

# DOWNWARD WAGE RIGIDITY IN AMERICAN TECHNOLOGY FIRMS

Xiaoying Chen <sup>\*</sup>, Jasmine Yur-Austin <sup>\*\*</sup>

<sup>\*</sup> Corresponding author California State University, Long Beach, USA  
Contact details: California State University, Long Beach, 1250 Bellflower Boulevard, Long Beach, CA 90840, USA  
<sup>\*\*</sup> California State University, Long Beach, USA



## Abstract

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This study reviews the role of various corporate governance mechanisms to pay for performance in American technology firms. Compared to traditional business leaders, CEOs in technology firms possess stronger power for negotiating with shareholders; such power theoretically lowers the chance of interest conflicts between management and control but may increase CEOs' wage rigidity during business downturns, especially in firms with poor corporate governance. We evaluate ownership structure; board composition; and the existence of independent compensation committees throughout the dot-com bubble and bubble-burst periods. We aim to examine during the business downturn period whether these CEOs cut their compensation effectively or exercise their negotiation power to protect their own benefit. Our empirical results provide strong evidence that given poor firm performance, CEOs with weak corporate governance negotiate higher cash-based pay rather than reduce their compensations. However, we find that venture capitalists play an important role in monitoring CEOs and revising compensation.

**Keywords:** Corporate Governance, Executive Compensation, Ownership, Wage Rigidity, Technology Industry

## 1. INTRODUCTION

During recent years, technology firm executives have been attracting more and more public attention due to the amount of compensation that these top executives are earning. As the United States recovered from the 2008-2009 financial crisis, technology firms became increasingly reliant on ballooned compensation packages to retain or attract high-caliber employees. In 2015, technology companies in America recorded expenses of more than \$40 billion in stock-based compensation, which is roughly 60% more than the bonus pool distributed to the New York employees of Wall Street banks. Despite some anecdotes of high-profile CEOs such as Facebook CEO Mark Zuckerberg and Google co-founders Larry Page and Sergey Brin opting for \$1 annual salaries, CEOs of Standard & Poor's 500 Index companies in 2017 reportedly received average total compensation packages of \$13.94 million, according to the new AFL-CIO Executive Paywatch. According to the New York Times, many of the 200 highest-paid CEOs in the United States during the same year ran tech companies.

Compared to traditional industries, technology firms are rich in abundant patents, new ideas, and intensive human capital investments. These new

economy firms have distinct corporate features such as small board sizes and founder CEOs. However, the latter feature has endowed CEOs with strong managerial powers in regard to negotiating their own compensation with the board. This practice is especially controversial when businesses become stagnant and CEOs wielding higher negotiation power refuse to budge on their own pay. Thus, the unique attributes of technology firms provide a great opportunity to explore whether effective corporate governance mechanisms can constraint CEOs' managerial power to resist downward wage rigidity.

Downward wage rigidity refers to employees' resistance toward any reduction of their nominal wages; such rigidity prevents wages from being renegotiated even if economic conditions worsen. The phenomenon is often observed during economic downturns when union workers rely on their strong collective bargaining power to obtain more favorable compensation agreements with companies. A rich array of economics literature has addressed wage rigidity issues related to the national aggregate level of employees. For example, Elsby et al. (2016) and Daly et al. (2012) documented prevalent nominal wage rigidity during several U.S. recessions. However, what interests us most is the evidence

provided by a microscope study that focused on a group of CEOs with high managerial power throughout a period of business downturn. We devote particular attention to hypothesizing that stronger negotiation power with shareholders may entail CEOs' wage rigidity during such downturns, especially in firms associated with poor corporate governance.

To shed additional light on the issue, this study reviews 890 technology firms that were listed on NASDAQ throughout the dot-com bubble and bubble-burst periods from 1997 to 2003. Our aim is to examine the magnitude of CEOs' wage rigidity within various corporate governance domains. Compared to traditional business leaders, CEOs in technology firms possess stronger power for negotiating with shareholders; such power theoretically lowers the chance of interest conflicts between management and control but may increase CEOs' wage rigidity during business downturns, especially in firms with poor corporate governance. We evaluate ownership structure; board composition; and the existence of independent compensation committees throughout the dot-com bubble and bubble-burst periods. We aim to examine during the business downturn period whether these CEOs cut their compensation effectively or exercise their negotiation power to protect their own benefit.

Contrary to the most literature, we don't apply the widely used executive compensation database known as ExecuComp. Instead, we collect corporate governance and executive compensation data from proxy statements through Lexis-Nexis. ExecuComp contains the firms in the S&P 500, S&P 600, and S&P 400. Within these 1,500 firms, the firms listed on NASDAQ only account for a very small proportion. Because our study collects compensation and board characteristics directly from annual proxy statements, we are able to code some variables that are essential but usually omitted from popular compensation databases; such variables include interlocked director seats and gray directors. Thus, this unique data structure enables us to fully investigate the various impacts of corporate governance functions on executive compensation.

The paper proceeds as follows. Section 2 provides a literature review, and Section 3 develops testable empirical hypotheses. Section 4 presents the methodology and describes the variables. Sample selection is provided in Section 5. We discuss the results in Section 6, and Section 7 concludes.

## 2. LITERATURE REVIEW

According to Jensen and Meckling (1976), the separation of ownership and control may entail agency problems, that is, principals (shareholders) authorize agents (executives) to manage their firms; however, executives act in their own best interests at the cost of the shareholders' best interests. To align these two parties' interests, scholars have suggested that principals should employ incentive compensation and encourage executives to make corporate decisions aimed at the principals' value maximization (Baker, Jensen, & Murphy, 1988). Many prior studies have examined the effectiveness of different compensation packages by estimating the direct link between management pay and firm performance. When optimal compensation plans are offered, pay-performance sensitivity (PPS) is generally expected to be greater. Abowd (1990)

found that a 10% increase in managerial bonuses for good economic performance was associated with a 0.3%-0.9% increase in firm after-tax gross economic income in the following year; a payment increase of 10% for stock performance was associated with a 4%-12% increase in expected total shareholder return. Kumar and Sopariwala (2002) also discovered that profitability grows subsequent to performance plan adoptions. Similarly, Mehran (1995) found that performance is positively related to the percentage of equity-based compensation. These prior studies investigated the supposition that optimal managerial compensation packages tend to mitigate agency conflicts and consequently improve a firm's performance.

