative. A positive coefficient indicates that the market perceives the acquisitions favorably when acquirers have more investment opportunities. On the other hand, prior studies find that high market to book "glamour" firms experience poor post-acquisition performance, suggesting that market might over-extrapolate the bidder's past performance. This notion would lead to a negative relation between *ACQMB* and announcement returns. Therefore, I make no prediction regarding the sign of the coefficient on *ACQMB*.

In addition, prior studies document a positive relation between equity-based compensation of acquiring managers and acquisition announcement returns (e.g., Datta 2001). Thus, I control for acquirer CEOs' equity holdings (*ACQEQUITYCOMP*) and stock ownership (*ACQCEOSHARE)* and expect the two variables to be positively associated with bidding announcement returns. Last, I include the inverse Mills ratio (*IMR*) estimated from equation (3) to control for potential endogeneity in compensation choice.

Panel A of Table 8 presents descriptive statistics for the variables in equation (6). As documented in prior studies, the market perceives acquisitions negatively, on average: mean (median) *CAR (-1, +1)* is -0.011(-0.007), and both are significant with p-value<0.01. In addition, related mergers comprise about 50% of the sample: mean *SAMEIND* is 0.553. Panel B shows that *CAR (-1,+1)* is less negative for *SALES*=1 firms than the other firms- mean (median) is -0.009 (-0.001) versus -0.013 (-0.009), but the difference is significant for median (p=0.08) but not for mean (p=0.44).

Panel C presents the regression results. The estimated coefficient on *SALES* is positive but is not significant. Thus, I find evidence indicating that the market does not perceive acquirers with revenue-contingent bonus plans differently from other firms. Consistent with expectations, I find that acquirers' 3-days announcement returns are significantly higher when relative size of acquirers to targets are larger (*RSIZE*) and the returns are significantly lower when there are more stock payments (*STKPAY*). In addition, the coefficient of -0.041 on *ACQCASH* is negative and marginally significant (p=0.09), suggesting the market perceives that acquisitions by cash-rich firms are value decreasing. The coefficients on other variables are not significant. Overall, I find results indicating that investors do not view acquisitions promoted from this compensation choice differently from other firms.[14]

2.6 Conclusions

In this paper, I explore whether the choice of performance measures is associated with investment decisions. Specifically, I examine the effect of using sales revenue as a performance measure in CEOs annual incentive contracts on merger and acquisition activity for a sample of S&P 500 firms over the time period 1993-2007. Using hand-collected data from firms' proxy statements filed with the Securities and Exchange Commission (SEC), I find that managers are more likely to pursue M&A deals when their annual incentive compensations are explicitly tied to revenue performance measure. The effect of revenue performance measure is stronger for conglomerate and horizontal mergers. In addition, I find evidences suggesting that acquirers with revenue-contingent bonus plans pay significantly lower premiums than other firms, and that investors do not respond differently to bid announcements of firms with revenue-contingent bonus plans. Overall, the results indicate that merger decisions motivated by this compensation choice might not incur more costs than other acquisitions.

There are limitations underlying the study. First, the sample consists of S&P 500 firms, excluding utilities and financial institutions. Therefore, the results may not be generalizable to

[14] In addition, I do not find the postmerger operating performances in terms of sales growth and profitability are different by whether revenue is used as an explicit performance metric in CEOs annual incentive plans.

other firms. However, evidence based on the S&P 500 is important in its own right since those firms are the leading companies that are crucial to the US economy. Second, my study is based on hand-collected data from firms' proxy statements filed with the SEC regarding the performance measures used in CEOs annual incentive contracts. Firms may fail to disclose executive compensation information accurately to avoid public attention to the huge managerial payments (Robinson et al. 2011). However, any noise introduced from erroneous compensation disclosures will bias the empirical tests against rejection of the null hypothesis. Nonetheless, the results should be interpreted with these caveats in mind.

The paper contributes to several steams of literature, including the literature on executive compensation, strategy, and mergers and acquisitions. The study provides new evidence on the impact of performance measures on merger activities and demonstrates the importance of the role of performance measures in directing corporate investment decisions.

