Mutual Monitoring and Corporate Governance

by

Zhichuan (Frank) Li

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved April 2012 by the
Graduate Supervisory Committee:

Jeffrey Coles, Chair
Ilona Babenko
Sreedhar Bharath
Michael Hertzel

ARIZONA STATE UNIVERSITY

May 2012

ABSTRACT

Mutual monitoring in a well-structured authority system can mitigate the agency problem. I empirically examine whether the number 2 executive in a firm, if given authority, incentive, and channels for communication and influence, is able to monitor and constrain the potentially self-interested CEO. I find strong evidence that: (1) measures of the presence and extent of mutual monitoring from the No. 2 executive are positively related to future firm value (Tobin's Q); (2) the beneficial effect is more pronounced for firms with weaker corporate governance or CEO incentive alignment, with stronger incentives for the No. 2 executives to monitor, and with higher information asymmetry between the boards and the CEOs; (3) such mutual monitoring reduces the CEO's ability to pursue the "quiet life" but has no effect on "empire building;" and (4) mutual monitoring is a substitute for other governance mechanisms. The results suggest that mutual monitoring by a No. 2 executive provides checks and balances on CEO power.

DEDICATION

This dissertation is dedicated to my wife Caixia Zhang. For better, for worse, for richer, for poorer, in sickness and in health, to love and to cherish.

It is also dedicated to my parents Zude Li and Huifang Chen, and grandma Yuying Ren for their constant love, and tears upon parting.

Both my children, Anthony and Anyi, were born during my 5-year PhD study. They are the other two masterpieces I produce and adore in addition to this dissertation.

ACKNOWLEDGMENTS

At ASU, I have had the privilege to work with many talented individuals, who have made contributions to my research experience. I am especially grateful to Dr. Jeffrey Coles for his shrewd insights and valued comments on this research. Jeff has been my mentor for the past five years, a life-changing experience that I'll remember all my life. It is my pleasure to acknowledge other committee members: Drs. Ilona Babenko, Sreedhar Bharath, and Michael Hertzel who have contributed to this dissertation and made my experience in the program very successful and happy.

TABLE OF CONTENTS

INTRODUCTION

Public corporations are managed by teams of executives. The CEO, the number 1 executive in charge, generally has been the focus of attention in the academic literature and among investors, the media, and regulators. Nonetheless, other members of the executive team are likely to play important roles in the firm. Top executives likely bring expertise to the formulation of investment, financial, and payout policies. They are a potential source of talent in succession planning for the CEO position. They collaborate with other members of the team in decision making. Finally, they potentially serve in the capacity of mutual monitors. In this paper, I focus on this last role and empirically examine whether mutual monitoring can constrain the potentially self-interested CEO. In particular, I develop measures of the presence and likely effectiveness of mutual monitoring by a "number 2" executive and assess the extent to which those measures are associated with firm performance, investment policy, and various aspects of firm governance and executive incentives.

I rely on the notion that mutual monitoring among managers in a well-structured authority system mitigates the agency problem. Alchian and Demsetz (1972), Jensen and Meckling (1976), Fama (1980), and Fama and Jensen (1983) all stress mutual monitoring as an important

control mechanism.[1] To frame the nature of mutual monitoring among members of an executive team, I note the following.

Although the CEO is the focal point for leadership and decision making, managing the firm requires significant teamwork (Hambrick and Mason, 1984). First, top executives other than the CEO often possess a set of responsibilities that only modestly intersect with those of the CEO. For example, the CFO often leads on financial reporting (Jiang, Petroni, and Wang, 2010) and the COO often presides over the day-to-day operations (Marcel, 2009). Second, the CEO needs collaboration from other team members. A top executive can withhold effort or information as a means of passive monitoring (Acharya et al., 2011). Or an executive can damage or effectively veto a CEO initiative by impeding implementation, termed "optimal dissent" by Landier, Sraer, and Thesmar (2009). In the extreme, an executive may leave the company due to disagreement with the CEO. Third, a non-CEO can influence the CEO by providing expertise, advice, and perspective. Often the information on product markets, operations, marketing, accounting, and finance flows through top executives to the CEO. And executives will bring different aptitudes, training, and experience to the various aspects of management (Bertrand and Schoar, 2003). Fourth, named executive officers (NEOs)

[1] Recent literature on mutual monitoring includes Baker, Jensen, and Murphy (1988), Drago and Garvey (1998), Core and Guay (2001), Hochberg and Lindsey (2010), and Acharya, Myers, and Rajan (2011).

possess resources and mechanisms to influence the CEO indirectly. Some NEOs have channels to the board and some themselves serve on the board. An executive can bring CEO behavior that is self-serving, fraudulent, unethical, or otherwise illegal to the attention of other employees or the board or, in the extreme, to regulators, the media, or even law enforcement authorities.[2] Dyck, Morse, and Zingales (2010) found employees play the most important role in fraud detection because of their access to inside information. In many cases, the second-in-command or other NEO has a fiduciary obligation to provide important and accurate information to the board, and boards routinely actively seek information and insight from executives other than the CEO. In theory and practice, mutual monitoring can lead to better executive decisions pertaining to investment and financial policy and to a lower likelihood of unfortunate or illegal events or corporate disaster.

Of course, the presence and effectiveness of mutual monitoring will vary in the authority, credibility, and influence of team members, whether team members have access to relevant information, and proximity of team members to decision-making processes. My measures of mutual monitoring reflect these tensions.

[2] A recent survey found 78% of Americans would blow the whistle on workplace wrongdoing under the protections and incentives now being offered by the SEC's new whistleblower program, part of the Dodd-Frank financial reform. The survey suggested higher-rank employees were more likely to be privy to misconduct and were more likely to blow the whistle. (Wall Street Journal, 2011)

To measure mutual monitoring, I focus on executives I surmise to be second-in-command to the CEO.[3] In the framework of mutual monitoring, conferring authority on the No. 2 executive is particularly important, because such executives can closely observe the CEOs on a routine basis whereas even the most diligent boards cannot. Alchian and Demsetz (1972) suggest the No. 2 executive in the firm, if given proper authority and channels, is able to constrain the self-serving actions of the CEOs.[4] Of course, the second-in-command can be extremely powerful in some firms, even to the point of ousting the CEO, whereas her influence can be insignificant in other firms.

I identify the No. 2 executive as the highest paid employee other than the CEO.[5] I use the gap between the compensation of the CEO and that of the second-highest-paid executive scaled by CEO total compensation, as a proxy for the authority differential between the two executives, and, thus, as a proxy for the relative monitoring capacity of the No. 2. This pay gap, hereafter known as the "*GAP*," is likely to be

[3] Mutual monitoring is more effective in a well-balanced authority structure as well as in small-group settings. In large groups, agents tend to free ride (Isaac and Walker, 1988) and have natural limits to observing each other (Heckathorn, 1988; Kandel and Lazear, 1992). In this sense, the No. 2 executive is a natural focal point for examining mutual monitoring.

[4] On the contrary, an unbalanced authority structure may prohibit mutual monitoring. For example, Rothschild and Miethe (1999) found undemocratic work environments set significant barriers to internal whistle-blowing.

[5] An alternative categorization that ignores the "CEO" title and defines the No.1 and No. 2 by their total compensation produces similar results.

correlated with various attributes of the second-in-command relative to the CEO, including skill, power, and influence (as distinct from formal authority), all of which determine monitoring capability.

Second, I create a variable that indicates whether the No. 2 executive also serves as a director on the company board. *Director-No. 2* is a dummy that takes the value one if the No. 2 is a board director in her firm, zero otherwise. The presence of an additional executive on the board reduces the information asymmetry vis-à-vis the CEO, which is likely to enhance the monitoring effectiveness of the board (Inderst and Mueller, 2009). Board membership provides the executive with formal and informal channels for monitoring authority and information transmission.[6]

Third, because titles are likely to represent structural power, influence, and access to information (Finkelstein, 1992), I consider whether the No. 2 executive also holds the title of "President." *President-*

[6] Due to information asymmetry, even "highly talented board members" from the outside have a natural limit as to what can be accomplished through direct monitoring (Jensen, 1993). Empirical studies suggest that structural "improvements" to the board, for example, by increasing representation of outside directors, only have modest effects (Hermalin and Weisbach, 2003). On a priori grounds, efforts to improve boards need not be limited to board structure in a narrow sense, but can also be shaped by governance processes. For example, any governance instrument or process that reduces the information asymmetry between the CEO and board will also make the board a better monitor (Inderst and Mueller, 2009). In particular, Fama and Jensen (1983) contend that mutual monitoring mitigates the problem by generating low-cost information about the CEO to be used in the control process. In their words, "The board is the top-level court of appeals of the internal agent market, and as such it must be able to use information from the internal mutual monitoring system."

No. 2 is a dummy equal to one if the No. 2 is the president of the firm, zero otherwise. Generally, the No. 2 executive can supply more checks and balances relative to the CEO if she is the president of the firm than if she is one of the vice presidents and the CEO is the president (Worrell, Demec, and Davidson, 1997).

Finally, if the No. 2 joined the firm after the CEO, she is more likely to be loyal to or serve at the pleasure of the CEO (Landier, Sraer, and Thesmar, 2006). A No. 2 appointed prior to the CEO is less likely to be co-opted[7] and is more likely to monitor the CEO. The measure I employ indicates whether the No. 2 was appointed prior to the CEO. *Independent-No. 2* is a dummy that equals one if the No. 2 joined the company before the CEO, zero otherwise. Mutual monitoring will be more effective when the *GAP* is smaller and when one or more of the three indicator variables takes the value of one.

I use these four proxies to test the implications of mutual monitoring for firm performance and policy, and to examine the relation between mutual monitoring and other governance characteristics. My analysis yields four classes of results.

First, I empirically identify executive, board, and firm characteristics that are associated with the measures of mutual monitoring. I find, for example, that the *GAP* is positively correlated with governance quality

[7] I adopt this notion from Coles, Daniel, and Naveen (2010), who develop the same argument for outside directors.

measures. This result is inconsistent with the notion that poor governance allows CEO entrenchment and corresponding rent extraction through compensation that is excessive relative to other executives (e.g., Bebchuk, Cremers, and Peyer, 2011). Instead, my results suggest a lower *GAP* represents stronger mutual monitoring by the second-in-command, which in turn can allow the firm to substitute away from more expensive governance mechanisms, such as direct monitoring by the board.

Second, I find a significant relation between firm performance and the measures of mutual monitoring. For example, for an increase in the *GAP* of one standard deviation, Tobin's *Q* one period forward is lower by the equivalent of $20 million.[8] In my sample, Tobin's *Q* one period forward is significantly and positively related to the three indicator variables for mutual monitoring, specifically *Director-No. 2*, *President-No. 2*, and *Independent-No. 2*. These results are consistent with the presence of mutual monitoring and the relevance of mutual monitoring for firm performance.

The "CEO Pay Slice" (CPS) of Bebchuk, Cremers, and Peyer (2011), which is CEO pay divided by total pay to the top 5 executives, is a

[8] Consistent with my results, one anecdote involves the legendary financier J.P. Morgan, who followed a rule of never investing in a firm in which CEO pay is more than double the second highest pay.

similar measure that is likely to be related to mutual monitoring.[9] When I include both the *GAP* and CPS in the specifications of firm performance on firm structure and executive characteristics, the *GAP* tends to have more statistical and economic power in determining firm performance. The estimated magnitude of the "*GAP* effect" is approximately double that of the "CPS effect." One possible reason is that the second-in-command is more relevant in mutual monitoring than any other executive further down the chain of authority.

Third, I find the effect of mutual monitoring on firm performance is of greater significance and magnitude when other aspects of corporate governance are weak according to conventional measures. Under weak external governance or CEO incentive alignment, internal mutual monitoring becomes more important and therefore has a stronger effect on firm performance. This result again suggests mutual monitoring is an effective substitute for other governance systems.

Furthermore, my four measures of mutual monitoring interact with CEO duality, horizon difference between the top two executives, and industry homogeneity, in a way that suggests the effect of mutual monitoring on firm performance is more prominent in firms where the No.

[9] Bebchuk et al. (2011) find that CEO dominance, as proxied by CPS, could damage firm value. As a key departure from their paper and other "pay gap" literature, which have focused on agency cost of an overpowered CEO proxied by pay gap, this paper suggests a failed mutual monitoring mechanism due to an unbalanced authority system by using the pay gap as a relative measure.

2 executive has sufficient incentive to monitor and where the information asymmetry between the board and the CEO is high. Additional results show that the monitoring role of the No. 2 executive as board director is more important post-SOX than pre-SOX. The constraints on board independence imposed by the Sarbanes-Oxley Act may have unintentionally weakened mutual monitoring.

Finally, I find evidence to support the "quiet life" hypothesis (Bertrand and Mullainathan, 2003) but not the "empire building" hypothesis. In particular, I find the *GAP* is positively related to selling, general, and administrative expenses and wages, but not related to measures of firm scale and executive span of control. The results are consistent with the hypothesis that monitoring from the second-in-command prevents the CEO from avoiding "cognitively difficult activities," such as haggling with labor unions, input suppliers, and organizational units demanding bigger overhead budgets. In contrast, the results provide little support for the notion that mutual monitoring reduces empire building.

Endogeneity in performance-on-structure and structure-on-structure experiments is a common and difficult problem (e.g., Roberts and Whited, 2011). In my empirical context, if shareholders can optimally assign the monitoring capacity to the No. 2 executive and adjust it in an instantaneous and costless way, there should be no empirical relation

between mutual monitoring and firm performance.[10] It is plausible, however, that the transaction costs of altering the authority system of mutual monitoring are present and nontrivial, so that one would be more likely to expect to observe a connection between my measures of mutual monitoring and firm performance, policy, and governance structure. Indeed, statistically the empirical results in the paper are robust to using a variety of relevant control variables and econometric methods. I also show that the endogeneity problem works against finding the relation between mutual monitoring and firm performance.