Strong corporate governance mechanisms may be another avenue of protecting shareholders from potential expropriations due to agency problems. Numerous prior studies have examined whether a firm's corporate governance (i.e., the composition of the board and shareholder ownership) influences firm value and shareholder wealth. For example, Hermalin and Weisbach (1991) found that firms with a higher proportion of outside directors usually perform better. Core, Holthausen and Larcker (1999) concluded that a firm's performance worsens when the board includes a greater proportion of gray and interlocked directors. Jensen and Meckling (1976) demonstrated that when managers have higher shareholdings, they tend to align their personal interests with those of the shareholders.

Mixed evidence has been found regarding the relationship between incentive compensations and corporate governance mechanisms. One group of studies suggested that effective direct monitoring reduces the need for incentive alignment; therefore, incentive compensations are used less often when a firm's monitoring mechanism is strong (i.e., substitution relation) (Eaton & Rosen, 1983). Alternatively, other studies have argued that strong corporate mechanism ensures the adoption of optimal compensation plans in firms and that PPS should be higher in such high-performing firms (i.e., reinforcement relation) (Baek & Pagan, 2006). Supporting the substitution argument, empirically, the ownership of outside directors has been found to be negatively related to incentive-based compensation; a higher ownership of outside directors represents higher monitoring power for executives, so the use of incentive pay to executives is not necessary (Mehran, 1995). More evidence has been presented in accordance with substitution relation: Cordeiro and Veliyath (2003) found that higher institutional shareholding leads to less CEO cash compensation; Ryan and Winggis (2001) suggested that higher blockholder ownership results in lower CEO option compensation. However, prior studies have also provided certain evidence in support of the reinforcement explanation. Cordeiro and Veliyath (2003) determined that the ratio of outside directors on the board has a positive impact on executive compensation; according to Yermack (1996), companies with smaller boards of directors have low CEO PPS.

## 3. HYPOTHESES DEVELOPMENT

While no consensus has been reached regarding the relationship between executive compensation and corporate governance, prior studies of the topic have been limited to large firms. Le et al. (2006) also

pointed out the fact that the impacts of corporate governance mechanisms differ across industries. Thus, in this paper, we focus on a group of high-technology firms listed on NASDAQ from 1997 to 2003. In particular, our study tends to shed light on issues concerning corporate governance of technology firms in which CEOs retained their incentive compensations during the economic downturns. At the beginning of 2000, the world was treated to a dot-com boom and promises of endless growth. Compared to traditional businesses, new economy dot-com firms started with great ideas and sound technology. They normally had smaller boards of directors that consisted of relatives (Maher et al., 2002). Unsurprisingly, founders usually took the duality role of CEO and chairman of the board. Furthermore, CEOs were often founders or cofounders of the businesses. They stayed longer in their chief positions and held a large number of shares in their own firms. While this special feature in technology firms enabled directors to hold meetings more frequently and cope with immediate issues more easily, the CEOs in these firms seemed to play dominant roles in both management and control and also possess high negotiation power. During the business downturns, these CEOs either adjusted their compensations (effectively responding to slowing firm performance) or exercised their negotiation power to protect their own compensation benefits.

Managerial power theory (Bebchuk & Fried, 2004; Bebchuk, Fried, & Walker, 2002) suggested that when confronting powerful CEOs, boards of directors rarely challenge compensation packages that are less sensitive to performance. For example, Van Essen et al. (2015) conducted a meta-analysis of 219 studies based in the United States and found that more powerful CEOs (measured by board size and CEO duality) are positively related to total compensation levels but do not display PPS. Cambini, Rondi, and Masi (2015) showed that PPS is more evident in an incentive-driven regulatory environment. Thus, regulatory policy complements corporate governance mechanisms to lessen the managerial entrenchment prospect.

Corporate governance is a system of rules, laws, and business ethics that is designed to deal with how managers conduct company affairs on behalf of their shareholders. We use the following variables to evaluate corporate governance in high-technology firms; then, we develop various hypotheses regarding corporate governance and CEO compensation.

Venture capital firms invest heavily in technology firms. As Conyon and He (2004) mentioned, venture capitalists play an important role in monitoring executives. Higher venture capitalist ownership represents higher monitoring power. We expect a positive impact of venture capitalist ownership in monitoring executive compensations.

Another governance efficiency indicator is the composition of the board of directors. Board composition is an important determinant of compensation policy. Core et al. (1999) found that less independent directors such as gray directors and interlocked directors lead to a higher level of CEO compensation. According to Core et al. (1999), gray outside directors are "directors who or whose employer received payments from the company in excess of his board pay." Interlocked directors are

commonly seen in the high-technology industry because of their unique expertise. Interlocked outside directors of Firm A are insiders of Firm B, and the insiders of Firm A also serve as outside directors of Firm B. Because the directors sit on each other's board, the independence levels of the boards are lower. Because interlocked directors lower the boards' independence, Core et al. (1999) suggested that a higher proportion of interlocked directors should have a negative impact on the monitoring mechanism. Taken together, gray directors and interlocked directors are expected to strengthen managerial negotiation power over compensation packages. Thus, the association between pay and performance is weaker.

The existence of a compensation committee indicates a board with higher independence in determining insider compensation. According to Shivdasani and Yermack (1999), if compensation committee members are inside directors, retired employees, directors whose ages are over 69, gray outside directors, or interlocked outside directors, then the compensation committee is considered nonindependent. In such cases, compensation committee members are more likely controlled by CEOs and cannot exert their authority to independently determine insider compensation. Conversely, the presence of a more independent compensation committee signifies the greater ability of the governance mechanism to alleviate executives' influence overcompensation.