Table 2.1 Performance Measures Used in CEO Annual Incentive Plans

Panel A: Frequency of firms using each performance measure (N=4,310)

			N	%
Earnings per share			1,663	39%
Revenue			1,298	30%
Operating income/pretax income/EBITDA			1,131	26%
Net income			874	20%
Cash flow/Free cash flow			756	18%
ROA/ROC/ROI			740	17%
ROE			388	9%
EVA/Economic profit			364	8%
Share price/Total shareholder return			283	7%
Operating Margin			264	6%
Cost control			141	3%
Others (financial)			565	13%
Individual			1,221	28%
Strategic			585	14%
Customer			352	8%
Leadership			198	5%
Human resource			189	4%
Safety, environment and health			140	3%
Others (non-financial)			615	14%
	Mean	Q1	Median	Q3
Number of measures used	2.82	2.00	2.00	4.00

Panel B: Chi-squared tests of differences in frequencies of reported performance measures, conditional on the use of revenue

	SALES=1 (N=1,298)		*SALES*=0 (N=3,012)		p-value
Earnings per share	533	41%	1130	38%	0.03
Operating income/pretax income/EBITDA	384	30%	747	25%	<0.01
Net income	260	20%	614	20%	0.79
Cash flow/Free cash flow	287	22%	469	16%	<0.01
ROA/ROC/ROI	213	16%	527	17%	0.39
ROE	72	6%	316	10%	<0.01
EVA/Economic profit	32	2%	332	11%	<0.01
Share price/Total shareholder return	81	6%	202	7%	0.57
Operating margin	178	14%	86	3%	<0.01
Cost control	44	3%	97	3%	0.77
Others (financial)	235	18%	330	11%	<0.01
Individual	362	28%	859	29%	0.67
Strategic	218	17%	367	12%	<0.01
Customer	184	14%	168	6%	<0.01
Leadership	64	5%	134	4%	0.49
Human resource	92	7%	97	3%	<0.01
Safety, environment and health	13	1%	127	4%	<0.01

Others (non-financial)	199	15%	416	14%	0.19

	Mean	Q1	Median	Q3
Number of measures (*SALES=1*)	2.41	1.00	2.00	3.00
Number of measures (*SALES=0*)	3.76	3.00	3.00	4.00

Panel A of Table 2.1 presents the frequency of firms using each performance measure in CEO annual bonus contracts. Panel B of Table 2.1 shows the use of other performance measures, conditional on the usage of sales revenue as a performance measure**.** *SALES =1* when firms use sales as a performance measure in CEO annual bonus contracts, and zero otherwise. Other financial performance measure include performance measures such as working capital turnover, inventory turnover, book value per share, dividend payout ratio, divisional financial performance measures (like divisional earnings; divisional revenue), capital expenditure, and some performance measures specific to certain industries (like underwriting margin and combined ratio for firms from insurance industry) etc. Other non-financial performance measures include performance measures such as credit rating changes and corporate objectives etc. P-values are based on two-tailed tests.

Table 2.2 Univariate Tests of Determinants of Revenue-contingent Plans

	Combined Sample (N=4,310)		*SALES*=1 Subsample (N=1,298)		*SALES*=0 Subsample (N=3,012)		T-test for difference in means	Wilcoxon test for difference in medians
	Mean	Median	Mean	Median	Mean	Median	p-value	p-value
SALESVR	0.006	0.002	0.009	0.008	0.004	0.001	0.33	<0.01
HHI	0.062	0.042	0.049	0.037	0.067	0.045	<0.01	<0.01
SALESPERSISTENCE	0.737	0.826	0.779	0.849	0.719	0.815	<0.01	<0.01
R&D	0.033	0.010	0.055	0.036	0.023	0.004	<0.01	<0.01
MB	2.402	1.859	3.109	2.441	2.097	1.711	<0.01	<0.01
LOGTA	8.599	8.496	8.572	8.378	8.610	8.531	0.32	0.07
ROA	0.068	0.067	0.084	0.087	0.062	0.061	<0.01	<0.01
Cash	0.122	0.056	0.198	0.112	0.090	0.043	<0.01	<0.01
PPE	0.342	0.295	0.254	0.209	0.380	0.332	<0.01	<0.01
FIRMAGE	36.046	32.000	32.464	28.000	37.590	33.000	<0.01	<0.01
EQUITYCOMP	5.801	1.982	9.218	3.053	4.328	1.644	<0.01	<0.01
EARNINGSVR	0.040	0.005	0.061	0.009	0.030	0.005	0.03	0.14
ROAPERSISTENCE	0.369	0.374	0.407	0.393	0.352	0.358	<0.01	<0.01