The remainder of the paper is organized as follows. Section 2 describes the data and Section 3 provides statistical description of the No. 2 compared to the CEO. Section 4 examines the relation of mutual monitoring and executive, firm, and governance attributes. Section 5 identifies the relation between mutual monitoring and firm performance, while Section 6 shows this relation depends on other governance characteristics of the firm. Section 7 examines the interactions between mutual monitoring capacity and incentives. Section 8 studies the effects of mutual monitoring on firm investment policy, specifically whether mutual monitoring affects the CEO's propensity to choose policies that promote empire building or the quiet life. Section 9 addresses endogeneity

[10] See the optimal contracting literature, e.g., Demstez and Lehn (1985) and Coles, Lemmon, and Meschke (2011), for equilibrium explanations.

concerns, and Section 10 discusses alternative explanations. Section 11 concludes.

DATA SOURCE

I construct my sample with firms that comprise the ExecuComp database for the years 1993–2006. The database contains details of top executives at each of the firms in the S&P 500, S&P Midcap 400, and S&P Smallcap 600. Because federal reporting requirements have been enhanced since December 15, 1992, the data for 1993–2006 are virtually complete. Firm financial data are from COMPUSTAT, governance-related data are from the IRRC database, and merger and acquisition data are from SDC database. Refer to Appendix 1 for a detailed description of each variable used in this paper.

THE NO. 2 EXECUTIVE

I define "CEO" using ExecuComp's annual CEO flag which identifies the executive who was the CEO for the majority of the fiscal year. The CEO usually has the highest total compensation among all the

executives in the firm. The No. 2 executive is defined as the highest paid non-CEO executive in each firm year.[11]

In Table 1, I classify the No. 2 executives by their reported job titles in order to identify the functional backgrounds of the executives. No. 2s have varying titles, with 35.36% holding the title of Vice President (VP), 25.86% President, 19.34% Chief Operating Officer (COO), 11.05% Chief Finance Officer (CFO), and 8.39% others such as Treasurer, Director, Secretary, Counsel, Chief Technology Officer, Chief Information Officer, etc. On average, each No. 2 executive has 1.46 titles. The most common combinations include VP & COO and VP & CFO.

Table 1
Reported Job Titles of the No. 2 Executives

Job Title	Number of Observations	Percent of Total
Vice President	10,108	35.36%
President	7,394	25.86%
COO	5,528	19.34%
CFO	3,159	11.05%
Others	2,399	8.39%
Sum	28,588	100%

[11] If a CEO, whether incoming or outgoing, serves for a partial year, her compensation is very likely not the highest in that firm year. I delete these observations. I also exclude special cases such as firms with co-CEOs, interim CEOs, missing CEOs, etc. After such screenings, I still find about 5% of times that the CEO's pay is not the highest in the firm. Because these cases defeat the purpose of using pay gap to capture the bottom-up monitoring system, I exclude them. Nonetheless, including all these cases of a negative *GAP* does not significantly change the empirical results reported below.

Note. This table provides summary statistics for the No. 2s' composition based on reported job titles in ExecuComp using cross-sectional yearly data from 1993 to 2006. There are 19,580 observations and 28,588 titles, i.e. 1.46 titles per executive on average.

I further examine the characteristics of the No. 2s. Because CEOs receive much more scrutiny and their characteristics are better known, for context, I compare CEOs and No. 2s along numerous dimensions. Table 2 shows that the No. 2s are notably different from the CEOs with respect to age, gender, board membership, compensation, pay performance sensitivity, etc. On average, No. 2s, as compared to the CEOs, are younger (age 52.7 vs. 55.6) with shorter tenure in the company (9.5 vs. 16.5), more likely to be female (4% vs. 1%), and less likely to be on the board (43% vs. 100%). They earn less ($3 million vs. $5 million) and own less of the firms (0.6% vs. 2.7%). As for wealth-performance sensitivity (WPS), No. 2 wealth is much less sensitive to shareholder wealth changes than is CEO wealth ($12 vs. $39 per thousand $ change in shareholder wealth). The percentage difference between the CEO and second-in-command in total compensation (43.36%) is smaller than in WPS (64.67%). (Refer to Appendix 2 for a detailed calculation of WPS.) Panel C shows that 43% of the No. 2 executives are board members of their firms, 30% hold the title of President, and 55% joined the firms before the CEOs.

Table 2
Summary Statistics

Panel A: Characteristics of No. 2 and CEO

		Mean		Median		Standard Deviation	
	Units	No. 2	CEO	No. 2	CEO	No. 2	CEO
Age	Years	52.66	55.60	52.00	56.00	8.34	7.58
Female	Y1/N0	0.04	0.01	0.00	0.00	0.18	0.11
Director	Y1/N0	0.43	0.99	0.00	1.00	0.49	0.10
Tenure	Years	9.50	16.51	5.00	14.00	10.69	12.20
Salary	$1000	460.51	731.19	396.84	668.75	281.88	397.57
Bonus	$1000	480.66	806.99	216.84	389.39	1,509.18	1,891.16
Stock Grant	$1000	353.33	544.70	0.00	0.00	3,150.84	5,942.13
Option Awards	$1000	1,600.23	2,617.51	436.08	657.35	5,711.26	10,507.63
Total Compensation	$1000	3,270.14	5,349.48	1,579.52	2,507.48	7,376.04	19,788.74
Ownership	%	0.59	2.71	0.06	0.34	2.76	6.55
WPS	per $1000	11.55	38.95	4.74	15.79	29.35	67.83

Panel B: Gaps between No. 2 and CEO

	Mean	Median	Standard Deviation	25th Percentile	75th Percentile
Gap of Total Compensation (%)	43.36	43.98	22.36	27.03	59.40
Gap of WPS (%)	64.67	69.05	25.09	49.04	84.60

Panel C: Three Additional Proxies for Monitoring from No. 2

	Mean	Median	Standard Deviation	25th Percentile	75th Percentile
Director-No. 2	0.43	0.00	0.51	0.00	1.00
President-No. 2	0.30	0.00	0.46	0.00	1.00
Independent-No. 2	0.55	1.00	0.50	0.00	1.00

Note. This table provides summary statistics for the No. 2s' characteristics as compared to the CEOs' using cross-sectional yearly data from 1993 to 2006. Among the variables, Female is a dummy variable with 1 for female and 0 for male, Director is a dummy variable with 1 if the executive serves

as a director during the fiscal year and 0 otherwise, Tenure is years in company, Total compensation includes salary, bonus, other annual, restricted stock grants, long-term incentive plan payouts, all other, and value of option grants, and Ownership is total shares owned % excluding options. WPS is wealth for performance sensitivity, defined by Jensen and Murphy (1990b) as the change in total compensation per thousand dollar change in shareholder wealth. The gap of total compensation is calculated as (CEO's pay-No. 2's pay)/CEO's pay. The gap of WPS is defined as (CEO's WPS-No. 2's WPS)/CEO's WPS. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not.

The characteristics and compensation of the No. 2 executives vary significantly both over time and across industries. Figure 1 reveals several trends. For example, the percentage of No. 2s that is female increases more rapidly than that of the CEOs during the sample period. In 1993, there were hardly any female CEOs and only 1% female No. 2s. In 2006, about 6% of No. 2s were female. While almost all the CEOs were board members, the No. 2s have been less and less likely to serve on the board. The percentage drops from 60% to 20%, with a dramatic and persistent trend. The reason, in part, is likely to be recently adopted listing

requirements and other recent pressures to increase board independence and reduce board size. In some cases these forces mean reducing the number of employees on the board of directors. As Figure 2 depicts, there is an increasing trend in the pay *GAP*: the gap between CEOs and the No. 2s increases from 40% of CEO pay to 60% over the sample period.

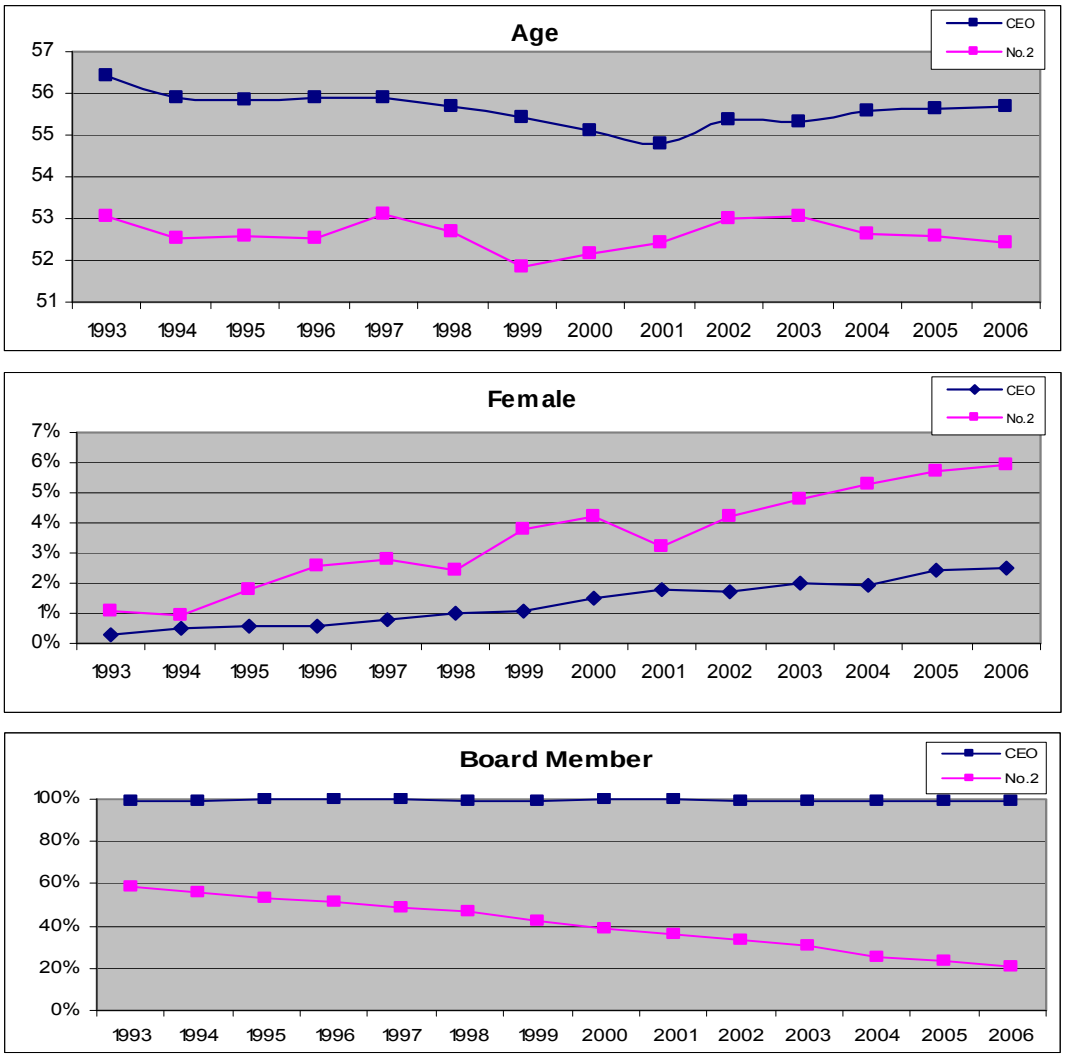

Figure 1. Annual Trends of Characteristics: No. 2 vs. CEO

Note. This panel uses cross-sectional yearly data from 1993 to 2006. Among the variables, Female is a dummy variable = 1 for female and 0 for male, Board Member is a dummy variable = 1 if the executive serves as a director in the firm and 0 if not.

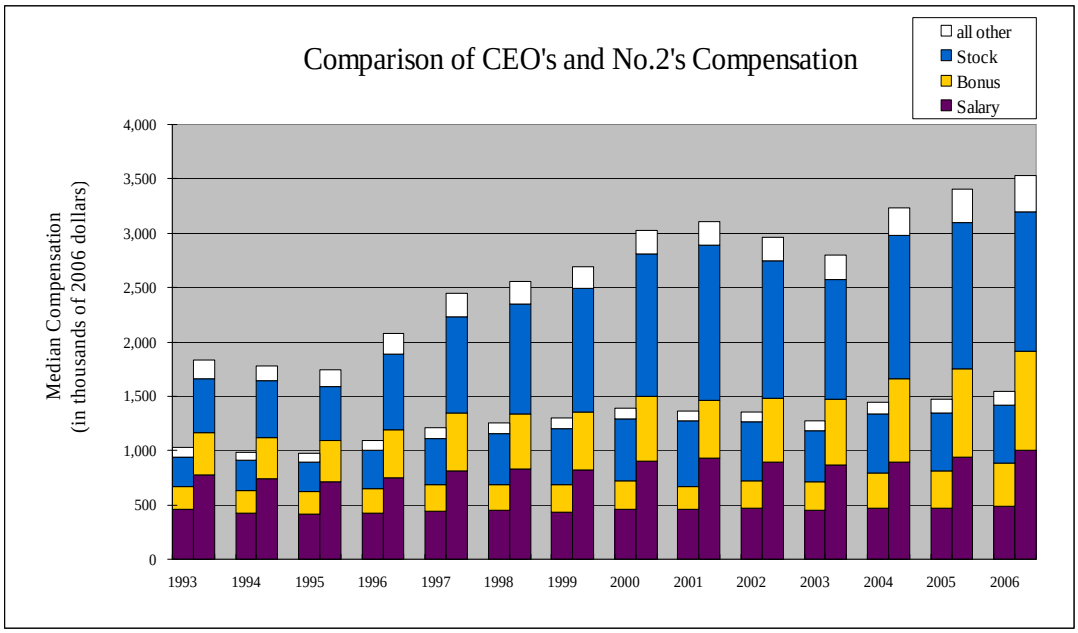

Figure 2. Annual Trends of Compensation (level and structure)

Note. This panel provides summary statistics for the No. 2s' median compensation as compared to the CEOs' using cross-sectional yearly data from 1993 to 2006. The left bars are the No. 2's compensation, and the right bars the CEO's. Among the variables, Stock is restricted stock grants in each year; Option is option awards in each year valued by the Black-Scholes model. All the numbers are in thousands of 2006 dollars.

