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A Study on the Effect of the Mandated Change In Board Composition on Firm Performance & Ceo Compensation

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A STUDY ON THE EFFECT OF THE MANDATED CHANGE IN BOARD COMPOSITION ON FIRM PERFORMANCE & CEO COMPENSATION

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DEDICATION

I dedicate this dissertation to my family whose strength and support were needed throughout this journey. This dissertation is also dedicated to my late grandfather who wanted me to become a doctor: Grandpa, I could not become the kind of doctor that you wanted me to be, but I will have a "Dr." before my name. This journey would not have been possible without the support of my beloved wife, Pragati, who never lost faith in me. This document would not have been possible without the luck of my two daughters: Jiera & Thisha.

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ABSTRACT

In this dissertation, I examine the long-run effect of the 2003 mandated change in board composition on firm performance and CEO compensation. In the first essay, I examine the impact of changes in firm performance to shed light on the debate between agency and insider-knowledge theorists. Agency theorists argue that installing an independent board would increase monitoring of management, thereby enhancing firm performance. In contrast, the insider-knowledge hypothesis suggests that an independent board lacks valuable insider information for effective advisory functions and, hence, is detrimental to firm performance. In the second essay, I investigate the effect of the mandate on CEO compensation to shed light on the debate between two agency viewpoints: the managerial power view and the complementarity view. The former suggests that total CEO compensation will decrease to better align CEOs' interests with those of shareholders. The latter argues that total CEO compensation will increase following the mandate to compensate executives for bearing firm-specific risks inherent in performance-based incentive packages. Using a difference-in-difference approach, I find a positive relationship between board independence and firm performance in the first essay, consistent with agency theory. I also find a positive relationship between board independence and CEO compensation in the second essay, along with an increase in pay-for-performance sensitivity, consistent with the complementarity view.

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CHAPTER I

INTRODUCTION

During the first year of the twenty-first century, the corporate world faced a crisis due to financial reporting scandals at publicly traded firms such as Enron and WorldCom. This crisis differed from crises in the later part of the previous century in that it affected Main Street along with Wall Street, and did so in a way that substantially decreased confidence in the financial markets. This prompted Congress to pass the Sarbanes-Oxley Act (SOX) in July 2002. With regard to the board of directors, this act requires all publicly traded corporations to have independent audit committees. This act also held board chairmen liable for certain managerial fraudulent actions and requires the forfeiture of bonuses awarded to managers in case of financial restatements.

During the legislative discussions surrounding SOX, on February 13, 2002, the Security and Exchange Commission (SEC) asked the New York Stock Exchange (NYSE) and the National Association of Securities Dealers (NASDAQ) to review their corporate governance requirements for firms listed on their respective exchanges (Chhaochharia & Grinstein, 2007). New corporate governance requirements were announced in October 2002. Following revisions and comments, the SEC approved the proposal made by these exchanges on November 4, 2003. One of the major requirements of the new regulations

was that all firms must have an outsider-controlled board (one with a majority of independent directors). This dissertation examines the long-run effect of this particular requirement on firm performance and CEO compensation for firms that had to change board composition (non-compliant firms). The following introduction starts with a short history of the composition of boards of directors, explains the mandate, justifies the use of boards, explains the endogeneity concerns, describes the research methods used, clarifies the study limitations, and summarizes the two essays.

History of Board Composition

As noted by legal scholar Gordon (2006), through the 1960s, most publicly traded firms had boards controlled by insiders—directors who were either officers of the firm or had affiliated business relationships with the firm. Since the collapse of Penn Central in 1976, the number of independent directors serving on boards has been on the rise. During the takeover decade of the 1980s, outside directors were seen as saviors of management from hostile takeover bids. In the 1990s, the shareholder value maximization principle allowed activist investors to demand a greater majority of outside directors. Finally, in the early decade of the new millennium, the accounting scandals at Enron, WorldCom, and other companies prompted the national stock exchanges (AMEX, NYSE, and NASDAQ) to require all firms to have outsider-control boards—boards with a majority of independent directors.