Table 2.2 presents descriptive statistics for variables used in revenue model. *SALEVR* is value relevance of revenue, obtained from using an 8-quarter rolling window estimation of the equation: $\mathrm{CAR}_{i,q} = a_0 + a_1\Delta\mathrm{RPS}_{i,q} + a_2\Delta\mathrm{EPS}_{i,q} + \varepsilon$, where *CAR* is the raw stock returns minus the CRSP value-weighted market portfolio return for firm i in quarter q. *ΔRPS (ΔEPS)* is changes in revenue per share (changes in earnings per share) from the same quarter of prior year. The estimated coefficient on *ΔRPS* is used as a proxy for value relevance of revenue, and the estimated coefficient on *ΔEPS* is used as a proxy for value relevance of earnings (*EARNINGSVR*). *R&D* is R&D expenditures deflated by total assets. *LOGTA* is log of total assets. *ROA* is earnings before extraordinary items over book value of assets. *CASH* is cash and marketable securities deflated by total assets. *PPE* is plans, property, and equipment over total assets. *FIRMAGE* is firm age. *SALESPERSISTENCE* is sales persistence, defined as γ estimated by regressing future revenue on current revenue: $REVENUE_{q+1} = \alpha_t + \gamma REVENUE_q + \zeta_q$. *ROAPERSISTENCE* is ROA persistence, defined as γ estimated by regressing future revenue on current revenue: $ROA_{q+1} = \alpha_t + \gamma ROA_q + \zeta_q$. Other variables are defined in Table 2.1. P-values are based on two-tailed tests.

Table 2.3 Probit Estimation of Determinants of Revenue-contingent Annual Incentive Plans

Variable	Predicted Sign	Estimated Coefficient	p-value
Intercept	?	-1.051	<0.01
$SALESVR_{t-1}$	+	0.259	0.12
HHI_{t-1}	-	-1.902	<0.01
$SALESPERSISTENCE_{t-1}$	+	0.410	<0.01
$R\&D_{t-1}$	+	4.700	<0.01
MB_{t-1}	+	0.067	<0.01
$LOGTA_{t-1}$	?	0.057	0.01
ROA_{t-1}	?	1.241	<0.01
$Cash_{t-1}$	?	0.343	0.05
PPE_{t-1}	?	-1.084	<0.01
$FIRMAGE_{t-1}$	?	-0.004	<0.01
$EQUITYCOMP_{t-1}$	?	0.001	0.35
$EQUITYCOMP_{t-1}$* $SALESVR_{t-1}$	-	-0.009	0.23
$EARNINGSVR_{t-1}$	?	0.132	0.03
$ROAPERSISTENCE_{t-1}$	?	0.178	0.05
Pseudo-R^2		16.22%	
N		4,310	
N(*SALES*=1)		1,298	

Table 2.3 shows probit estimation of determinants of revenue-contingent annual bonus plans. Dependent variable is a dummy variable that equals one when firms use sales revenue as a performance measure in CEO annual incentive contracts, and zero otherwise. Independent variables are defined in Table 2.2. Year dummies are included in the regression.

Table 2.4 Descriptive Statistics on Firm Characteristics of Making Acquisition Bids

	Combined Sample (N=4,310)		*BID*=1 Subsample (N=1,446)		*BID*=0 Subsample (N=2,864)		T-test for difference in means	Wilcoxon test for difference in medians
	Mean	Median	Mean	Median	Mean	Median	p-value	p-value
SALES	0.301	0.000	0.360	0.000	0.272	0.000	<0.01	<0.01
RETURN	0.056	0.003	0.081	0.021	0.044	-0.004	<0.01	<0.01
CHGSALES	0.108	0.078	0.127	0.090	0.098	0.072	<0.01	<0.01
NONCASH WC	0.052	0.036	0.049	0.032	0.054	0.038	0.30	0.23
LEVERAGE	0.226	0.222	0.208	0.203	0.233	0.231	<0.01	<0.01
MB	2.402	1.859	2.639	2.007	2.282	1.795	<0.01	<0.01
PE RATIO	22.045	19.804	24.865	21.129	20.621	19.263	0.02	<0.01
$SIZE_{t-1}$ (LOG of total assets)	8.599	8.496	8.716	8.599	8.540	8.457	<0.01	<0.01
CASH	0.122	0.056	0.148	0.076	0.109	0.049	<0.01	<0.01
ROA	0.068	0.067	0.076	0.074	0.065	0.064	<0.01	<0.01