DETERMINANTS OF MUTUAL MONITORING

DETERMININANTS OF THE GAP

The relation between CEO compensation (level, structure, etc.) and its economic determinants has been extensively documented (e.g., Bizjak, Brickley, and Coles, 1993; Murphy, 1999; Core and Guay, 1999; Hermalin and Wallace, 2001; Coles and Li, 2010). Recent papers (e.g., Frydman and Saks, 2010; Bebchuk et al., 2011) study pay dispersion among the top 5 executives. Nonetheless, the compensation gap between the CEO and the No. 2 executive has received little direct attention, despite the likelihood that the balance of authority and decision rights between the CEO and the No. 2 executive is central for performance and value, perhaps more central than the balance between the CEO and executives lower in the organization.

I use the following regression to study the determinants of the *GAP*:

$$GAP_{i,t+1} = \alpha + X_{it}\beta + Y_{it}\gamma + Z_{it}\delta + \theta_i + \mu_t + \varepsilon_{it}$$

where $GAP_{i,t+1}$ depends on: executive characteristics, X_{it}, board structure, Y_{it}, firm characteristics, Z_{it}, for firm i in year t; firm fixed effects, θ_i; and time effects, μ_t. I use lagged independent variables because many of them are year-end data while the *GAP* is largely determined at year beginning.

Another reason is that the specification is meant to capture factors that lead to subsequent changes in the *GAP*.

I use year dummies to account for time varying changes that are common to all the companies. I use firm dummies to control for unobservable time-invariant firm characteristics. In some cases, I control for industry, according to 4-digit SIC code, with industry dummies to capture industry variation. To adjust for potential heteroskedasticity and within-firm correlation, I report standard errors clustered by firm.

Table 3 presents the results on the determinants, grouped by class of variable, of the *GAP*. The three specifications vary only in the fixed effects employed.

Table 3
Determinants of GAP

Panel A: Determinants of *GAP*

Dependent Variable: GAP_{t+1}

		Predicted Sign	(1)	(2)	(3)
Executive Info	*Director-No. 2*	-	-6.64***	-5.76***	-3.09***
			(0.41)	(0.42)	(0.47)
	President-No. 2	-	-8.54***	-8.01***	-7.27***
			(0.42)	(0.43)	(0.49)
	Independent-No. 2	-	-1.70**	-1.55*	-1.39
			(0.82)	(0.83)	(1.08)
	Age Difference	+	0.06***	0.05**	0.06***
			(0.02)	(0.02)	(0.02)
	CEO Pay	+	0.25***	0.26***	0.21***
			(0.01)	(0.01)	(0.02)
Governance Measure	Board Independence	?	3.77***	2.62**	0.92
			(1.10)	(1.14)	(1.31)
	Institutional Holdings	?	5.42	3.89	3.90
			(10.66)	(10.65)	(10.48)
	Board Size	?	-0.12**	-0.11	-0.06
			(0.07)	(0.07)	(0.09)
	Classified Board	?	-0.14	0.30	-0.16
			(0.47)	(0.50)	(0.94)
	G-Index	?	0.37***	0.25***	0.22
			(0.09)	(0.09)	(0.17)
Firm Characteristic	*Qt*	+	0.50***	0.48***	0.32***
			(0.08)	(0.08)	(0.09)
	Firm Volatility	+	0.83	2.47***	2.21*
			(0.69)	(0.85)	(1.18)
	Firm Size	+	4.41***	4.32***	3.13***
			(0.58)	(0.63)	(1.26)
	Firm Size Squared	-	-0.26***	-0.25***	-0.23***
			(0.04)	(0.04)	(0.09)
	Fixed Effects		Year	Year+Industry	Year+Firm
	Observations		16,150	16,150	16,150
	Adjusted R^2		0.09	0.15	0.40

Panel B: Governance Measures and *GAP*

Dependent Variable: GAP_{t+1}

	Substitution Hypothesis	Complement Hypothesis	(1)	(2)	(3)
Board Independence	+	-	9.68***	6.97***	2.35*
			(1.09)	(1.14)	(1.32)
Institutional Holdings	+	-	-4.66	2.62	0.52
			(10.87)	(10.84)	(10.57)
Board Size	-	+	-0.57***	-0.43***	-0.17*
			(0.07)	(0.07)	(0.09)
Classified Board	-	+	-0.11	0.56	-0.31
			(0.48)	(0.51)	(0.95)
G-Index	-	+	0.10	-0.01	-0.14
			(0.06)	(0.07)	(0.11)
Fixed Effects			Year	Year+Industry	Year+Firm
Observations			16,150	16,150	16,150
Adjusted R^2			0.03	0.10	0.40

Note. The table shows OLS regressions of *GAPi,t+1 = a + bXit + cYit + dZit + (year dummies) + (industry dummies) + (firm dummies) + eit* using cross-sectional yearly data from 1993 to 2006. The dependent is *GAP**100 where *GAP* = (CEO's total compensation – No. 2's total compensation) ÷ CEO's total compensation. In Panel A, independent variables include *Director-No. 2*, *President-No. 2*, *Independent-No. 2*, Age Difference, CEO Pay, Board Independence, Institutional Holdings, Board Size, Classified Board, G-Index, CEO Pay, *Q*, Firm Volatility, Firm Size, Firm Size Squared. In Panel B, independent variables include Board Independence, Institutional Holdings, Board Size, Classified Board, G-Index, *Q*, Firm Size, and Firm Size Squared. *Director-No. 2* is a dummy, with 1 for No. 2

is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. All other control variables are defined in Appendix A. Year dummies are created for years 1993–2006. Industry dummies are based on the firm's four-digit SIC code. Firm dummies are based on firm's GVKEY identifier in Compustat. Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

Managerial Attributes:

Among all right-hand side variables, regardless of which fixed effects are included, executive characteristics have the highest explanatory power. All of them are related to the *GAP* at the 5% level of significance or better. The coefficients on *Director-No. 2* are all significant and negative. Although the CEOs are usually board members, the No. 2s rarely are. If a No. 2 is also on the board, that status suggests that she is powerful and has channels to the board that do not go through the CEO, so the *GAP* is smaller. Similarly, when the No. 2 is the president or joined the firm before the CEO, such status reflects her authority, influence, and independence in the firm.

Firm Characteristics:

As Panel A of Table 3 indicates, firm specific characteristics are associated with the *GAP*. For example, Tobin's *Q* in year t Q_t, is strongly and positively related to the *GAP*. Past firm performance, if good, rewards and empowers the CEO more than the No. 2s. Firm volatility in period t is positively related to *GAP*. On one hand, an imperial CEO with less monitoring may increase firm volatility. On the other hand, a volatile firm would prefer to give the CEO more discretion especially when facing crisis and turnaround situations. Firm size is significantly and positively related, and the relationship is concave. The CEO requires more discretion to manage a larger, more complex, company.

Governance Measures:

Supposing that the array of governance mechanisms is chosen jointly to maximize value, I examine empirically the relation among those mechanisms. Of course, my focus is on mutual monitoring from the No. 2 executive. Is such mutual monitoring a substitute or complement relative to other aspects of governance? If a firm has strong monitoring from an independent board, for example, is mutual monitoring necessary? Or perhaps an independent board will view mutual monitoring as an important device to supplement board monitoring. If a firm has weak governance, for instance, the board cannot closely monitor the CEO or the costs of direct monitoring outweigh the benefits, perhaps a powerful second-in-command will be particularly valuable. On the contrary, if a firm has

sufficient governance, a powerful No. 2 might lead to over-monitoring and inefficiency. In the specification in the last column of Table 3 Panel A, the coefficients of the governance measures are often not significant. Of course, the likely reason is that this specification includes firm fixed effects and governance measures, such as board size and classified board, which do not vary much over time, as compared to other variables in the regression.[12] In the specifications that do not include firm fixed effects, the coefficients on board independence and G-Index are significantly positive. The *GAP* is larger when the board is more independent and when the firm has more takeover barriers in place. A second approach is to include slowly changing variables *only*. Controlling only for *Q*, firm size, and firm size squared, Panel B of Table 3 confirms the result for board independence, but not for the G-index, and finds that the *GAP* and board size are negatively related. Overall, these results support the substitution hypothesis. The *GAP* is significantly and positively correlated with board independence, and significantly and negatively correlated with board size. Notably, the results are inconsistent with CEO entrenchment story which suggests both poor governance and corresponding large pay gap.

DETERMININANTS OF THE OTHER MEASURES

[12] As Zhou (2001) points out, if explanatory variables change slowly over time, firm fixed-effect regressions may fail to detect relations in the data even when they exist.

Table 4 examines whether each of the other three measures of mutual monitoring are related to other governance attributes. Panel A considers the indicator variable for whether the second-in-command holds a seat on the board of directors. Panel B examines the correlates of whether the No. 2 holds the title of president, while Panel C considers the correlates of whether the No. 2 executive joined the firm prior to the CEO.

Table 4
Governance Measures and Three Additional Proxies

Panel A: Governance Measures and *Director-No. 2*

Dependent Variable: *Director-No. 2* $_{t+1}$

	Substitution Hypothesis	Complement Hypothesis	(1)	(2)	(3)
Board Independence	-	+	-2.25***	-2.65***	-1.79***
			(0.11)	(0.04)	(0.18)
Institutional Holdings	-	+	0.18*	0.07	0.12
			(0.11)	(0.05)	(0.09)
Board Size	+	-	0.13***	0.12***	0.06***
			(0.01)	(0.01)	(0.01)
Classified Board	+	-	0.02	-0.03	0.14
			(0.05)	(0.05)	(0.13)
G-Index	+	-	0.00	0.02***	-0.02
			(0.00)	(0.00)	(0.01)
Fixed Effects			Year	Year+Industry	Year+Firm
Observations			16,057	16,057	16,057
Pseudo R^2			0.08	0.15	0.41

Panel B: Governance Measures and *President-No. 2*

Dependent Variable: *President-No. 2* $_{t+1}$

	Substitution Hypothesis	Complement Hypothesis	(1)	(2)	(3)
Board Independence	-	+	-0.48***	-0.66***	-0.53***
			(0.10)	(0.15)	(0.16)
Institutional Holdings	-	+	-0.16	-0.14*	-0.14*
			(0.11)	(0.07)	(0.07)
Board Size	+	-	0.04***	0.03***	0.01
			(0.01)	(0.01)	(0.01)
Classified Board	+	-	0.02	-0.01	0.21*
			(0.05)	(0.05)	(0.12)
G-Index	+	-	-0.00	0.01*	-0.02
			(0.00)	(0.01)	(0.02)
Fixed Effects			Year	Year+Industry	Year+Firm
Observations			17,925	17,925	17,925
Pseudo R^2			0.02	0.10	0.41

Panel C: Governance Measures and *Independent-No. 2*

Dependent Variable: *Independent-No. 2* $_{t+1}$

	Substitution Hypothesis	Complement Hypothesis	(1)	(2)	(3)
Board Independence	-	+	-0.25*	-0.40**	-1.07***
			(0.17)	(0.20)	(0.37)
Institutional Holdings	-	+	0.07	0.37	-0.74***
			(0.17)	(0.26)	(0.20)
Board Size	+	-	0.01	0.05***	0.00
			(0.01)	(0.02)	(0.02)
Classified Board	+	-	0.02	-0.10	-0.14
			(0.08)	(0.12)	(0.28)
G-Index	+	-	-0.02	-0.01	0.08***
			(0.01)	(0.02)	(0.03)
Fixed Effects			Year	Year+Industry	Year+Firm
Observations			5,971	5,971	5,971
Pseudo R^2			0.05	0.16	0.39

Note. The table shows logistic regressions of three additional proxies for No. 2's monitoring capacity on governance measures using cross-sectional yearly data from 1993 to 2006. The dependent variables are *Director-No. 2* in Panel A, *President-No. 2* in Panel B, and *Independent-No. 2* in Panel C. Independent variables, which are the same in each panel, include Board Independence, Institutional Holdings, Board Size, Classified Board, G-Index, *Q*, Firm Size, and Firm Size Squared. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. All other control variables are defined in Appendix A. Year dummies are created for years 1993–2006. Industry dummies are based on the firm's four-digit SIC code. Firm dummies are based on firm's GVKEY identifier in Compustat. R^2 is log-likelihood based pseudo R^2. Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

The results in Table 4 suggest that weaker boards, e.g., less independent or larger boards, tend to confer more authority, more decision rights, and better access to information on the second-in-command, again supporting the substitution hypothesis.

I now turn to the primary focus of the analysis. The sections below measure the extent to which mutual monitoring affects firm performance and investment policy.