Overall, strong corporate governance generally involves a combination of high venture capitalist ownership; a small portion of gray outside directors and interlocked directors on the board; and the existence of an independent compensation committee. In contrast, poor corporate governance generally involves low venture capitalist ownership; a large portion of gray outside directors and interlocked directors on the board; and no independent compensation committee. Accordingly, we develop two testable hypotheses:

*H<sub>1</sub>: In firms with strong corporate governance, CEOs' compensation is closely related to firm performance, and CEOs' PPS is positive.*

*H<sub>2</sub>: In firms with poor corporate governance, CEOs may exercise their negotiation power to protect their own compensation benefits; thus, CEOs' PPS is low positive and may be negative during business downturns.*

#### 4. METHODOLOGY AND VARIABLE DESCRIPTION

We investigate the impacts of corporate governance on CEOs compensation in high-technology firms from 1997 to 2003, including periods before and after the internet bubble burst. To test our hypotheses, the following OLS regression is applied to examine the PPS of cash-based compensation and stock-based compensation. Cash-based compensation is calculated by summing annual salary and cash bonus; stock-based compensation is the sum of option grants, stock, and other long-term compensation.

$$COMPENSATION_t = \alpha + \beta_1 ROA_{t-1} + \varepsilon \quad (1)$$

Accounting performance (return on assets, ROA in  $t-1$ ) is used to represent firm performance. The coefficient,  $\beta_1$ , is the estimated PPS, which measures changes of compensation given per unit change in

the firm performance. Accordingly, we utilize the model to estimate PPS in two subperiods, 1997–2000 and 2001–2003, which reflect booming and contracting market conditions. Daly et al. (2012), Daly and Hobijn (2014, 2015), Fallick et al. (2016), and Elsbey et al. (2016) documented the prevalent patterns of nominal wage rigidities that occurred in the labor market in the presence of prior severe U.S. recessions. We intend to examine whether nominal wage rigidity can also be found during the internet bubble-burst period. More importantly, will corporate governance mechanisms play an essential role in restraining the magnitude of downward wage rigidity?

Furthermore, we compare PPS between strong vs. poor corporate governance. We expect that the PPS will be higher in strong corporate governance firms than in poor governance firms, especially from 2001 to 2003.

Next, CEO characteristics and other firm specifics are incorporated into the regression for further analysis. We define CEO ownership (CEO OWN) as the percentage of outstanding shares owned by the CEO; we also define CEO tenure (CEO TENURE) as the total years that a CEO stayed in the position. We define a dummy variable to indicate whether a firm's CEO was also the founder. FOUNDER CEO equals one when a CEO is the founder of the firm and equals zero otherwise. Prior literature has discussed other factors that affect compensation contracts—for example, Tobin's Q, Leverage, and firm size. Tobin's Q (TOBIN'S Q) is the market-to-book value of the assets of a firm and is often used as a proxy for the firm's future growth opportunities. A higher Tobin's Q indicates a firm's potential growth; as reported in prior studies, a

growing firm is more likely to award more stock-based compensation to executives. Leverage ratio (LEVERAGE) can be used as a proxy for external creditor monitoring or as a firm-risk indicator. Leverage ratio is defined as long-term debt to total assets. Responding to the substitution and reinforcement relationships between monitoring mechanism and incentive compensation, past studies (Core & Guay, 2001; John & John, 1993) have reported both positive and negative relationships between leverage and CEO stock options. Prior studies also provided conflicting hypotheses about the relationship between agency cost and firm size in terms of total assets (ASSET). For example, Smith and Watts (1992) and Ittner et al. (2003) suggested that when a firm gets larger, the firm's operations become more complex, and its managers have more assets at their disposal; therefore, the possibility of agency conflicts in the firm eventually increases, and there is more need for the shareholders to use an incentive device to control their managers. Conversely, Murphy (1985) and Frye (2004) found that compared to smaller firms, larger firms receive more publicity and are exposed to more analyst coverage. Thus, publicity and analyst research reduce asymmetric information between managers and shareholders. In contrast, smaller firms gain less publicity, and shareholders face more difficulty with externally monitoring their managers. In addition, affecting a firm's value is relatively easier for individual employees in smaller firms than in larger ones; thus, the potential for agency conflicts is higher in smaller firms.

The effect of corporate governance on PPS is examined by interactive terms of governance dummies and firm performance.

$$\begin{aligned} \text{COMPENSATION } t = & \alpha + \beta 1 \text{ROA } t-1 + \beta 2 \text{ CEO OWN } t + \beta 3 \text{ CEO TENURE } t + \beta 4 \text{ FOUNDER CEO } t + \beta 5 \\ & \text{LNASSET } t-1 + \beta 6 \text{ LEVERAGE } t-1 + \beta 7 \text{ TOBIN'S Q } t-1 + \beta 9 \text{ VC } * \text{ROA } t-1 + \beta 10 \text{ OUT } * \text{ROA } t-1 + \beta 11 \\ & \text{INTERLOCK } * \text{ROA } t-1 + \beta 12 \text{ GRAY } * \text{ROA } t-1 + \beta 13 \text{ COMP } * \text{ROA } t-1 + \varepsilon \end{aligned} \quad (2)$$

Where VC = 1 for firms with venture capital, otherwise VC = 0; OUT = 1 for firms whose outside directors are more than inside directors, otherwise OUT = 0; INTERLOCK = 1 for firms with interlocked directors, otherwise INTERLOCK = 0; GRAY = 1 for firms with gray seat directors, otherwise GRAY = 0; COMP = 1 for firms with independent compensation committee, otherwise COMP = 0.