Table 2.4 shows descriptive statistics on firm characteristics of making acquisition bids. *RETURN* is annual abnormal stock return. *CHGSALES* is changes in sales, defined as $(SALES_{i,t} - SALES_{i,t-1}) / SALES_{i,t-1}$. *NONCASHWC* is non-cash working capital, defined as the net working capital (current assets minus current liabilities) minus cash and cash equivalents, deflated by total assets. *LEVERAGE* is leverage ratio, defined as (short-term debt+long-term debt)/total assets. *PE RATIO* is price to earnings ratio, defined as the stock price divided by earnings per share. Other variables are defined in Table 2.2. P-values are based on two-tailed tests.

Table 2.5 Simultaneous Bivariate Probit Estimation of Revenue-contingent Annual incentive Contracts and Making Acquisition Bids

Two-equation system estimated using a seemingly unrelated bivariate probit model

Sales Model		Bid Model	
	Coefficient (p-value)		Coefficient (p-value)
INTERCEPT	-1.024 (<0.01)	*INTERCEPT*	-1.600 (<0.01)
SALESVR $_{t-1}$	0.234 (0.16)	*SALES* $_{t}$	0.854 (<0.01)
HHI $_{t-1}$	-2.021 (<0.01)	*RETURN* $_{t-1}$	0.022 (0.66)
SALESPERSISTENCE $_{t-1}$	0.348 (<0.01)	*CHGSALES* $_{t-1}$	0.170 (0.09)
R&D $_{t-1}$	4.833 (<0.01)	*NONCASH WC* $_{t-1}$	0.133 (0.40)
MB $_{t-1}$	0.065 (<0.01)	*LEVERAGE* $_{t-1}$	-0.439 (0.01)
LOGTA $_{t-1}$	0.061 (<0.01)	*MB* $_{t-1}$	-0.027 (0.12)
ROA $_{t-1}$	1.243 (<0.01)	*PE RATIO* $_{t-1}$	0.001 (0.08)
Cash $_{t-1}$	0.334 (0.05)	*LOGTA* $_{t-1}$	0.132 (<0.01)
PPE $_{t-1}$	-1.052 (<0.01)	*CASH* $_{t-1}$	0.183 (0.31)
FIRMAGE $_{t-1}$	-0.004 (<0.01)	*ROA* $_{t-1}$	0.731 (0.03)
EQUITYCOMP $_{t-1}$	0.002 (0.10)		
EQUITYCOMP $_{t-1}$ * *SALESVR* $_{t-1}$	-0.013 (0.09)		
EARNINGSVR $_{t-1}$	0.099 (0.11)		
ROAPERSISTENCE $_{t-1}$	0.168 (0.06)		
N	4,310	N	4,310

Table 5 shows simultaneous bivariate probit estimation of revenue-contingent annual incentive contracts and making acquisition bids. In the sales model, dependent variable is a dummy variable that equals one when firms use sales revenue as a performance measure, and zero otherwise. In the bid model, dependent variable is an indicator variable that equals one when firms make at least one acquisition bid, and zero otherwise. Independent variables are defined in in Table 2.2 and Table 2.4. Year dummies are included in both regressions.

Table 2.6 Bivariate Ordered Probit

Two-equation system estimated using a seemingly unrelated bivariate ordered probit model