MUTUAL MONITORING AND FIRM PERFORMANCE

HYPOTHESIS

In terms of prior literature, the optimal contracting hypothesis (e.g., Holmstrom, 1979; Grossman and Hart, 1983) contends that boards of directors bargain at arm's length as shareholders' loyal agents, and minimize agency costs and maximize firm value by optimally assigning executives with incentives and responsibility. It implies optimal monitoring from the No. 2 executive and needs not imply a systematic relationship between mutual monitoring and firm performance.

In contrast, the managerial power hypothesis (e.g., Bertrand and Mullainathan, 1999; Bebchuk, Fried, and Walker, 2002) argues that boards do not always bargain at arm's length and therefore are not able to construct an optimal monitoring system. In particular, they suggest that the CEO has so much power and authority, as compared to the No. 2s, that the extent of mutual monitoring is insufficient to constrain the powerful CEO. Under this view, stronger mutual monitoring is likely to be associated with better firm performance because the extent of mutual monitoring in place is less than optimal. Thus, for example, as the *GAP* becomes larger firm value or performance would decline. Likewise, when

one or more of my other three variables indicates more mutual monitoring, firm performance would increase.

Tournament theory (e.g., Lazear and Rosen, 1981), on the other hand, suggests an opposing effect from the *GAP*. If a big raise is the tournament prize to advancing to the CEO position, executives who are not CEO have a large incentive to provide managerial input that advances firm performance. Kale, Reis, and Venkateswaran (2009) provide evidence that the difference between CEO compensation and compensation of lower executives is positively related to firm performance.[13]

Ultimately, assessing which theory dominates is an empirical question. While research focuses intensively on formal mechanisms, such as compensation incentives designed to "pull" the executives to work and board monitoring designed to "push" executives to work, with the exception of a few contributions listed above there is little evidence on the effects of the internal allocation of authority and information.[14] My hypothesis is that a well-structured authority system, by imbuing

[13] There are two major differences between the experiments in Kale et al (2009) and those in this section. First, they use pay gap between the CEO and median pay of all the VPs, while I use top 2 executives. Second, they use contemporaneous *Q* on the LHS, and I use 1 year forward *Q*. Since I have shown past firm performance is an important determinant of pay gap, using contemporaneous *Q* might have reverse causality issues.

[14] An exception is Acharya et al. (2011), which provides a model of "internal governance" where subordinates may limit the CEO's self-serving actions.

executives with appropriate incentives and distributing power, information, and responsibility in a fashion that balances costs and benefits, potentially results in better firm performance. I state my specific hypothesis as follows.

Hypothesis 1: The extent of mutual monitoring is positively related to firm performance. In particular, GAP is negatively related to firm performance. The No. 2 executive holding a board seat, holding the title of president, and being appointed prior to the CEO are positively associated with firm performance.

Below I provide what to my knowledge is the first empirical evidence on the relationship between mutual monitoring and firm performance.

EVIDENCE

Following prior literature (e.g.; McConnell and Servaes, 1990; Bebchuk et al., 2011), I use Tobin's *Q* in year t+1 as a proxy for future firm performance. *Q* is defined as the ratio of the market value of the firm to the replacement value of the firm's asset. To explain Q_{t+1}, I control for a variety of variables that are suggested by theoretical and empirical literature. In particular, control variables commonly used in performance equations include research and development expenses, advertising expenses, capital intensity, treasury stock, board size, institutional holdings (Palia, 2001), earnings before extraordinary items, the natural

logarithm of net assets (as a proxy for firm size), the square of the log of net assets, interest expense, common dividends, new financing, property plant equipment (Dittmar and Mahrt-Smith, 2007), percent of independent directors, G Index, CEO total compensation, whether the firm has a classified board, return on assets, return on sales, leverage, firm volatility, and a Delaware company dummy (Faleye, 2007). I also include combinations of year, industry, and firm fixed effects, the last to control for unobservable firm characteristics.

Consistent with Hypothesis 1, Table 5 Panel A, a simple OLS, reports a negative relation between Tobin's *Q* in period t+1 and the *GAP* in period t. Panel A also suggests that the No. 2 executive being a director of the company or president or being "independent" benefits the firm through increased future value.

Notably, while controlling for board independence (% of outside directors) so that the well-studied relation between board independence and performance is held constant, the *Director-No. 2* dummy is still positively associated with performance. This suggests that the No. 2, as a board member, can monitor better than an arbitrary inside director.

Table 5
Mutual Monitoring and Firm Performance

Panel A: Year and Industry Fixed Effects

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GAP	-0.06*	-0.09*						
	0.04	0.05						
Director-No. 2			0.02	0.04*				
			0.02	0.02				
President-No. 2					0.09***	0.08***		
					0.03	0.03		
Independent-No. 2							0.07	0.12*
							0.06	0.06
Fixed Effect	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Observations	18,873	18,873	18,873	18,873	18,873	18,873	4,551	4,551
Adjusted R^2	0.17	0.25	0.17	0.26	0.18	0.28	0.16	0.25

Panel B: Firm Fixed Effects

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GAP	-0.10*	-0.11*						
	0.06	0.06						
Director-No. 2			0.04*	0.05**				
			0.02	0.02				
President-No. 2					0.04*	0.06**		
					0.02	0.02		
Independent-No. 2							0.15**	0.12*
							0.07	0.07
Year + Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Y	N	Y	N	Y	N	Y	N
Observations	18,873	19,019	18,873	19,019	18,873	19,019	4,551	4,551
Adjusted R^2	0.53	0.48	0.51	0.48	0.52	0.48	0.46	0.43

Panel C: Controlling for Q_t

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GAP	-0.14**	-0.13**						
	0.06	0.06						
Director-No. 2			0.03	0.05*				
			0.02	0.03				
President-No. 2					0.05**	0.07***		
					0.02	0.02		
Independent-No. 2							0.04	0.21***
							0.05	0.08
Q_t	0.34***	0.20***	0.34***	0.31***	0.34***	0.31***	0.34***	0.30***
	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Fixed Effect	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Observations	18,873	18,873	18,873	18,873	18,873	18,873	4,551	4,551
Adjusted R^2	0.37	0.40	0.33	0.40	0.33	0.41	0.32	0.38

Panel D: First-Differences Model

Dependent Variable: ΔQ_{t+1}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ*GAP*	-0.13*	-0.13*						
	0.07	0.07						
Δ*Director-No. 2*			0.08**	0.08**				
			0.04	0.04				
Δ*President-No. 2*					0.01	0.01		
					0.04	0.04		
Δ*Independent-No. 2*							0.32**	0.32**
							0.15	0.15
Fixed Effect	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Observations	15,888	15,888	14,210	14,210	15,724	15,724	3,082	3,082
Adjusted R^2	0.08	0.10	0.09	0.10	0.08	0.09	0.10	0.11

Panel E: Industry-Adjusted Model

Dependent Variable: Ind-adj Q_{t+1}

	(1)	(2)	(3)	(4)
Ind-adj *GAP*	-0.09*			
	0.05			
Ind-adj *Director-No. 2*		0.06***		
		0.02		
Ind-adj *President-No. 2*			0.07***	
			0.03	
Ind-adj *Independent-No. 2*				0.12*
				0.07
Fixed Effect	Year+Firm	Year+Firm	Year+Firm	Year+Firm
Control Variables	Y	Y	Y	Y
Observations	18,873	18,873	18,873	4,551
Adjusted R^2	0.41	0.41	0.41	0.37

Panel F: Q_{t+3}

Dependent Variable: Q_{t+3}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GAP	-0.09*	-0.11**						
	0.05	0.05						
Director-No. 2			0.05**	0.05**				
			0.02	0.02				
President-No. 2					0.04*	0.05**		
					0.02	0.02		
Independent-No. 2							-0.07	-0.03
							0.06	0.06
Q_t	0.15***	0.11***	0.15***	0.11***	0.15***	0.11***	0.10***	0.07***
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Fixed Effect	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Observations	13,220	13,220	13,220	13,220	13,147	13,147	3,238	3,238
Adjusted R^2	0.24	0.31	0.24	0.31	0.24	0.32	0.23	0.31

Panel G: Q_{t+5}

Dependent Variable: Q_{t+5}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GAP	-0.06	-0.04						
	0.06	0.06						
Director-No. 2			0.05*	0.06**				
			0.03	0.03				
President-No. 2					0.05	0.06*		
					0.03	0.03		
Independent-No. 2							-0.09	-0.08
							0.08	0.08
Q_t	0.09***	0.07***	0.09***	0.07***	0.09***	0.07***	0.06***	0.04***
	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Fixed Effect	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind	Year	Yr+Ind
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Observations	9,476	9,476	9,476	9,476	9,418	9,418	2,280	2,280
Adjusted R^2	0.20	0.28	0.20	0.28	0.20	0.29	0.20	0.28

Panel H: 2SLS

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)
GAP	-0.17*			
	0.09			
Director-No. 2		0.16**		
		0.08		
President-No. 2			0.05*	
			0.03	
Independent-No. 2				0.17
				0.10
Fixed Effect	Year+Ind	Year+Ind	Year+Ind	Year+Ind
Control Variables	Y	Y	Y	Y
Observations	7,014	6,897	8,478	1,871
Adjusted R^2	0.24	0.24	0.26	0.22
F stat	16.44***	26.77***	29.67***	21.13***
p (Sargan test)	0.25	0.48	0.33	0.35
p (Durbin-Wu-Hausman test)	0.28	0.18	0.21	0.28

Note. The table shows regressions for the cross-sectional yearly data from 1993 to 2006. The dependent variable is Tobin's *Q*. The independent variables include *GAP*, *Director-No. 2*, *President-No. 2*, *Independent-No. 2*. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. Control variables are Age Difference, CEO Pay, Board size, Institutional Holdings, Board Independence, G Index, Classified Board, Firm volatility, Firm size, Firm

Size squared, Stock Ret 3yr, R&D, Advertising, Interest, New Finance, Capital Intensity, PPE, CEO WPS, Leverage, Earnings, Treasury Stock, ROA, ROS, Delaware, and Year dummies. All the variables are defined in Appendix A. In industry fixed effect model in Panel A, industry dummies are based on the firm's four-digit SIC code. Panels B, C, D, E, F and G are robustness checks. In firm fixed effect model in Panel B, firm dummies are based on firm's GVKEY in Compustat. In columns 2, 4, 6, and 8, only Q_t, firm size, and firm size squared are controlled for. Panel C controls for past firm performance Q_t. Panel D uses first-differences model. Panel E uses industry-adjusted method. The dependent variables are Q_{t+3} and Q_{t+5} in Panel F and G, respectively. Panel H reports the second stage results of 2SLS estimates with industry median measures and 5 year lagged measures as instrumental variables. Panel Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

Conferring the title of president on the second-in-command is positively related to future value. This result is consistent with the notion that titles are associated with formal authority and informal influence and that such enhance firm value by enabling effective monitoring of the CEO by the No. 2 executive. Likewise, the positive coefficient on the *independent No. 2* indicator suggests that a No. 2 who was appointed

prior to the CEO is less co-opted by the CEO and, thus, is better able to serve in the capacity of mutual monitor.

ROBUSTNESS

The above empirical results are robust to adding or dropping any control variable. In addition, I obtain similar results using firm fixed effect model in Table 5 Panel B which mitigates omitted variable problem by controlling for unobserved time-invariant firm specific information.

In Panel C, I control for Q_t and show that based on past performance Q_t, mutual monitoring within a firm provides incremental explanatory power to account for future firm performance Q_{t+1}.

In Panel D, I further study within-firm variation and show similar results by regressing changes in performance on changes in mutual monitoring measures in the first differences model.

In Panel E, following Bebchuk et al. (2011), I use industry-adjusted performance and industry-adjusted measures. Results are still robust.

Furthermore, I regress 3 year forward Q_{t+3} and 5 year forward Q_{t+5} on the four measures in Panels F and G, respectively. The results are similar except that the coefficients for t+5 are rarely significant. Mutual monitoring may have a moderately long term effect on firm performance.

In Panel H, I use 2SLS approach with industry median measure and five year lagged measure as instrumental variables to my four measures. Industry median measures of mutual monitoring are related to

the measures in the firm. DiMaggio and Powell (1983) argue that organizations tend to be similar by adopting similar organizational practices through institutional isomorphism. Therefore it's reasonable to expect the mutual monitoring structure of industry peers has a positive influence on a focal firm. On the other hand, for example, whether a No. 2 is the president in an industry median firm should have no direct impact on a focal firm's performance (after adjusting for industry and year fixed effects).[15] The second instrument is five year lagged measure. It is a commonly used approach to the choice of instruments in time series or panel data (Greene, 2000; Kennedy, 2003). By construction, this lagged measure is related to contemporaneous measure but has no or less direct effect on firm performance. I also statistically test the instruments for their relevance and validity. The first-stage F statistics all surpass the usual rule of thumb of 10, the over-identification test (Sargan's test) can't reject the null hypothesis that the instruments are valid and orthogonal to the regression residuals, and the Durbin-Wu-Hausman test cannot reject exogeneity of all four measures in this model, suggesting these measures can be treated as largely exogenous under the usual analysis of instrumental variables and therefore OLS might be more efficient than

[15] With industry and year fixed effects, the estimation of the coefficients on the endogenous variables is based on the time series and cross-sectional variation of the industry median instruments. Several recent studies employ the same approach to construct instrument (e.g., John and Kadyrzhanova, 2008; Bebchuk et al., 2011; Kini and Williams, 2012).

2SLS in this case. Indeed the results from the second stage of 2SLS, as shown in Panel H, are similar to those from the OLS regressions.

Across the variety of different specifications, the coefficients on *GAP* are about -0.11. For a one-standard-deviation decrease in the *GAP* (from median 44% to 22%), forward Tobin's *Q* increases from median 1.48 to 1.50 and firm value increases from median $1.39 billion to $1.41 billion.