The significance tests of the interactive terms may reveal whether CEO PPS differs between strong and poor corporate governance mechanisms, and the empirical tests may also disclose which corporate governance mechanism is the most efficient for curtailing agency problems.

## 5. DATA AND SAMPLE SELECTION

Corporate governance variables and compensation variables are collected from proxy statements through the Lexis-Nexis database. Firm-specific financial variables are collected from Standard and Poor's Compustat database. The sample is 890 high-technology firms listed on NASDAQ from 1997 to 2003. We identify high-technology firms by 4-digit SIC codes (3570–3572, 3575–3577, 3661, 3669–3674, 3677–3679, 3690, 3825–3826, 3841–3845, 3851, 4812–4813, 4899, 7350, 7359, 7370–7374, 7377,

7380, 7385, 7600, 8711). The initial sample contains 4,127 firm-year observations.

As shown in Table 1, the average CEO pay in the technology firms is about \$1.35 million. Cash compensation is a small fraction of CEOs' total income (less than one-third), and the rest of their total income consists of stocks and options (\$0.88 million). Compared to other industries, technology firms are more in favor of granting stock-based pay to their CEOs. According to Zingales (2000), technology firms are unique because of their higher reliance on human capital; such human capital becomes the most vital component of these firms' values. In order to effectively manage their essential growth factor of human capital, options and other forms of stock-based compensation are especially important to such firms (Anderson et al., 2000). Ryan and Wiggins (2001) suggested that options such as compensation encourage managers to undertake risky investment projects provided that managerial human capital is likely undiversified. Also reported in Table 1, the mean total asset of our sample is \$230 million, and the long-term leverage ratio is 8%. These statistics are consistent with the fact that technology firms are usually smaller in terms of assets and prefer issuing stocks to finance their growth. The Tobin's Q of 3.13 in the sample is higher than the general average of 2–2.5 across industries (Chen, 2006).

**Table 1.** CEO compensation and firm characteristics (1997-2003)

Variable	Mean	S. D.	N
<i>CEO Compensation (\$)</i>			
Salary	252,901.20	117549.57	4107
Bonus	98,688.16	142508.10	4106
option	732,220.29	1920392.40	4113
stock	9,949.85	105129.63	4113
others	19,336.53	40210.69	4098
Stock_based	878,463.26	2294704.60	4113
Cash_based	388,268.39	264896.83	4096
Total	1,352,314.86	2632277.38	4096
<i>Firm Characteristics</i>			
Assets (\$ m)	230.50	414.06	4064
Leverage	0.08	0.15	4053
Tobin's Q	3.13	3.40	3770
ROA	-0.19	0.41	4052
Stock Return	0.74	6.00	3503
<i>Corporate Governance</i>			
Venture capital ownership (%)	10.00	11.56	4110
BODSize	6.54	1.74	4127
Insider director (%)	49.47	31.22	4127
Outside director (%)	50.53	31.22	4127
Interlocked director (%)	2.69	6.41	4127
Gray director (%)	3.94	6.82	4127
Independent director %	42.32	29.63	4127
Independent Compensation Committee	0.36	0.48	3933
<i>CEO Characteristics</i>			
FounderCEO	0.18	0.39	4127
CEO tenure	6.49	5.45	4127
CEO ownership (%)	7.90	9.28	4127

Note: Accounting data are from Compustat Annual Industry file. CEO compensation data are collected from annual proxy statements through the Lexis-Nexis database. The sample includes 838 technology firms over the period 1997 to 2003 listed in NASDAQ. We identify high technology firms by 4-digit SIC codes (3570-3572, 3575-3577, 3661, 3669-3674, 3677-3679, 3690, 3825-3826, 3841-3845, 3851, 4812-4813, 4899, 7350, 7359, 7370-7374, 7377, 7380, 7385, 7600, 8711).

As to the descriptive statistics of corporate governance variables, venture capitalists hold an average of 10% shares outstanding; on average, six directors serve on the board; among these directors, 49.47% are inside directors, and 50.53% are outside directors; the majority of outside directors are independent; and less than half of the technology firms (0.36) obtain independent compensation committees. Table 1 also indicates that in 18% of our sample technology firms, CEOs are founders or co-founders of their businesses; on average, the CEOs serve 6.5 years in their positions and hold 7.90% of total shares outstanding.

Next, compensation and firm performance variables are further analyzed between the booming

(1997–2000) and contracting market (2001–2003). As shown in Table 2, CEOs' total pay decreases from \$1.466 million between 1997 and 2000 to \$1.247 million between 2001 and 2003. This is in response to the collapse of the internet bubble (which climaxed on March 10, 2000, with the NASDAQ peaking at 5132.52). In particular, the value of stock-based pay drops from \$9.84 million to \$7.81 million. However, CEOs' cash compensation (including mainly salaries and bonuses) increases from \$3.64 million to \$4.11 million; this is in spite of the fact that firm performance goes down (stock returns drop from 195% average annual return in 1997–2000 to -18% in 2001–2003, and ROA drops from -0.12 to -0.26).

**Table 2.** Statistics of variables related to pay-performance relations

Variables	97-00			01-03		
	Mean	S.D.	N	Mean	S.D.	N
<i>CEO Compensation (\$)</i>						
Y= CEO total pay in t	1,466,224.49	3161984.11	1967	1,247,072.85	2018281.99	2129
Y=CEO stock-based-pay in t	984,225.34	2739206.30	1975	780,764.42	1783630.00	2138
Y=CEO cash-based-pay in t	363,616.32	258979.67	1967	411,044.64	268302.88	2129
<i>Stock performance</i>						
R=Stock returns in t-1	1.95	8.93	1519	-0.18	0.66	1984
<i>Accounting performance</i>						
ROA= ROA in t-1	-0.12	0.32	1920	-0.26	0.47	2132

Note: The following OLS regression is applied to examine the pay-performance sensitivity of cash-based compensation and stock-based compensation.  $COMPENSATION_t = \alpha + \beta_1 FIRM\_PERFORMANCE_{t-1} + \epsilon$ . The coefficient,  $\beta_1$ , is the estimated pay-performance sensitivity (PPS), measuring changes of compensation given per unit change in the firm performance. Firm performance may be measured by either stock market performance or accounting earnings. In the rest of this study, we report the results focusing on ROA as we find that high prices of internet stocks around the bubble are not an appropriate proxy for firm performance.