Sales Model		Bid Model	
	Coefficient (p-value)		Coefficient (p-value)
SALESVR $_{t-1}$	0.249 (0.14)	*SALES* $_t$	0.556 (<0.01)
HHI $_{t-1}$	-1.967 (<0.01)	*RETURN* $_{t-1}$	0.007 (0.89)
SALESPERSISTENCE $_{t-1}$	0.364 (<0.01)	*CHGSALES* $_{t-1}$	0.145 (0.14)
R&D $_{t-1}$	4.834 (<0.01)	*NONCASH WC* $_{t-1}$	0.052 (0.74)
MB $_{t-1}$	0.066 (<0.01)	*LEVERAGE* $_{t-1}$	-0.385 (0.03)
LOGTA $_{t-1}$	0.059 (<0.01)	*MB* $_{t-1}$	-0.015 (0.41)
ROA $_{t-1}$	1.251 (<0.01)	*PE RATIO* $_{t-1}$	0.000 (0.15)
Cash $_{t-1}$	0.333 (0.05)	*LOGTA* $_{t-1}$	0.117 (<0.01)
PPE $_{t-1}$	-1.048 (<0.01)	*CASH* $_{t-1}$	0.320 (0.09)
FIRMAGE $_{t-1}$	-0.004 (<0.01)	*ROA* $_{t-1}$	0.956 (<0.01)
EQUITYCOMP $_{t-1}$	0.001 (0.19)		
EQUITYCOMP $_{t-1}$* *SALESVR* $_{t-1}$	-0.012 (0.13)		
EARNINGSVR $_{t-1}$	0.114 (0.07)		
ROAPERSISTENCE $_{t-1}$	0.172 (0.05)		
N	4,310	N	4,310
N (horizontal and conglomerate mergers)		748	
N (Vertical mergers)		698	
N (No mergers)		2,864	

Table 6 presents results from simultaneous bivariate ordered probit estimation of revenue-contingent annual incentive contracts and deal type. In the sales model, dependent variable is a dummy variable that equals one when firms use sales revenue as a performance measure, and zero otherwise. In the bid model, the dependent variable is coded as “2” for conglomerate or horizontal mergers; a “1” for vertical mergers; or “0” for no bidding activity. Horizontal mergers are defined as those in which acquirers and targets have the same 4-digit SIC code; conglomerate mergers are those where the two firms have different 2-digit SIC codes; and vertical mergers are those where targets have the same 2-digit SIC code as the acquirer but a different 4-digit code. Independent variables are defined in in Table 2.2 and Table 2.4. Year dummies are included in both regressions.

Table 2.7 Premium Analysis

Panel A: Descriptive statistics

Variables	Q1	Mean	Median	Q3
PREMIUM1DAY	0.153	0.371	0.273	0.465
PREMIUM1WK	0.176	0.417	0.320	0.547
PREMIUM4WK	0.218	0.491	0.372	0.598
STKPAY	0.00%	34.53%	0.00%	95.95%
TENDER	0.000	0.286	0.000	1.000
HOSTILE	0.000	0.048	0.000	0.000
RSIZE	1.261	1.734	1.574	1.948
ACQMB	1.546	2.794	2.150	3.185
ACQCASH	0.027	0.135	0.077	0.198
ACQLEV	0.106	0.201	0.193	0.283
TARMB	1.322	2.406	1.871	2.823
TARREVGROWTH	0.030	0.572	0.152	0.361
ACQEQUITYCOMP	0.877	6.106	3.096	6.804
ACQCEOSHARE	0.000	0.011	0.001	0.002

Panel B: Univariate tests of premium

Variables	*SALES*=1 (N=166)		*SALES*=0 (N=250)		T-test for difference in mean	Wilcoxon test for difference in medians
	Mean	Median	Mean	Median	p-value	p-value
PREMIUM1DAY	0.319	0.273	0.405	0.273	0.30	0.21
PREMIUM1WK	0.358	0.306	0.457	0.323	0.25	0.22
PREMIUM4WK	0.437	0.344	0.526	0.394	0.32	0.24

Panel C: Regression analysis of premium

Variables	*PREMIUM1DAY*	*PREMIUM1WK*	*PREMIUM4WK*
	0.151	0.124	0.010
Intercept	(0.68)	(0.73)	(0.98)
	-0.204	-0.210	-0.190
Sales PM	(0.03)	(0.03)	(0.06)
	-0.192	-0.199	-0.241
STKPAY	(0.11)	(0.10)	(0.06)
	0.012	0.012	-0.008
TENDER	(0.91)	(0.91)	(0.94)
	0.130	0.141	0.055
HOSTILE	(0.52)	(0.49)	(0.80)
	0.002	0.030	0.044
RSIZE	(0.97)	(0.63)	(0.51)
	0.078	0.071	0.089
ACQMB	(0.01)	(0.02)	(0.01)