A HORSE RACE

The CEO pay slice measure (Bebchuk et al., 2011) and my measure, the *GAP*, are somewhat similar in intent and functional form. CEO Pay Slice (CPS) is CEO total compensation divided by the total compensation paid to the top 5 executives. In Table 6, I compare the explanatory power of *GAP* and CPS. Excluding the *GAP* as a regressor, the significant effects of CPS on *Q* are mostly similar to those in Bebchuk et al. (2011). The inclusion of the *GAP*, however, largely reduces the economic and statistical significance of the CPS. The *GAP* has more statistical power than CPS in most of the specifications. Moreover, based on a normalized comparison, the economic magnitude of the "*GAP* effect" is approximately double the "CPS effect" on average.[16] Perhaps the

[16] For example, assume a 10% raise on average CEO pay from $5 million to $5.5 million. The *GAP* increases by 0.05 from mean 43% to 48%, and the CPS by 0.02 from mean 34% to 36%. Then considering the coefficients in Table 7, the economic significance of the *GAP* doubles that of the CPS on average.

authority and access to information is significantly higher for No. 2 executives than for executives lower in the organizational hierarchy.

Table 6
Horse Race: *GAP* vs. CPS

Dependent Variable:	Tobin's *Q*				Industry-adjusted Tobin's *Q*				Ind-adj Tobin's *Q* (controlling for lagged *Q*)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CPS	-0.18**	-0.14			-0.34***	-0.28***			-0.25**	-0.18		
	(0.09)	(0.09)			(0.11)	(0.11)			(0.11)	(0.13)		
GAP		-0.10*				-0.16***				-0.07		
		(0.05)				(0.06)				(0.06)		
Ind-adj CPS			-0.10	-0.06			-0.32***	-0.24**			-0.27**	-0.14
			(0.09)	(0.08)			(0.11)	(0.12)			(0.12)	(0.14)
Ind-adj *GAP*				-0.09*				-0.21***				-0.13*
				(0.05)				(0.07)				(0.07)
Observations	12,151	12,151	11,963	11,963	12,139	12,139	12,139	12,139	13,775	13,775	13,775	13,775
Adjusted R^2	0.48	0.48	0.47	0.47	0.10	0.10	0.10	0.10	0.30	0.30	0.30	0.30

Note. The table shows OLS regressions for the cross-sectional yearly data from 1993 to 2006. All specifications include year dummies. In specifications 1 2 3 and 4, the dependent variable is Tobin's *Q* in the following year. Year and firm fixed effects are included. In 5 6 7 and 8, the dependent variable is industry-adjusted Tobin's *Q* in the following year. Year fixed effects are included. In 9 10 11 and 12, the dependent variable is Tobin's *Q* in the following year while controlling for

Tobin's *Q* in the current year. Year fixed effects are included. The explanatory variable *GAP* = (CEO's total compensation – No. 2's total compensation) ÷ CEO's total compensation. CPS is the CEO's Pay Slice, calculated as the CEO's total compensation divided by the total pay to the top 5 executives. Control variables include Age Difference, CEO Pay, G Index, Classified Board, Board size, Institutional Holdings, Board Independence, Firm volatility, Firm size, Firm Size squared, Stock Ret 3yr, R&D, Advertising, Interest, New Finance, Capital, PPE, CEO WPS, Leverage, Earnings, Treasury Stock, ROA, ROS, Delaware, and Year dummies. All the variables are defined in Appendix A. Industry-adjusted method is based on the firm's four-digit SIC code. Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

FURTHER DISCUSSTION

All the previous results seem to support that mutual monitoring by a No. 2 executive is likely to be weaker than would be ideal so that stronger mutual monitoring is associated with increased performance. Nonetheless, there are potential concerns with this interpretation.

The dollar gain to a one-standard deviation reduction in *GAP* is consequential. The question is why that $20 million potential gain to the shareholders is observable in data. One possibility is the standard sort of transaction cost argument. Any potential gain to increased mutual monitoring would be offset or outweighed by the various transaction costs of the corresponding organizational change, with the result that some or many firms rationally choose mutual monitoring below the level that would be optimal in the absence of transaction costs. A variant of this story is that CEO power, in practice, is "sticky" (Granovetter, 1985; Pfeffer, 1981). Once CEO power has been accumulated, it becomes increasingly difficult or expensive to remove or redistribute. In addition, radical changes in the authority system generate nontrivial costs, such as costs of renegotiation, disruption, and turnover, etc. Tirole (1999) categorizes contracting transaction costs into unforeseen contingencies, cost of writing contracts, and cost of enforcing contracts. These costs tend to be higher when contracting with a more powerful CEO under weaker governance.

Also note that there are regulatory constraints on organizational changes that might enhance mutual monitoring. The obvious example in my study is whether or not the second-in-command serves on the company board of directors. The logic for including the No. 2 executive on the board is simple. Fama and Jensen (1983) make that case in terms of mutual monitoring. Moreover, executives who are also board members are likely to be fired only with consent of the board and thus are protected from reprisals from the CEO. Nonetheless, the basic guidelines of the Sarbanes-Oxley Act 2002 (SOX) and the listing exchanges require firms to increase the representation on the board of nonemployee directors.[17] Moreover, audit, compensation, nominating, and governance committees must be comprised of at least three members, all of whom must be independent directors. Allocating an additional board seat to an employee is difficult when there are pressures as well to reduce board size. These various rules and pressures combined have reduced participation of employees on boards.[18] In my data, in 2006 only 20% of the No. 2 executives served on the board, as compared to 60% in 1993.

---

[17] In Section 7.4, I empirically study the "SOX effect" and provide further discussion.

[18] An unintended consequence of SOX is likely to be a reduced connection between top executives and board and, thus, reduced mutual monitoring. One possibility is to resort to other channels to reconnect to the No. 2 executives. For example, No. 2 executives could be invited to attend their

In light of these considerations, a systematic relation between *Q* and my measures of mutual monitoring need not be surprising.

MUTUAL MONITORING AND FIRM PERFORMANCE UNDER WEAK GOVERNANCE

Agency costs can be reduced through a variety of methods. A primary means is the use of a board of directors to monitor the CEO. Bebchuk and Fried (2004) argue that the CEO will have more power when the board is weak, for instance, when there is a lower percentage of outsiders as directors, when there are fewer institutional shareholders, when the company has strong anti-takeover defenses, and when the board has a greater number of members. It is precisely under such circumstances that internal governance, through mutual monitoring, for instance.

Hypothesis 2: Mutual monitoring will have a stronger effect on firm performance when other governance mechanisms are weak. In particular, firm performance will be more sensitive to the mutual monitoring measures when the board is larger and less independent, institutional holdings are lower, and the G Index is higher.

---

firms' annual shareholders meetings, strategic retreats, board developmental programs, and related off-site activities.

To test this hypothesis, for each governance mechanism I divide sample firms into two groups of equal size, one group having "strong governance" and the other "weak governance", as conventionally defined.[19] I then explore the relationship between my four measures and *Q* within these two groups. I include the following commonly used variables as proxies for governance strength.

Board size:

Agency problems become more severe in a larger board because of the "free-rider" problems. While the advisory role of a large board can offset the costs of less effective monitoring and lower maneuverability (Coles et al., 2008), the CEOs can capture a larger board more easily and obtain excessive power in decision making (e.g. Jensen, 1993). I separate the data into two halves, one with board size less than 10 members and the other with board size of 10 or greater. Missing values are excluded.

As shown in Table 7 Panel A, when companies have larger boards, the estimated coefficient on *GAP* as a determinant of forward *Q* is significantly negative. The coefficient on *GAP* for companies with smaller

[19] Note that "weak" here doesn't necessarily mean bad. A firm may form a "weak" board, for example, a less independent board because the board's advisory role outweighs its monitoring role. In such cases, mutual monitoring may be an important supplement to board governance.

boards is also negative but, in contrast, not statistically significant. The two coefficients are not statistically different. The results in Panels B and D for board size support Hypothesis 2 that mutual monitoring is more valuable in firms with weak governance. However, since *Director-No. 2* is mechanically related to board size and board independence, we should interpret the relevant results with caution.

Institutional Holdings:

Similarly, I divide the sample with non-missing institutional holdings data into two halves. The "weak" group has a minority institutional holding (<50% holding), and the "strong" group has a majority holding (>=50%). The estimated coefficient on *GAP* in the "weak" group is significantly negative. Moreover, it is significantly different from the coefficient on *GAP* for the group with higher institutional ownership. The results in Panels A, B, and C, but not D, are consistent with Hypothesis 2.

Board Independence:

I classify boards composed of 70% (median) or fewer independent directors as "weak" and remaining boards as "strong." In Panel A, the coefficient on *GAP* for firms with less independent boards is significantly negative and significantly more negative than the (slightly positive) coefficient on *GAP* for more independent boards. This result supports Hypothesis 2, but results in Panels B, C, and D are not significant.

G Index:

I partition the data into quartiles based on the G Index with missing values excluded. The highest quartile has G Index ranging from 0 to 6. This quartile has "strong" governance on this dimension. The weakest firms are in the lowest quartile, with G ranging from 11 to 24. Panels A thru D show that the coefficients in high-G-Index group are not significantly different from the other coefficients in low-G-Index group. The results do not support Hypothesis 2.

For a one-standard-deviation increase in the *GAP*, the potential loss to the shareholders is about $30 million when the board is large; $131 million when institutional holdings are low; and $73 million when the board is less independent.

Table 7
Mutual Monitoring and Firm Performance Conditional on Governance Measures

Panel A: *GAP*

Dependent Variable: Q_{t+1}

	Board Size			Institutional Holdings			Board Independence			G Index		
	>=10	<10	Diff P-val	<50%	>=50%	Diff P-val	<=70%	>70%	Diff P-val	11~24	0~6	Diff P-val
GAP	-0.14*	-0.11	0.65	-0.57**	-0.19	0.02	-0.33***	0.02	0.04	-0.07*	-0.07	0.26
	(0.07)	(0.12)		(0.27)	(0.17)		(0.11)	(0.10)		(0.04)	(0.15)	
Observations	5,178	5,501		1,006	2,305		5,919	4,737		4,755	3,672	
Adjusted R^2	0.66	0.64		0.68	0.65		0.62	0.64		0.62	0.58	

Panel B: *Director-No. 2*

Dependent Variable: Q_{t+1}

	Board Size			Institutional Holdings			Board Independence			G Index		
	>=10	<10	Diff P-val	<50%	>=50%	Diff P-val	<=70%	>70%	Diff P-val	11~24	0~6	Diff P-val
Director-No. 2	0.07**	0.01	0.09	0.13*	0.02	0.08	0.03	0.05*	0.44	0.04*	0.03	0.21
	(0.03)	(0.02)		(0.07)	(0.05)		(0.03)	(0.03)		(0.02)	(0.02)	
Observations	4,730	4,965		1,014	2,157		5,702	4,615		5,295	4,858	
Adjusted R^2	0.53	0.51		0.65	0.62		0.53	0.53		0.64	0.62	

Panel C: *President-No. 2*

Dependent Variable: Q_{t+1}

	Board Size			Institutional Holdings			Board Independence			G Index		
	>=10	<10	Diff P-val	<50%	>=50%	Diff P-val	<=70%	>70%	Diff P-val	11~24	0~6	Diff P-val
President-No. 2	0.02	0.05	0.34	0.12*	-0.01	0.10	0.03	0.02	0.62	0.02	0.02	0.89
	(0.02)	(0.03)		(0.07)	(0.05)		(0.03)	(0.03)		(0.03)	(0.02)	
Observations	5,102	5,368		1,019	2,203		5,835	4,873		5,603	5,183	
Adjusted R^2	0.53	0.53		0.66	0.62		0.52	0.53		0.65	0.67	

Panel D: *Independent-No. 2*

Dependent Variable: Q_{t+1}

	Board Size			Institutional Holdings			Board Independence			G Index		
	>=10	<10	Diff P-val	<50%	>=50%	Diff P-val	<=70%	>70%	Diff P-val	11~24	0~6	Diff P-val
Independent-No. 2	0.20*	-0.03	0.04	0.02	0.07	0.65	0.09	0.06	0.74	0.19*	016*	0.82
	(0.11)	(0.09)		(0.10)	(0.17)		(0.10)	(0.09)		(0.09)	(0.09)	
Observations	1,293	1,358		268	481		1,405	1,257		2,417	2,126	
Adjusted R^2	0.65	0.63		0.77	0.78		0.63	0.65		0.53	0.50	

Note. The table shows OLS regressions with firm and year fixed effects for the cross-sectional yearly data from 1993 to 2006. The dependent variable is Tobin's *Q*. The independent variables are *GAP* in Panel A, *Director-No. 2* in Panel B, *President-No. 2* in Panel C, and *Independent-No. 2* in Panel D. I separate data into two groups, weak governance and strong governance firms, based on board size, institutional holdings, independent directors and G index respectively. Board size is the number of directors. Institutional Holdings are the percentage of company's outstanding common shares held by institutions. Board Independence is the number of independent outside directors divided by board size. G Index is

the number of anti-takeover-provision (ATP) measures in a firm's charter and in the legal code of the state where the firm is incorporated. Control variables include Age Difference, CEO Pay, Classified Board, Board Independence, Firm volatility, Firm size, Firm Size squared, Stock Ret 3yr , R&D, Advertising, Interest, New Finance, Capital Intensity, PPE, CEO WPS, Leverage, Earnings, Treasury Stock, ROA, Delaware, Year dummies and Firm dummies. Firm dummies are based on firm's GVKEY in Compustat. All the variables are defined in Appendix A. The significance of the difference in coefficients (P-value) is also reported. Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

MUTUAL MONITORING AND INCENTIVES

INCENTIVES FOR MUTUAL MONITORING

All of my four measures describe monitoring capacity of the No. 2 executive. However, it is likely that even with sufficient monitoring power, the No. 2 executives may still prefer colluding to monitoring. Therefore, I further study the incentives for the second-in-command to monitor the CEO. The hypothesis is that based on monitoring capacity, the No. 2 executives still require proper incentives to do monitoring. The first incentive I consider is the difference in appropriation horizons between the CEO and the No. 2. Acharya, Myers, and Rajan (2011) suggest that internal monitoring is more operative in firms with greater age differences between the top two executives, namely with old CEOs who are about to retire and young No. 2's who care about the future of their firms. Moreover, since elderly CEOs have less career or reputation concerns, mutual monitoring may be more effective. I interact age difference between the top two executives with all four mutual monitoring measures. Results in Table 8 Panel A indicate that the effects of mutual monitoring are more pronounced in firms with larger age differences, signifying greater divergences in appropriation horizon.