## 6. ANALYSES OF EMPIRICAL RESULTS

Shown in Panel A of Table 3, the PPS estimated by Model 1 indicates that firm performance affects CEO compensation differently during the bubble and contracting periods. CEO compensations are more

significantly associated with firm performance in 1997–2000 than in 2001–2003. In 1997–2000, for every 1% increase/decrease in ROA, CEO compensation increases/decreases \$15,166; for 2001–2003, for every 1% increase/decrease in ROA, CEO compensation increases/decreases \$5,163. In

Panel B of Table 3, the PPS is estimated between strong and poor governance characters. Findings include that (i) within both strong and weak governance groups, the pay-to-ROA sensitivities are lower during the contracting period (2001-2003) and (ii) throughout both internet bubble and flagging market, the pay-to-ROA sensitivities are higher in strong governance firms (VC=1, OUT=1, INTERLOCK=0, GRAY=0, COMP=1) than in poor governance firms (VC=0, OUT=0, INTERLOCK=1, GRAY=1, COMP=0). For example, in 2001-2003, in firms with venture capital (VC=1), their CEO compensations are reduced by \$6,538 for every 1%

decrease in their ROA compared to \$2,961 of compensation cut in firms without venture capital (VC=0). The compensation drops from \$5,879 to \$4,029 between OUT=1 and OUT=0. The same conclusions are held for corporate governance proxies such as INTERLOCK, GRAY, and COMP. This result is supportive of reinforcement relation between corporate governance and incentive compensation. Strong corporate mechanism ensures the adoption of optimal compensation plans in firms, and PPS should be higher in these high-performing firms.

**Table 3. Pay-performance Sensitivities (PPS) in subperiods and across various corporate governance factors**

<i>Panel A. PPS are estimated between two periods: 1997-2000, 2001-2003</i>		
	<i>1997-2000</i>	<i>2001-2003</i>
Intercept	1,603,906*** (19.16)	1,399,691*** (26.83)
ROA ( $\beta_1$ )	1,516,659*** (5.51)	516,343*** (5.41)
F	30.33**	29.22**
Adjusted-R <sup>2</sup>	0.0201	0.0147
<i>Panel B. PPS values within subgroups of board compositions, ownership structure, CEO characteristics and compensation governance</i>		
	<i>1997-2000</i>	<i>2001-2003</i>
<i>Strong Corporate Governance</i>		
VC=1	2,085,899*** (5.44)	653,890*** (5.39)
OUT=1	1,506,645*** (4.99)	587,969*** (4.56)
INTERLOCK=0	1,504,070*** (4.83)	561,439*** (5.43)
GRAY=0	2,204,207 (5.52)	543,267*** (4.42)
COMP=1	1,706,228*** (4.49)	692,874*** (5.29)
	<i>1997-2000</i>	<i>2001-2003</i>
<i>Weak Corporate Governance</i>		
VC=0	778,042** (2.03)	296,133* (1.91)
OUT=0	1,425,214*** (3.57)	402,965*** (2.87)
INTERLOCK=1	1,552,726*** (2.78)	226,619 (0.90)
GRAY=1	752,176** (2.02)	503,562*** (3.29)
COMP=0	1,465,060*** (3.06)	338,852** (2.29)

Notes: PPS are estimated by Model 1:  $COMPENSATION_t = \alpha + \beta_1 ROA_{t-1} + \varepsilon$ . Dependent variable is a CEO's total compensation in year  $t$ . The coefficient,  $\beta_1$ , is the estimated pay-performance sensitivity (PPS), measuring changes of compensation given per unit change in ROA. "\*\*\*", "\*\*", "\*" indicate the value is significant at 1%, 5%, 10% level, respectively. VC=1 for firms with venture capital, otherwise VC=0; OUT=1 for firms whose outside directors are more than inside directors, otherwise OUT=0; INTERLOCK=1 for firms with interlocked directors, otherwise INTERLOCK=0; GRAY=1 for firms with gray seat directors, otherwise GRAY=0; COMP=1 for firms with independent compensation committee, otherwise COMP=0.

Table 4 shows the regression results of Model 2, with CEOs' total pay as the dependent variable. The evidence substantiates our wage rigidity hypothesis that during business downturns, executives of high-tech firms tend to exert their negotiation power with boards of directors over compensation contracts. The coefficient of ROA is positive in 1997-2000 but negative in 2001-2003. In order to unravel the relationship between corporate governance in compensation and firms' performance, we employ the interactive terms of governance dummies and firm performance into our regression. During the internet bubble, if ROA decreases by 1%, CEOs' total pay drops by \$2,355. To be consistent with the principle of "accountability", the managerial pay is further cut by an additional \$9,713, provided that the firm has venture capital shareholders. A discernible finding is that during the business downturn in 2001-2003, CEOs in firms

without venture capital will earn an additional \$1,273 for any 1% drop in ROA. The evidence substantiates our hypothesis that CEOs of our high-tech sample firms tend to preserve their compensation while the economy is contracting. Should the venture capital owners have presented, the effects of wage rigidity may have been attenuated. As reported in Table 4, when venture capital owners are present, CEOs have a net reduction in their compensation by \$1,622 (-\$1,273+\$2,895). A higher proportion of gray directors indicates a less effective monitoring function by the board. The regression results find a negative impact of gray directors on CEO incentive compensations. Other governance characters about board compositions and independent compensation committees don't seem to play significant roles in influencing compensation plans. Consistent with prior evidence, our results indicate that based on

accounting performance (ROA), CEOs tend to be paid more in firms of larger size (LNASSET), lower debt (LEVERAGE), and higher Tobin's Q. In addition, our results show that CEO OWN (the percentage of

outstanding shares owned by the CEO) is negatively associated with CEO compensation, which suggests that large CEO stock ownership reduces the need for incentive compensation.