	0.833	0.849	0.851
ACQCASH	(0.03)	(0.03)	(0.03)
	0.726	0.771	0.885
ACQLEV	(0.05)	(0.04)	(0.03)
	-0.052	-0.046	-0.041
TARMB	(0.05)	(0.09)	(0.14)
	-0.011	-0.010	-0.008
TARREVGROWTH	(0.40)	(0.42)	(0.54)
	-0.007	-0.007	-0.007
ACQEQUITYCOMP	(0.15)	(0.17)	(0.17)
	-1.738	-1.413	-1.234
ACQCEOSHARE	(0.12)	(0.20)	(0.29)
	-0.100	-0.121	-0.047
IMR	(0.58)	(0.50)	(0.81)
N	416	416	416
N (*SALES*=1)	166	166	166
Adjusted R^2	0.04	0.04	0.03

Table 2.7 shows premium analyses. *PREMIUM1DAY* is premium of offer price to target closing stock price 1 day prior to the original announcement date (%). *PREMIUM1WK* is premium of offer price to target closing stock price 1 week prior to the original announcement date (%). *PREMIUM4WK* is premium of offer price to target closing stock price 4 weeks prior to the original announcement date (%) from SDC. *STKPAY* is the percentage of the acquisition price paid in stock. *TENDER* is a dummy variable that equals one if bids are tender offers and zero otherwise. *HOSTILE* is a dummy variable that equals one if deals are classified as hostile and zero otherwise. *ACQCASH* is acquirers' cash and marketable securities deflated by total assets of the fiscal year prior to bid announcement year. *ACQLEV* is acquirers' leverage ratio of the fiscal year prior to bid announcement year. *ACQMB* is acquirers' market to book ratio of the fiscal year prior to bid announcement year. *RSIZE* is relative size, defined as the ratio of the acquirers' total assets to the targets' total assets of the fiscal year prior to bid announcement year. *TARMB i*s targets' market to book ratio of the fiscal year prior to bid announcement year. *TARREVGROWTH* is targets' changes in sales revenue of the fiscal year prior to bid announcement year. *ACQEQUITYCOMP* is acquirers' CEOs' equity compensation of the fiscal year prior to bid announcement year. *ACQCEOSHARE* is acquirers' CEOs' shareholding of the fiscal year prior to bid announcement year.

Table 2.8 Announcement Returns Analyses

Panel A: Descriptive statistics

Variables	Q1	Mean	Median	Q3
CAR(-1,+1)	-0.033	-0.011	-0.007	0.017
RSIZE	1.261	1.734	1.574	1.948
STKPAY	0.00%	34.53%	0.00%	95.95%
ACQCASH	0.027	0.135	0.077	0.198
ACQLEV	0.106	0.201	0.193	0.283
SAMEIND	0.000	0.553	1.000	1.000
ACQMB	1.546	2.794	2.150	3.185
ACQEQUITYCOMP	0.877	6.106	3.096	6.804
ACQCEOSHARE	0.000	0.011	0.001	0.002

Panel B: Univariate tests of market reactions

Variables	*SALES*=1 (N=166)		*SALES*=0 (N=250)		T-test for difference in mean	Wilcoxon test for difference in medians
	Mean	Median	Mean	Median	p-value	p-value
CAR(-1,+1)	-0.009**	-0.001	-0.013***	-0.009***	0.44	0.08

Variables	Coefficient	p-value
Intercept	-0.010	0.67
SALES	0.006	0.35
RSIZE	0.010	<0.01
STKPAY	-0.019	<0.01
ACQCASH	-0.041	0.09
ACQLEV	-0.003	0.89
SAMEIND	-0.002	0.74
ACQMB	-0.001	0.74
ACQEQUITYCOMP	0.000	0.63
ACQCEOSHARE	0.045	0.51
IMR	-0.009	0.41
N	416	
Adjusted R^2	0.06	

Table 2.8 shows announcement returns analyses. *CAR(-1,+1)* is Acquirers' 3-day cumulative abnormal returns surrounding bidding announcement dates. *SAMEIND* is a dummy variable equals one when acquisitions involve a target on the same industry as the acquirer, based on 2-digit SIC codes and zero otherwise. ***, ** and * denote significance at the 0.01, 0.05 and 0.10 levels, respectively. All variables are defined in in Table 2.7.

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Chapter 1

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