Table 8
Mutual Monitoring Incentives

Panel A: Age Difference

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)
GAP	-0.04			
	0.05			
*GAP**Age Difference	-0.99*			
	0.57			
Director-No. 2		0.05*		
		0.03		
*Director-No. 2**Age Difference		0.50*		
		0.30		
President-No. 2			0.07***	
			0.03	
*President-No. 2**Age Difference			0.15	
			0.28	
Independent-No. 2				0.17**
				0.08
*Independent-No. 2**Age Difference				-0.06
				0.86
Age Difference	0.21	-0.40	-0.25	-0.22
	0.27	0.27	0.18	0.50
Fixed Effect	Year+Firm	Year+Firm	Year+Firm	Year+Firm
Control Variables	Y	Y	Y	Y
Observations	18,873	18,873	18,873	4,551
Adjusted R^2	0.53	0.51	0.52	0.49

Panel B: CEO Duality

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)
GAP	0.06			
	0.08			
*GAP**CEO Duality	-0.11			
	0.10			
Director-No. 2		0.12***		
		0.04		
*Director-No. 2**CEO Duality		-0.10**		
		0.05		
President-No. 2			0.17***	
			0.05	
*President-No. 2**CEO Duality			-0.12**	
			0.05	
Independent-No. 2				0.02
				0.11
*Independent-No. 2**CEO Duality				0.13
				0.14
CEO Duality	0.05	0.03	0.02	0.09
	0.05	0.04	0.03	0.09
Fixed Effect	Year+Firm	Year+Firm	Year+Firm	Year+Firm
Control Variables	Y	Y	Y	Y
Observations	18,661	16,725	18,580	4,502
Adjusted R^2	0.53	0.51	0.53	0.49

Note. The table shows regressions for the cross-sectional yearly data from 1993 to 2006. The dependent variable is Tobin's *Q*. The independent variables include *GAP*, *Director-No. 2*, *President-No. 2*, *Independent-No. 2,* and their interactions with age difference in Panel A, and CEO duality in Panel B. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the

company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. Age difference is CEO's age minus No. 2's age, scaled by 100. CEO duality is a dummy, with 1 if the CEO is the chairman of the board. Control variables are CEO Pay, Board size, Institutional Holdings, Board Independence, G Index, Classified Board, Firm volatility, Firm size, Firm Size squared, Stock Ret 3yr, R&D, Advertising, Interest, New Finance, Capital Intensity, PPE, CEO WPS, CEO tenure, Leverage, Earnings, Treasury Stock, ROA, ROS, Delaware, firm dummies, and Year dummies. All the variables are defined in Appendix A. Panel Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

The CEO being the chair of the board (namely CEO duality) should discourage mutual monitoring from the No. 2 especially when the No. 2 executive is a board member. As shown in Table 8 Panel B, CEO duality cancels out the positive effects of *Director-No. 2* and *President-No. 2* on firm performance. The results are consistent with that the CEO duality acts as a *disincentive* for mutual monitoring.

CEO INCENTIVE

I've shown in Sections 5 and 6 that mutual monitoring is a substitute to other corporate governance systems. Similarly, I hypothesize

that it is also a substitute to CEO incentive. Because CEO incentive alignment can mitigate agency problem, mutual monitoring may become unnecessary when the CEO has sufficient incentives to work harder and better. In Table 9, I use CEO wealth-for-performance sensitivity (delta) to interact with mutual monitoring measures. The results support that mutual monitoring and CEO incentive are substitutes, and mutual monitoring is more valuable when CEO incentive alignment is deficient.

Table 9
Mutual Monitoring and CEO Incentive

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)
GAP	-0.13**			
	0.06			
*GAP**CEO Delta	0.13***			
	0.05			
Director-No. 2		0.07**		
		0.03		
*Director-No. 2**CEO Delta		-0.07**		
		0.03		
President-No. 2			0.09**	
			0.03	
*President-No. 2**CEO Delta			-0.03	
			0.03	
Independent-No. 2				0.10
				0.08
*Independent-No. 2**CEO Delta				0.32*
				0.17
CEO Delta	0.04	0.11***	0.09***	0.02
	0.04	0.04	0.03	0.09
Fixed Effect	Year+Firm	Year+Firm	Year+Firm	Year+Firm
Control Variables	Y	Y	Y	Y
Observations	18,873	18,873	18,873	4,551
Adjusted R^2	0.53	0.51	0.52	0.48

Note. The table shows regressions for the cross-sectional yearly data from 1993 to 2006. The dependent variable is Tobin's *Q*. The independent variables include *GAP*, *Director-No. 2*, *President-No. 2*, *Independent-No. 2,* and their interactions with CEO delta. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1

for No. 2 is the president of the company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. CEO delta is CEO's wealth performance sensitivity scaled by 100. Control variables are CEO Pay, Board size, Institutional Holdings, Board Independence, G Index, Classified Board, Firm volatility, Firm size, Firm Size squared, Stock Ret 3yr, R&D, Advertising, Interest, New Finance, Capital Intensity, PPE, CEO WPS, Leverage, Earnings, Treasury Stock, ROA, ROS, Delaware, firm dummies, and Year dummies. All the variables are defined in Appendix A. Panel Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

MUTUAL MONITORING AND INFORMATION ASYMMETRY

The board should encourage mutual monitoring within the management team especially when information asymmetry between the board and the CEO is high. For instance, in a heterogeneous industry, it might be impossible or too costly for the board to assess the CEO's performance and therefore the information generated from the mutual monitoring system may be crucial in solving information asymmetry. On the contrary, information asymmetry in a homogeneous industry is low because the CEO's performance can be so easily and accurately evaluated that mutual monitoring may not be particularly useful. Following

Parrino (1997), I use the correlation between stock returns within 2-digit SIC industries to measure industry homogeneity. Results in Table 10 suggest that mutual monitoring is more valuable to the firms in heterogeneous industries than to those in homogeneous industries.

Table 10
Mutual Monitoring and Industry Homogeneity

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)
GAP	-0.07			
	0.07			
*GAP**Homogeneity	0.07			
	0.11			
Director-No. 2		0.07*		
		0.04		
*Director-No. 2**Homogeneity		-0.09*		
		0.05		
President-No. 2			0.22***	
			0.04	
*President-No. 2**Homogeneity			-0.23***	
			0.05	
Independent-No. 2				0.15*
				0.08
*Independent-No. 2**Homogeneity				-0.21
				0.13
Homogeneity	-0.29***	-0.23***	-0.19***	-0.18**
	0.05	0.04	0.03	0.08
Fixed Effect	Year	Year	Year	Year
Control Variables	Y	Y	Y	Y
Observations	18,873	18,873	18,873	4,551
Adjusted R^2	0.17	0.18	0.18	0.17

Note. The table shows regressions for the cross-sectional yearly data from 1993 to 2006. The dependent variable is Tobin's *Q*. The independent variables include *GAP*, *Director-No. 2*, *President-No. 2*, *Independent-No. 2,* and their interactions with Homogeneity. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. Homogeneity is a dummy, with 1 if the firm is in a homogeneous industry (Parrino, 1997), 0 if not. Control variables are CEO Pay, Board size, Institutional Holdings, Board Independence, G Index, Classified Board, Firm volatility, Firm size, Firm Size squared, Stock Ret 3yr, R&D, Advertising, Interest, New Finance, Capital Intensity, PPE, CEO WPS, Leverage, Earnings, Treasury Stock, ROA, ROS, Delaware, and Year dummies. All the variables are defined in Appendix A. Panel Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

SARBANES-OXLEY ACT OF 2002

Table 11 Panel A shows that SOX has the most significant effect on *Director-No. 2*. In particular, 51% of the No. 2s were board member before SOX and only 33% after SOX. The constraints on board independence imposed by the Sarbanes-Oxley Act may have unintentionally weakened mutual monitoring: some firms may be forced away from their equilibrium levels of mutual monitoring by a *Director-No. 2*. Therefore, it is not surprising to see in Column 2 of Table 11 Panel B the significantly positive coefficient on the interaction between *Director-No. 2* and SOX dummy, the only significant one among all four measures. Having a No. 2 as a board member is more valuable, though probably harder, in the post-SOX environment.

Table 11
Mutual Monitoring and SOX

Panel A: Means before and after SOX

	Pre-SOX	Post-SOX
GAP	0.42	0.46
Director-No. 2	0.51	0.33
President-No. 2	0.32	0.27
Independent-No.2	0.53	0.58

Panel B: SOX Effect

Dependent Variable: Q_{t+1}

	(1)	(2)	(3)	(4)
GAP	-0.06			
	0.06			
*GAP**SOX	-0.10			
	0.10			
Director-No. 2		0.02		
		0.03		
*Director-No. 2**SOX		0.10**		
		0.05		
President-No. 2			0.06**	
			0.03	
*President-No. 2**SOX			0.02	
			0.05	
Independent-No. 2				0.18**
				0.08
*Independent-No. 2**SOX				-0.11
				0.13
SOX	0.49***	0.44***	0.43***	0.44***
	0.07	0.06	0.05	0.13
Fixed Effect	Year+Firm	Year+Firm	Year+Firm	Year+Firm
Control Variables	Y	Y	Y	Y
Observations	18,875	16,921	18,774	4,551
Adjusted R^2	0.51	0.52	0.51	0.50

Note. The table shows the means of the measures before and after Sarbanes-Oxley Act 2002 and regressions for the cross-sectional yearly data from 1993 to 2006, in Panels A and B respectively. The dependent variable is Tobin's *Q*. The independent variables include *GAP*, *Director-No. 2*, *President-No. 2*, *Independent-No. 2,* and their interactions with SOX. *Director-No. 2* is a dummy, with 1 for No. 2 is a board director, 0 for not. *President-No. 2* is a dummy, with 1 for No. 2 is the president of the

company, 0 for not. *Independent-No. 2* is a dummy, with 1 for No. 2 joined the company before the CEO, 0 for not. SOX is a dummy, with 1 if the firm-year is 2002 or after, 0 for not. Control variables are CEO Pay, Board size, Institutional Holdings, Board Independence, G Index, Classified Board, Firm volatility, Firm size, Firm Size squared, Stock Ret 3yr, R&D, Advertising, Interest, New Finance, Capital Intensity, PPE, CEO WPS, Leverage, Earnings, Treasury Stock, ROA, ROS, Delaware, and Year dummies. All the variables are defined in Appendix A. Panel Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

EMPIRE BUILDING OR THE QUIET LIFE?

While the above results suggest that the monitoring from the No. 2 executive may enhance firm value by mitigating agency problems, they do not indicate which agency problem is being mitigated. Immediate suspects include whether No. 2 executives curb managerial “empire building” (Jensen and Meckling, 1976) or instead prevent CEOs from avoiding “cognitively difficult activities” and enjoying a “quiet life” (Bertrand and Mullainathan, 2003).

It is theoretically plausible that both empire building and the quiet life damage firm value. In reality, however, it is likely to be hard for the

board to judge when the CEO is extracting rents in these ways. In Table 12 following the methodology of Giroud and Mueller (2010), I attempt to distinguish between the "Empire Building" and the "Quiet Life" hypotheses. Panel A shows that the *GAP* is not significantly related to various "empire building" proxies, such as capital expenditures, asset growth, property, plant, and equipment (PPE) growth, the volume of acquisitions, and the likelihood of being an acquirer. One plausible explanation is that the No. 2s are reluctant to monitor such activities because they may benefit from empire building as well. After all, for example, the No. 2 executive is likely to earn more in a larger firm.