**Table 4.** Total Pay-performance Sensitivities (PPS) with firm other characteristics

<i>Dependent Variable is a CEO's total compensation in year t</i>					
	<i>Expected Sign</i>	<i>1997-2000</i>		<i>2001-2003</i>	
		<i>Coefficient</i>	<i>T</i>	<i>Coefficient</i>	<i>T</i>
Intercept		-2,036,920.520	-7.56***	-1,397,819.289	-8.95***
ROA	+	235,543.926	0.34	-127,372.347	-0.62
CEOOwn	+	-34,066.239	-3.57***	-23,573.886	-4.37***
CEOTenure	+	-5,230.143	-0.33	-2,719.843	-0.31
founderCEO	+	251,427.321	1.14	47,816.743	0.40
lnassets	+	798,866.062	14.57***	544,900.530	21.33***
leverage	-	-1,849,873.350	-3.14***	-833,277.942	-2.98***
Tobin's Q	+	167,985.827	7.88***	181,830.488	8.59***
VC dummy *ROA	+	971,366.257	1.82*	289,505.516	1.78*
OUT dummy*ROA	+	-724,828.417	-1.15	-64,971.874	-0.39
INTERLOCK dummy *ROA	-	32,570.366	0.05	-157,778.612	-0.69
GRAY dummy *ROA	-	-1,574,955.474	-2.92***	-70,372.897	-0.43
COMP dummy *ROA	+	-161,706.684	-0.26	3,844.447	0.02
Adj R <sup>2</sup>		0.235		0.260	
N		1,373		1,885	

Notes: Model 2: COMPENSATION  $t = \alpha + \beta_1 ROA_{t-1} + \beta_2 CEO OWN_t + \beta_3 CEO TENURE_t + \beta_4 FOUNDER CEO_t + \beta_5 LNASSET_{t-1} + \beta_6 LEVERAGE_{t-1} + \beta_7 TOBIN'S Q_{t-1} + \beta_8 VC * ROA_{t-1} + \beta_9 VC * ROA_{t-1} + \beta_{10} OUT * ROA_{t-1} + \beta_{11} INTERLOCK * ROA_{t-1} + \beta_{12} GRAY * ROA_{t-1} + \beta_{13} COMP * ROA_{t-1} + \epsilon$ . CEO ownership (CEO OWN) is the percentage of outstanding shares owned by the CEO, and CEO tenure (CEO TENURE) is the total years that a CEO stays in the position. A dummy variable (founder CEO) indicates if a firm's CEO is also the founder. Logarithm of total assets (ln assets) aims to capture the size effect in compensation plans. Leverage ratio is defined as long-term debt to total assets, a proxy for external creditor monitoring or a firm's riskiness. Tobin's Q (TOBIN'S Q) is the market-to-book value of the assets of a firm, reflecting a firm's future growth opportunities. VC=1 for firms with venture capital, otherwise VC=0; OUT=1 for firms whose outside directors are more than inside directors, otherwise OUT=0; INTERLOCK=1 for firms with interlocked directors, otherwise INTERLOCK=0; GRAY= 1 for firms with gray seat directors, otherwise GRAY=0; COMP=1 for firms with independent compensation committee, otherwise COMP=0. "\*\*\*\*", "\*\*\*", "\*\*", "\*" indicate the value is significant at 1%, 5%, 10% level, respectively.

To further explore the puzzle that CEOs could earn more dollars when their firms' profits decrease after the internet bubble burst, we investigate the relationship of ROA to stock-based pay and CEOs' cash-based pay. Table 5 and Table 6 report the regression results of Model 2 - with CEOs' stock-based pay and CEOs' cash-based pay as the dependent variables. First, the results in Table 5 and Table 6 corroborate the prior finding of Table 4 that the coefficients of LNASSET, LEVERAGE, and Tobin' Q are positive, negatively, and positively related to CEO compensation, respectively. These coefficients are signed by at least 5% confidence level. Second, in Table 5, ROA is insignificant to stock pay through the bubble and post-bubble periods—except that during the 1997-2000 bubble, two governance dummies interact with ROA present significant coefficients: VC dummy\*ROA and GRAY dummy\*ROA. This implies that venture capital investment and gray directors on the board may influence the variation of CEO stock pay. If the firm's ROA drops 1%, CEOs in firms with venture capital (VC=1) earn less by \$7,398, and CEOs with gray directors (GRAY=1) earn \$14,247 more in 1997-2000. In 2001-2003, if the firm's ROA drops 1%, CEOs in firms with venture capital (VC=1) earn less by \$1,770, and CEOs in firms with gray directors (GRAY=1) earn \$620 more.

Third, when all the proxies of weak corporate governance (VC=0, OUT=0, INTERLOCK=1, GRAY=1, COMP=0) are combined, both CEOs' stock-based PPS and CEOs' cash-based PPS are negative during the business downturn of 2001-2003. The evidence indicates that executives with weak corporate governance negotiate higher stock-based pay and cash-based pay rather than reduce their

compensation in response to the poor firm performance. According to Kole (1997), firms employ compensation plans to mitigate myopic managerial behavior. In line with his argument, our results suggest that CEOs in high-technology firms are not punished but rather awarded for negative ROA in 2001-2003. By doing so, these high-tech firms can retain "caliber" executives to execute appropriate business decisions during the dire dot-com bubble burst. Thus, CEOs are rewarded \$2173.09 (-211.25 - 1341.62 - 620.22 = -2173.09; see Table 5) in stock-based pay vs. \$778.43 (- 260.96 -361.28 - 156.19 = - 778.43; see Table 6) in cash-based pay for every 1% loss in ROA.

However, in firms of strong corporate governance (VC=1, OUT=1, INTERLOCK=0, GRAY=0, COMP=1), CEOs' stock-based pay to ROA after dummy variable adjustment is positive (-211.25 + 1770.98 - 1336.53 + 754.06 = 977.26; see Table 5), and CEOs' cash-based pay to ROA after the adjustment is positive (-260.96 + 602.33 + 294.85 - 572.59 = 63.63; see Table 6). As shown in Table 5, CEOs' stock-based pay goes down by \$977.26 for 1% down in ROA. Given the strong corporate governance mechanisms in place, CEOs find preventing pecuniary penalties relatively difficult while negotiating their cash-based compensation during economic downturns. As shown in Table 6, CEOs have a reduction of \$63.63 in their cash-based compensation for 1% reduction in ROA. Thus, in firms with strong corporate governance, the CEOs receive lower pay for underperformance. High-tech firms may save their cash reserves to bail themselves out of the slow economic environment; accordingly, wage rigidity does not exist given this scenario.

Table 5. Stock-based Pay-performance Sensitivities with firm other characteristics

Dependent Variable is a CEO's stock-based compensation in year t					
	Expected Sign	1997-2000		2001-2003	
		Coefficient	T	Coefficient	T
Intercept		-1,726,375.911	-7.21***	-1,290,048.936	-9.06***
ROA	+	361,574.262	0.59	-21,125.929	-0.11
CEOOwn	+	-29,254.314	-3.45***	-19,635.232	-3.98***
CEOTenure	+	-2,510.820	-0.18	-2,209.237	-0.27
founderCEO	+	251,353.351	1.28	36,045.145	0.33
lnassets	+	615,698.677	12.61***	422,455.975	18.11***
leverage	-	-1,522,927.250	-2.90***	-714,703.418	-2.80***
Tobin's Q	+	137,762.656	7.26***	155,427.123	8.03***
VC dummy *ROA	+	739,893.922	2.96***	177,098.617	1.19
OUT dummy*ROA	+	-653,697.174	-1.17	-133,653.848	-0.87
INTERLOCK dummy *ROA	-	241,742.903	0.38	-134,162.415	-0.64
GRAY dummy *ROA	-	-1,424,778.822	-1.55	-62,022.898	-0.42
COMP dummy *ROA	+	-105,965.047	-0.19	75,406.947	0.48
Adj R <sup>2</sup>		0.195		0.206	
N		1,379		1,894	

Notes: Model 2: COMPENSATION  $t = \alpha + \beta_1 ROA_{t-1} + \beta_2 CEO OWN_t + \beta_3 CEO TENURE_t + \beta_4 FOUNDER CEO_t + \beta_5 LNASSET_{t-1} + \beta_6 LEVERAGE_{t-1} + \beta_7 TOBIN'S Q_{t-1} + \beta_8 VC * ROA_{t-1} + \beta_9 OUT * ROA_{t-1} + \beta_{10} INTERLOCK * ROA_{t-1} + \beta_{11} GRAY * ROA_{t-1} + \beta_{12} COMP * ROA_{t-1} + \epsilon$  (3). Stock-based compensation includes stock options and stock grants. CEO ownership (CEO OWN) is the percentage of outstanding shares owned by the CEO, and CEO tenure (CEO TENURE) is the total years that a CEO stays in the position. A dummy variable (founder CEO) indicates if a firm's CEO is also the founder. Logarithm of total assets (ln assets) aims to capture the size effect in compensation plans. Leverage ratio is defined as long-term debt to total assets, a proxy for external creditor monitoring or a firm's riskiness. Tobin's Q (TOBIN'S Q) is the market-to-book value of the assets of a firm, reflecting a firm's future growth opportunities. VC=1 for firms with venture capital, otherwise VC=0; OUT=1 for firms whose outside directors are more than inside directors, otherwise OUT=0; INTERLOCK=1 for firms with interlocked directors, otherwise INTERLOCK=0; GRAY= 1 for firms with gray seat directors, otherwise GRAY=0; COMP=1 for firms with independent compensation committee, otherwise COMP=0. "\*\*\*\*", "\*\*\*", "\*\*", "\*" indicate the value is significant at 1%, 5%, 10% level, respectively.

Table 6. Cash-based Pay-performance Sensitivities with firm other characteristics

Dependent Variable is a CEO's cash-based compensation in year t					
	Expected Sign	1997-2000		2001-2003	
		Coefficient	T	Coefficient	T
Intercept		-21,598.345	-1.03	96,528.327	4.72***
ROA	+	-15,897.034	-0.30	-26,096.330	-0.97
CEOOwn	+	-1,744.460	-2.34**	-2,847.169	-4.03***
CEOTenure	+	2,275.252	1.86*	1,746.189	1.51
founderCEO	+	-48,566.162	-2.82***	-55,335.490	-3.50***
lnassets	+	96,219.943	22.45***	73,143.002	21.85***
leverage	-	-102,987.552	-2.23**	9,172.693	0.25
Tobin's Q	+	4,632.230	2.78***	4,685.668	1.69*
VC dummy *ROA	+	52,003.691	1.80*	60,233.534	2.83***
OUT dummy*ROA	+	-16,120.144	-0.33	29,485.560	1.34
INTERLOCK dummy *ROA	-	17,737.355	0.31	-36,128.866	-1.20
GRAY dummy *ROA	-	-76,045.077	-1.24	-15,619.328	-0.74
COMP dummy *ROA	+	-60,365.001	-1.26	-57,259.738	-1.35
Adj R <sup>2</sup>		0.344		0.259	
N		1,373		1,885	