Table 12
"Empire Building" or "Quiet Life"

Panel A: Empire Building

Dependent Variable:	Capital Expenditures	Asset Growth	PPE Growth	Acquisition Ratio	Likelihood of Being Acquirer
GAP	-3.99	0.00	-0.08	11.94	-0.02
	(3.43)	(0.01)	(0.08)	(39.20)	(0.02)
Firm&Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	10,073	10,071	9,852	3,585	1,382
Adjusted R^2	0.87	0.40	0.20	0.29	0.41

Panel B: Quiet Life

Dependent Variable:	Selling,General& Admin. Expenses	Advertising Expenses	R&D Expenses	Cost of Goods Sold	Wages
GAP	11.88***	-0.01	1.48	25.76	0.20**
	(4.40)	(0.90)	(2.26)	(18.40)	(0.09)
Firm&Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	11,307	10,073	10,073	13,878	1,980
Adjusted R^2	0.84	0.82	0.76	0.82	0.85

Panel C: Quiet Life and Interaction between *GAP* and Board

Dependent Variable:	Selling, General& Admin. Expenses	Advertising Expenses	R&D Expenses	Cost of Goods Sold	Wages
GAP	-8.54	-3.84**	-1.54	-58.32	0.42**
	(9.18)	(1.73)	(2.79)	(45.02)	(0.18)
*GAP**InsiderBoard	2.72	2.64	1.16	69.34	-0.03
	(10.15)	(1.88)	(3.03)	(48.94)	(0.17)
*GAP**BoardSize	41.69***	1.98	-1.42	121.23***	-0.43**
	(10.21)	(1.86)	(2.99)	(48.90)	(0.18)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6,678	5,848	5,848	8,218	1,126
Adjusted R^2	0.83	0.78	0.78	0.80	0.79

Panel D: CEO Compensation and Interaction between *GAP* and Board

Dependent Variable:	CEO Total Compensation	CEO WPS
GAP	-2.05	-2.55
	(1.26)	(3.40)
*GAP**InsiderBoard	1.56	1.92
	(1.38)	(3.71)
*GAP**BoardSize	3.83***	5.29
	(1.36)	(3.66)
Firm & Year Fixed Effects	Yes	Yes
Observations	5,848	5,848
Adjusted R^2	0.38	0.79

Note. The table shows OLS regressions with firm and year fixed effects for the cross-sectional yearly data from 1993 to 2006. In Panel A, dependent variables include Capital Expenditures, Asset Growth, PPE Growth, Acquisition Ratio, and Likelihood of Being Acquirer. Capital expenditures are normalized by total assets; Asset Growth is the percentage change in total assets from last year; PPE Growth is the percentage change in property, plant, and equipment from last year; Acquisition Ratio is the total value of all acquisitions made by the firm divided by total assets; Likelihood of Being Acquirer is a dummy variable = 1 if the firm makes at least one acquisition in the year and 0 if not. In Panel B and C, dependent variables include Selling, General & Admin. Expenses, Advertising

expenses, Costs of Goods Sold, R&D expenses, and Wages. Selling, General & Admin. Expenses are SG&A expenses normalized by total assets; Advertising expenses are normalized by total assets; Costs of Goods Sold are normalized by sales; R&D expenses are normalized by firm size; Wages are the natural logarithm of labor and related expenses normalized by the number of employees. In Panel D, dependent variables include CEO Total Compensation and CEO WPS. CEO's total compensation is TDC1 from ExecuComp. CEO WPS is Wealth-for-performance sensitivity, defined as the proportion of shares outstanding owned by the executive plus the proportion of shares outstanding in options awarded to the executive times the Black-Scholes hedge ratio. In Panels A B C and D, independent variables are lagged *GAP*, CEO Pay, *Q*, Firm size, and Firm Size squared. In Panel C and D, independent variables also include InsiderBoard, a dummy variable = 1 if there are more than 30% of inside directors and 0 if not, and BoardSize, a dummy variable = 1 if there are 10 or more directors and 0 if not. All the variables are defined in Appendix A. Standard errors are clustered at the firm level, and presented in parenthesis. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

In Panel B, I test the hypothesis by using various proxies for the quiet life as the dependent variable. Consistent with the predictions of the

hypothesis, the *GAP* is positively correlated with overhead costs (selling, general and administrative expenses), R&D expenses, cost of goods sold, and wages. The coefficients on overhead costs and wages are statistically significant, results which are consistent with the quiet life hypothesis. If the second-in-command is not engaged in effective mutual monitoring, perhaps the CEO tends to grant extravagant overhead budgets to organizational units and avoid haggling with input suppliers and labor unions.

In Panel C, I attempt to investigate whether the board governance and the monitoring from the No. 2 executive can supplement each other to mitigate the quiet life problem. The *GAP* is shown in Section 4 to be a substitute for some governance measures, among which board independence and board size are the most significantly related. Therefore I interact the *GAP* with the "insider board" dummy (1 for board with more than 30% of insiders) and the "board size" dummy (1 for board with 10 or more directors). Columns 1 thru 4 have the predicted sign on 7 out of eight coefficients. The only significant coefficients of the eight, however, are on board size interacted with *GAP* in columns 1 and 4. In particular, the results imply that in the presence of a large board, the No. 2 executive may prevent the CEO from some quiet life activities which are otherwise hard to judge and control due to information asymmetry. Panel D shows

that the *GAP* is positively correlated with future CEO pay, but *not* with future Wealth-performance sensitivity. This relation again is more pronounced under weaker boards. It suggests that the CEOs are able to enjoy higher pay and lower risk as a result of a less vigorous mutual monitoring.

ENDOGENEITY

Endogeneity is a concern. However, it is hard to find a story for endogeneity to generate all the results based on all four measures. Furthermore, I carefully deal with endogeneity issue based on econometric remedies and economic theory. Below, for simplicity, I use the *GAP* measure as an example to illustrate my points, although the arguments are also valid for the other three measures.

While the *GAP* may affect performance, so may Tobin's *Q* affect the *GAP*. First note that it is more likely that the *GAP* affects future firm performance, rather than future *Q* affecting the *GAP*. One direct way is to investigate whether the *GAP* is associated with past *Q* or future *Q*. I lag the *GAP* with respect to firm performance, as a Granger Causality test, and document the significant statistical and economic relation between the *GAP* and future *Q*. As shown in Table 3 Panel A, *GAP* is positively linked to past *Q*. The reason is likely that the CEO receives credit for good prior firm performance and thus higher compensation, which leads to a larger

GAP. Note that, supposing that past *Q* and future *Q* are highly correlated, this positive effect works in favor of finding a positive relation between *GAP* and future *Q*. Nonetheless, I find a negative relation.

Second, beyond controlling for observable operational and governance characteristics, I also control for unobservable firm fixed effects and industry fixed effects. Thus, the negative relation between the *GAP* and *Q* arises exclusively from time-series variation within each firm or industry. Firm fixed effects capture firm specific characteristics, such as organizational culture and ethics, which influence the *GAP* and future *Q* simultaneously. Graham, Li, and Qiu (2011) and Coles and Li (2010) show that firm fixed effects are important determinants of managerial incentives, pay level, and performance. The firm fixed effect model removes these unobservable firm characteristics from the error term, ideally making the error term uncorrelated with the *GAP* thereby allowing the regression model to deliver an unbiased estimate. Moreover, year effects, included in all specifications, potentially capture temporal variations in various market forces that affect both the *GAP* and future *Q*.

Third, I control for past firm performance and use first differences model to show that after including past firm information, my measures still have incremental explanatory power to account for future firm performance. As causality is basically a time-series relation, results from

such within-firm analysis also lend credibility to the notion that causality runs from the *GAP* to future *Q*.

Fourth, I use instrumental variable approach to provide reasonable exogenous variation to identify the impact of mutual monitoring on firm performance. I show the instruments are valid based on economic theories and statistical tests.

Other robustness checks (e.g. using industry-adjusted variables, decomposing the *GAP* into a predicted part and an unpredicted part, and controlling for a variety of relevant variables) all generate very similar results. Almost all the control variables in the regressions have the predicted signs, further suggesting that the models I estimate are approximately correctly specified.

FURTHER DISCUSSION

This paper is based upon agency theory, more specifically the mutual monitoring framework. I acknowledge, however, that the four measures of mutual monitoring potentially capture many other economic forces that can affect firm performance through channels other than mutual monitoring. I provide the following discussion to explore such channels and explain why the results are supportive of the mutual monitoring story.

THE "TALENT" STORY

The No. 2 executive needs authority to access information and talent to analyze such information.[20] Therefore, the "talent" component plausibly captured by the four measures also reflects monitoring capability. The No. 2's talent, however, could affect the firm through channels other than mutual monitoring, for example, through a direct channel by his own decision making or an indirect channel by providing advice to the CEO. Although talent and monitoring capacity are not mutually exclusive, my four measures seem to be better and more direct proxies for mutual monitoring:

First, the "pay gap" literature always uses pay dispersion as a proxy for "CEO power" and no paper uses pay gap as a talent measure (e.g., Bebchuk et al., 2011). Second, board membership is a more direct measure of monitoring role, the most basic judicial function, than talent (Fama, 1980). Third, the presence of separate CEO and president positions is a more fundamental measure of organizational structure than talent (Levinson, 1993). Fourth, the theoretical and empirical literature on "co-option" is clearly consistent with the mutual monitoring story, but no theory supports the talent story (Coles et al., 2010).

[20] A recent survey found employees with higher education and higher position were more privy to misconduct and were more likely to blow the whistle. (Wall Street Journal, 2011)

Furthermore, all of the results from the four measures and their interactions with corporate governance, CEO incentive, mutual monitoring incentives, and info asymmetry are consistent with mutual monitoring, but not the notion that talent is the driver. For example, for the result that mutual monitoring substitutes for board governance, it's plausible that a weak board would use a monitoring No. 2 to substitute away from board monitoring, but it is hard to explain why a weak board would install a talented No. 2.

THE "HEIR-APPARENT" STORY

If the four measures capture the presence of the No. 2 as the heir apparent, then such succession planning could affect corporate policy and performance. Note, however, that an heir apparent exists only in a small portion of firms, while mutual monitoring is more prevalent. Only 60% of firms use insider succession, among which some use tournament succession, and some don't appear to use any succession planning. Thus, the heir apparent story has limitation of applicability, being relevant in a small set of companies, while mutual monitoring appears to be in place in most companies.

Moreover, the four measures generally are more incisive proxies for monitoring: few papers use pay gap as a measure of the presence of an heir apparent; board membership is a more direct measure of the No. 2's

monitoring role than succession; the position of president being only one small step from the CEO creates motivation for mutual monitoring (Levinson, 1993); and the *independent-No. 2* measure is based on co-option theory and empirical work (Coles et al., 2010).[21] In addition, all of the results from the 4 measures and their interactions with corporate governance, CEO incentive, mutual monitoring incentives, and information asymmetry are in concert with the mutual monitoring hypotheses, but not succession-planning hypotheses.

CONCLUSION

The No. 2 executive is likely to be an important member of the managerial team. Such importance arises in the normal ways associated with effective management, but also insofar as the second-in-command serves as a monitor of the CEO and other team members. I develop measures of the presence and likely effectiveness of mutual monitoring by a No. 2 executive and assess the extent to which those measures are associated with firm performance, incentives of mutual monitoring,

[21] Some literature uses the president title as a proxy for heir apparent. Based on the fact that heir apparent is usually hired after the current CEO, the "hire-before-CEO" dummy should generate the opposite results to those from the "president" dummy. However, these two measures provide consistent results in this paper, which suggests that in the setting of this research mutual monitoring is a more important economic force to drive all the results.

resources diverted to empire building or the “quiet life”, and various aspects of firm governance.

I find that measures mutual monitoring from the second-in-command are positively related to firm value, as measured by forward Tobin’s *Q*. Furthermore, the relation is stronger the weaker is corporate governance otherwise, as measured by board size, institutional ownership, board independence, and takeover protections in place. Similarly the relation is stronger when CEO incentive alignment, delta, is low. The effectiveness of mutual monitoring also depends on the incentives for the No. 2 executive to monitor the CEO, as proxied by age difference and CEO duality. In addition, mutual monitoring seems more important for firms with high information asymmetry between the board and the CEO. In terms of the channel connecting mutual monitoring to firm value, mutual monitoring appears to deter investment policy that allows the CEO to pursue the quiet life, but has little effect on empire building.

Future research on mutual monitoring might be directed to developing less noisy, more incisive measures of mutual monitoring system, incentive, and environment. Theorists and empiricists might address how to construct an effective mutual monitoring system and provide appropriate incentives to the No. 2 executive. What

characteristics make the No. 2 executive an effective monitor? How do specific monitoring activities regulate the CEO and thereby affect firm performance? Can mutual monitoring prevent corporate fraud? In underperforming firms, can mutual monitoring facilitate more effective strategic change and CEO turnover?

REFERENCES

Acharya, V., Myers, S., and Rajan, R. (2011). The internal governance of firms. *Journal of Finance*, 66: 689-720.

Aggarwal, R., and A. Samwick. (1999). The other side of the trade-off: The impact of risk on executive compensation. *Journal of Political Economy* 107: 65-105.

Alchian, A., and Demsetz, H. (1972). Production, information costs, and economic organization. *American Economic Review*, 62: 777-795.

Baker, G., M. Jensen, and K. Murphy, (1988). Compensation and incentives: Practice vs. theory. *Journal of Finance*, 43 (3), 593-616.

Bebchuk, L. and J. Fried. (2004). *Pay without performance: The unfulfilled promise of executive compensation*. Cambridge: Harvard University Press.

Bebchuk, L., J. Fried, and D. Walker. (2002). *Managerial power and rent extraction in the design of executive compensation*. University of Chicago Law Review 69: 751- 846.

Bebchuk, L., M. Cremers, and U. Peyer. (2011). The CEO pay slice. *Journal of Financial Economics* 102, 199-221.

Bertrand, M. and S. Mullainathan. (1999). Is there discretion in wage setting? A test using takeover legislation. *Rand Journal of Economics* 30: 535-554.

Bertrand, M., S. Mullainathan. (2003). Enjoying the quiet life? Corporate governance and managerial preferences. *Journal of Political Economy* 111, 1043-1075.

Bertrand, M. and A. Schoar, (2003), Managing with Style: the Effect of Managers on Firm Policies, *Quarterly Journal of Economics*, 118-4, 1169-1208.

Black, F., and M. Scholes. (1973). The pricing of options and corporate liabilities. *Journal of Political Economy* 81: 637-654.

Bizjak, J., Brickley, J., Coles, J., (1993). Stock-based incentive compensation and investment behavior. *Journal of Accounting and Economics* 16, 349–372.

Coles, J., Daniel, N., Naveen, L., (2010). Co-opted Boards, Arizona State University working paper.

Coles, J., Lemmon, M., Meschke, J., (2011). Structural models and endogeneity in corporate finance: the link between managerial ownership and corporate performance. Forthcoming, *Journal of Financial Economics*.

Coles, J., M. Lemmon, and Y. Wang, (2011). The joint determinants of managerial ownership, board independence and firm performance, Arizona State University working paper.

Coles, J., and Li, Z., (2010). Managerial attributes, incentives, and performance. Arizona State University working paper.

Core, J. and W.Guay. (1999). The use of equity grants to manage optimal equity incentive levels. *Journal of Accounting and Economics* 28:151-184.

Core, J. and W. Guay. (2001). Stock option plans for non-executive employees. *Journal of Financial Economics* 61, 253-287.

Demstez, H. and Lehn, K., 1985. The structure of corporate ownership: causes and consequences. *Journal of Political Economy* 93: 1155–1177.

DiMaggio, P., and W. Powell. (1983). The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *American Sociological Review* 48:147-160.

Dittmar, A. and J. Mahrt-Smith. (2007). Corporate governance and the value of cash holdings. *Journal of Financial Economics* 83:599-634.

Drago, R., and G. T. Garvey, (1998), Incentives for helping on the job: Theory and evidence*, Journal of Labor Economics* 16, 1-25.

Dyck, A., A. Morse, and L. Zingales, (2010), Who blows the whistle on corporate fraud? *Journal of Finance* 65, 2213–2253.

Fama, E. (1980). Agency problems and the theory of the firm. *Journal of Political Economy*, 88: 288-307.

Fama, E., and Jensen, M. (1983). Separation of ownership and control. *Journal of Law and Economics*, 26: 301-325.

Faleye, O., (2007). Classified boards, firm value, and managerial entrenchment. *Journal of Financial Economics* 83: 501-529.

Finkelstein S., (1992). Power in top management teams: dimensions, measurement, and validation. *Academy of Management Journal* 35: 505-538.

Frydman, C., and R. Saks. (2010). Executive compensation: A new view from a long-run perspective. *Review of Financial Studies* 23 (5): 2099-2138

Giroud, X., and H.M. Mueller. (2010). Does corporate governance matter in competitive industries? *Journal of Financial Economics* 95: 312-331.

Gompers, P., J. Ishill, and A. Metrick. (2003). Corporate governance and equity prices. *The Quarterly Journal of Economics*, MIT Press, vol. 118(1), pages 107-15.

Granovetter, M. (1985). Economic action and social structure: The Problem of embeddedness. *American Journal of Sociology* 91, 481-510.

Greene, W. H. (2000). *Econometric analysis* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Grossman, S., and O. Hart, (1983), An analysis of the principal-agent problem, *Econometrica,* 51, no 1, 7-45.

Graham, J., Li, S., and Qiu, J., (2011). Managerial attributes and executive compensation. *Review of Financial Studies*, Forthcoming.

Hambrick, D. C., and Mason, P. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9: 193-206.

Heckathorn, D., (1988). Collective sanctions and the creation of prisoner's dilemma norms. *American Journal of Sociology*, 94, 535-562.

Hermalin, B., and N. Wallace. (2001). Firm performance and executive compensation in the savings and loan industry. *Journal of Financial Economics*: 61:139-170.

Hermalin, B., and M. Weisbach, (2003). Boards of directors as an endogenously determined institution: A survey of the economic literature. *Economic Policy Review* 9, 7–26.

Hochberg, Y., and L. Lindsey, (2010), Incentives, targeting, and firm performance: An analysis of non-executive stock options, *Review of Financial Studies* 23, 4148-4186

Holmstrom, B., (1979), Moral hazard and observability, *Bell Journal of Economics* 10(1), 74-91.

Inderst, R., Mueller, H.M. (2009). CEO replacement under Private Information. *Review of Financial Studies*, 93: 276-291.

Isaac, R. M., and Walker, J. M. (1988). Group size effects in public goods provision: The voluntary contributions mechanism. *Quarterly Journal of Economics*, 103: 179-199.

Jensen, M., (1993). The Modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance* 48: 831-880.

Jensen, M., and Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics*, 3: 305-360.

Jensen, M., and K. Murphy. (1990). Performance pay and top management incentives. *Journal of Political Economics* 98: 225-264.

Jiang, J., Petroni, K., Wang, I., (2010). CFOs and CEOs: Who has the most influence on earnings management? *Journal of Financial Economics* 96 (3), 513–526.

John, K., D. Kadyrzhanova, (2008). Peer effects in corporate governance, Working Paper. New York University.

Kale, J., E. Reis, and A. Venkateswaran, (2009), Rank-order tournaments and incentive alignment: The effect on firm performance, *Journal of Finance* 64, 1479-1512.

Kandel, E., and E. Lazear, (1992). Peer pressure in partnerships. *Journal of Political Economy*, 100, 801-817.

Kennedy, P. (2003). *A guide to econometrics* (5th ed.). Oxford, UK: Blackwell.

Kini, O., and R. Williams, (2012). *Tournament incentives, firm risk, and corporate policies*, 103, 350-376.

Kubo, K., and T. Saito, (2007). The Japanese honors system and incentives for presidents, Waseda University, Working paper.

Landier, A., D. Sraer, and D. Thesmar, (2009), Optimal dissent in organizations, *Review of Economic Studies* 76, 761–794.

Lazear, E., and S. Rosen. (1981). Rank-order tournaments as optimum labor contracts. *Journal of Political Economy*, 89(5): 841–64.

Marcel, J. J., (2009). Why top management team characteristics matter when employing a chief operating officer: a strategic contingency perspective. *Strategic Management Journal* 30 (6): 647-658.

Matthews, C., (2011). Would-be whistleblowers unaware of SEC bounty program, survey says. The Wall Street Journal. Available online at http://blogs.wsj.com/corruption-currents/2011/12/13/would-be-whistleblowers-unaware-of-sec-bounty-program-survey-says

McConnell J., and H. Servaes. (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial Economics* 27: 595-618.

Merton, R. (1973). Theory of rational option pricing. *Bell Journal of Economics and Management Science* 4: 141-183.

Murphy, K.J. (1999). *Executive compensation, Handbook of Labor Economics*, in: O. Ashenfelter & D. Card (ed.), Handbook of Labor Economics, edition 1, volume 3, chapter 38, pages 2485-2563 Elsevier.

Palia, D. (2001). The endogeneity of managerial compensation in firm valuation: A solution. *The Review of Financial Studies* 14: 735-764.

Parrino, R. (1997). CEO turnover and outside succession: A cross-sectional analysis, *Journal of Financial Economics*, 46, 165-197.

Pfeffer, J. (1981). *Power in organizations*, Pitman Publishing, London.

Roberts, M. R. and T. M. Whited. (2011). Endogeneity in empirical corporate finance. Working paper. University of Pennsylvania.

Rothschild, J. and Miethe, T. (1999). *Disclosing misconduct in work organizations: An empirical analysis of the situational factors that foster whistleblowing*. In I. Harper & R.L. Simpson (Eds.), Research in the Sociology of Work Vol 8, Ohio: JAI Press.

Tirole, J. (1999). Incomplete contracts: Where Do We Stand? *Econometrica* 67: 741–781.

Worrel D., Demec C., Davidson W. (1997). One hat too many: key executive plurality and shareholder wealth. *Strategic Management Journal* 18(6): 499-507.

Zhou, X., (2001). Understanding the determinants of managerial ownership and its relationship to firm performance. *Journal of Financial Economics* 62: 559-571.

APPENDIX A

VARIABLE DEFINITIONS

Variable	Definition
Executive Characteristics:	
Director-No. 2	A dummy variable = 1 if No. 2 is a director in the firm and 0 if not.
President-No. 2	A dummy variable = 1 if No. 2 is a president and 0 if not.
Independent-No. 2	A dummy variable = 1 if No. 2 joined the company before the CEO and 0 if not.
Female	A dummy variable = 1 for female and 0 for male.
Tenure	The number of years since the executive joined the company.
WPS (Delta)	Wealth-for-performance sensitivity, defined as the proportion of shares outstanding owned by the executive plus the proportion of shares outstanding in options awarded to the executive times the Black-Scholes hedge ratio. Refer to Appendix 2 for detailed calculation.
WPS Gap	The gap of WPS between CEO and No. 2, calculated as (CEO's WPS-No. 2's WPS)/CEO's WPS.
Age Difference	CEO's age – No. 2's age.
CEO Pay	CEO's total compensation, TDC1 from ExecuComp, including salary, bonus, grants of restricted stock, grants of stock options, long-term incentive plan payouts, gross-ups for tax liabilities, perquisites, preferential discounts on stock purchases, contributions to benefit plans, severance payments, and all other compensation.
Board Structure:	
Board size	The number of directors in the board.
Classified Board	A dummy variable = 1 if the directors in the board are elected to staggered terms instead of annual term and 0 if not.
Board Independence	The number of independent outside directors divided by board size.
Institutional Holdings	Percentage of company's outstanding common shares held by institutions.

G-Index	The number of anti-takeover-provision (ATP) measures in a firm's charter and in the legal code of the state where the firm is incorporated (Gompers, Ishii, and Metrick, 2003).
Firm characteristics:	
Q	The ratio of the sum of market value of equity and the book value of debt to total assets.
Treasury stock	The dollar treasury stock scaled by total assets.
Firm volatility	CDF of standard deviation of monthly stock returns in the past three years. Refer to Appendix 3 for detailed calculation.
R&D	Research and development expenses divided by total assets.
Advertising	Advertising expenses divided by total assets.
Leverage	Book leverage: Interest-bearing debt divided by total assets.
Firm size	The natural logarithm of Net Asset where Net Asset is total asset less cash and short-term investments.
Capital Intensity	Capital stock divided by total assets.
ROA	Return on assets: Net income before extraordinary items and discontinued operations divided by total assets.
Stock Ret 3yr	3 year return to shareholders with dividend reinvested.
ROS	Return on sales: Operating income before depreciation divided by sales.
Earnings	Earnings before extraordinary divided by total assets.
Interest	Interest expense divided by total assets.
Dividend	Common dividends divided by total assets.
New Finance	Net New Equity Issues + Net New Debt Issues.
PPE	Property, plant, and equipment divided by total assets.
Delaware	A dummy variable = 1 if the firm is incorporated in the state of Delaware and 0 if not.
Capital	Capital expenditures divided by total assets.

Expenditures	
Asset Growth	The percentage change in total assets from last year.
PPE Growth	The percentage change in property, plant, and equipment from last year.
Acquisition Ratio	The total value of all acquisitions divided by total assets.
Likelihood of Being Acquirer	A dummy variable = 1 if the firm makes at least one acquisition in the year, and 0 if not.
Selling, General & Admin. Expenses	SG&A expenses divided by total assets.
Costs of Goods	Cost of goods sold divided by sales.
Wages	The natural logarithm of labor and related expenses divided by the number of employees.

APPENDIX B

CALCULATION OF WEALTH-PERFORMANCE SENSITIVITY (WPS)

Jensen and Murphy (1990) developed this incentive measure which is analogous to the executive's percentage ownership. WPS is provided primarily through executive stock and option holdings. The WPS of stock is simply the fraction of the firm's stock that the executive owns. For options, I multiply the fraction of the firm's stock on which the options are written by the deltas of the options. Option delta or called hedge ratio, defined as the sensitivity of option value to stock price, is the partial derivative of Black-Scholes call option value with respect to the share price. In this context, it can be thought of as a weight between 0 and 1 indicating the likelihood that the option will end up in the money. I use Black-Scholes (1973) model as modified by Merton (1973) to account for dividend payouts to evaluate executive stock options. On average, the delta is 0.75 for a new grant of long term stock option. It means that the option value increases by $0.75 if stock price goes up by $1. The total WPS is the sum of stock WPS and option WPS: $1000 * (# shares held + # stock options held*option delta)/common shares outstanding. The $1000 is a scaling factor.

Similar to past research, I find the CEOs' WPS is about $39 per thousand dollar increase in shareholder wealth. No. 2s' WPS ($11.55 per thousand) is less than one third of the CEOs'.

APPENDIX C

CDF

Stock return variance is the relative risk measure within a firm that needs to be standardized to CDF. CDF provide useful information about the risk level of a firm relative to other firms. I follow this method (see Aggarwal and Samwick, 1999) except that I use standard deviation to generate CDF. Although all CDFs of stock return standard deviations for each firm-year are generated through computer programming. I'd like to use a simple example to demonstrate the algorithm of the method.

ExecuComp provides stock return standard deviation for prior 60 months, denoted BS_VOLATILITY. Suppose I have 3 firms and 2 years with volatility as follows.

	Firm 1	Firm 2	Firm 3
Year 1	0.2	0.3	0.5
Year 2	0.3	0.4	0.5

According to the definition of CDF, the minimum and maximum of CDF are zero and one for the lowest and highest volatility respectively. First I rank all volatilities in ascending order (with ranks from 0 to 5 in this case). Second, I count how many firm-year observations totally (6 in this case). Then CDF = rank / (count-1). For example:

For firm 1 in year 1, CDF_{11} = Prob(volatility < 0.2) = 0

CDF_{12} = CDF_{21} = Prob(volatility <= 0.3) = 0.4

CDF_{22} = Prob(volatility <= 0.4) = 0.6

CDF_{31} = CDF_{32} = Prob(volatility <= 0.5) = 1