Notes: Model 2: COMPENSATION  $t = \alpha + \beta_1 ROA_{t-1} + \beta_2 CEO OWN_t + \beta_3 CEO TENURE_t + \beta_4 FOUNDER CEO_t + \beta_5 LNASSET_{t-1} + \beta_6 LEVERAGE_{t-1} + \beta_7 TOBIN'S Q_{t-1} + \beta_8 VC * ROA_{t-1} + \beta_9 OUT * ROA_{t-1} + \beta_{10} INTERLOCK * ROA_{t-1} + \beta_{11} GRAY * ROA_{t-1} + \beta_{12} COMP * ROA_{t-1} + \epsilon$  (3). CEO ownership (CEO OWN) is the percentage of outstanding shares owned by the CEO, and CEO tenure (CEO TENURE) is the total years that a CEO stays in the position. A dummy variable (founder CEO) indicates if a firm's CEO is also the founder. Logarithm of total assets (ln assets) aims to capture the size effect in compensation plans. Leverage ratio is defined as long-term debt to total assets, a proxy for external creditor monitoring or a firm's riskiness. Tobin's Q (TOBIN'S Q) is the market-to-book value of the assets of a firm, reflecting a firm's future growth opportunities. VC=1 for firms with venture capital, otherwise VC=0; OUT=1 for firms whose outside directors are more than inside directors, otherwise OUT=0; INTERLOCK=1 for firms with interlocked directors, otherwise INTERLOCK=0; GRAY= 1 for firms with gray seat directors, otherwise GRAY=0; COMP=1 for firms with independent compensation committee, otherwise COMP=0. "\*\*\*\*", "\*\*\*", "\*\*", "\*" indicate the value is significant at 1%, 5%, 10% level, respectively.

Overall, our findings are consistent with the premise that the attributes of corporate governance generally influence changes in executives' incentive compensations differently. In particular, CEOs of our high-tech sample firms are able to prevent severe pecuniary penalties for their compensation during economic downturns. This old tale of wage rigidity becomes more apparent in CEOs when the corporate governance mechanisms are poorly structured.

## 7. SUMMARY AND CONCLUSION

This study offers detailed examinations concerning changes in CEOs' incentive pay in American technology firms throughout the dot-com bubble (1997-2000) and after the dot-com bubble burst (2001-2003). Most

importantly, this study reveals new evidence on the relationship between changes in CEOs' compensation and corporate governance based on contracting market conditions. Generally, our findings suggest that CEOs of high-tech firms are capable of preventing pecuniary penalties to their compensation during business downturns.

With a sample of 890 American technology firms, we hypothesized that for firms associated with strong corporate governance, CEOs' compensation should be closely related to firm performance; CEOs' PPS was expected to be high. Alternatively, for firms associated with poor corporate governance, CEOs may exert their negotiation power over the boards of directors to preserve their own compensation benefits. Thus,



CEOs' PPS was predicted to be low and possibly negative during the bubble-burst period, thereby causing downward wage rigidity.

First, we find that the CEOs' total pay and the value of their stock-based compensations drop between the booming market (1997-2000) and the contracting market (2001-2003). However, despite the fact that firm stock returns and ROA drop between 1997-2000 and 2001-2003, CEOs' cash compensations (including mainly salaries and bonuses) increase from \$3.64 million to \$4.11 million. Second, we find that the relationship between executive compensation and firm performance weakens after the internet bubble burst. The PPS coefficients decrease between 1997-2000 and 2001-2003. CEO compensations are shielded from the implications of firm losses during business downturns. Third, after controlling CEO features and other firm characteristics, we found that the PPS of CEOs' total pay and stock-based compensation are both positive in 1997-2000 but turn to negative in 2001-2003; the PPS of cash-based compensations is negative through 1997-2003, implying the existence of downward wage rigidity in both stock-based and cash-based compensations. Fourth, the PPS was further examined along with the suggested corporate governance mechanisms. Specifically, we explored how differences in ownership structure, board composition such as insiders vs. outsiders, independent vs. dependent (e.g., gray directors and interlocked directors), and the existence of independent compensation committees may affect the relationship between CEO compensation and firm performance. Our evidence supports the notion that board composition is currently not an effective governance mechanism to curtail the extent of downward wage rigidity in technology firms. The board plays a vital role in monitoring and disciplining managers (Fama, 1980); however, given the complicated corporate strategies orchestrated by CEOs in tech industries, the effectiveness of a board's capability for scrutinizing a CEO is expected to dissipate. From this perspective, we argue that during economic downturns, managers may insulate themselves from

pecuniary deprivation. We also hypothesize that CEOs' PPS is insignificant or even negative when firms have less powerful boards. Fifth, our results demonstrate that professional investors such as venture capitalists are more likely driven by self-interest to closely monitor firms' management. Our evidence finds significantly stronger pay for performance associations in firms backed by venture capital investments.

This study contributes to the corporate governance literature by adding new evidence on how the effectiveness of corporate governance can lessen the degree of wage rigidity from high-tech firms' CEOs during a contracting market. Unlike traditional business leaders, CEOs of high-tech firms possess stronger managerial power in negotiating with boards of directors. Boards of directors in the technology industry are usually small. The CEOs in the high-tech firms are often founders or co-founders of the business. Such CEOs stay longer in their chief positions and hold a larger number of shares in their own firms. When business conditions worsen, all of these attributes intertwine with complicated strategic decision-making processes to enable CEOs to outplay the board in compensation negotiation.

What we learned from this historical review of corporate governance is that an old tale of wage rigidity indeed exists for our high-tech sample firms. The findings of our study also have practical implications. The impacts of corporate governance mechanisms differ across industries. In particular, the countervailing effects of high information asymmetries in high ownership concentration contexts require more attention in high-technology firms. Our findings suggest that boards should equip themselves in advance to face severe market correction. Van Essen et al. (2015) asserted that powerful (i.e., well-governed) boards have more influence over pay-performance compensation. Our findings insinuate that boards should recognize certain board configurations in order to empower themselves to curtail the immensity of wage rigidity when engaging in arms-length negotiation with CEOs.

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