Exchange Mandate of 2003

The huge scandals of large, highly reputable firms, in particular Enron, during the early 2000s caused enormous outrage among the public, investors, and even politicians. In response to this uproar, Congress passed the Sarbanes-Oxley Act (SOX) in July 2002.

Among other things, the act requires companies to have an independent audit committee with at least one member certified as a "financial expert." It also makes the chairman of the board liable for fraudulent actions of management and requires management's forfeiture of bonuses upon financial restatements. It is important to note that SOX does not require a company to have an independent board.

While SOX was being discussed in Congress, the SEC asked NYSE (and its subsidiary AMEX) and NASDAQ to review the corporate governance requirements for publicly traded firms on their respective exchanges. Chhaochharia and Grinstein (2007) and Wintoki (2007) provide a brief timeline of both the passage of SOX and exchange listings' trading regulations. The new exchange requirements, announced in 2002 and approved in November 2003, require companies to have a majority of independent directors on the board. The definition used to identify an "independent director' was also made more stringent (see Pandya & Bathala (2013) for full criteria regarding the independence requirement). For instance, all three exchanges require previous employees to have a 3-year cool-off period before being declared an independent member. In addition, independent directors' compensation from non-board-related activities is limited.

Impact of Board of Directors

The directors of the board are important members of any organization. They determine the direction of the firm and provide oversight of the executive team. Using the analogy of the US government structure, if one compares the CEO and his team to the president and the executive branch, then the board of directors can be compared to the legislative branch. Just as the president has to go to Congress before making major policy

changes, so the CEO has to get approval regarding any major new projects. Similar to the congressional approval needed by the president if changes are to be made to the Constitution, the board also has to approve any changes the CEO wants to make to the corporate charter. The board of directors must also approve any increase or decrease in CEO compensation. Moreover, if the changes are not unanimous (or at least approved by a large majority of board members), stakeholders might perceive the CEO and board members as not agreeing. The consequences of this perception may be serious among shareholders.

Another responsibility of the board is to monitor the CEO and their team and ensure that they work to the benefit of the shareholders and not of themselves. Conventional wisdom suggests that directors who also work for the firm (insiders) and directors whose remuneration is determined by the CEO, such as those of legal counsel or bank executives (affiliated), will side with top management on most decisions and be sympathetic to the CEO most of the time.

From an agency perspective, Jensen and Meckling (1976) argue that since management does not own the majority of shares in a company, they are likely to consume perks at a cost to the firm. To align the interests of management with those of shareholders, the board of directors must include members who are not affiliated with the firm or management (outsiders or independent). Fama (1980) explains that outside directors have to worry about their reputation in the labor market for directors. An outside director who is sympathetic to management might not only not be reelected by shareholders to the current firm but might also not receive many requests to join the boards of other firms. Specifically, the supporters of the mandate argue that market forces

alone cannot control management behavior. Regulations are needed to ensure that outsiders are seated on the board who will effectively monitor management.

Shareholders of companies that maintained insider-controlled boards must have had some reasons for doing so. The primary reason is that insiders and affiliated directors bring firm-specific or area-specific knowledge that a CEO needs to make decisions. The opponents of this mandate argue that the new regulation would unnecessarily burden firms and increase the costs associated with the mandate. Firms previously resisted the change to boards composed of a majority of outsiders because it was optimal for them to have done so.

Endogeneity

Endogeneity in board studies is a common issue. Hermalin and Weisbach (2003) explain that, in most cases, the board is endogenously chosen. For instance, Hermalin and Weisbach (1988) showed that board independence increases after poor performance. It is highly possible that board independence was not the only change that occurred, and many other changes (such as CEO replacement, reductions in workforce, and spin-off of a section of the firm) occurred simultaneously. This leads to an endogeneity problem in determining the effectiveness of board composition. It is quite difficult to distinguish between the effects of board independence alone and the effects of these other changes. Adams, Hermalin, and Weisbach (2010) posit that the best way to avoid this pitfall is to look for "natural experiments" such as the passage of new laws and regulations.

Roberts and Whited (2013) claim that the difference-in-difference (DD) estimator provides an unbiased and consistent estimation for a natural experiment. Thus, in this study, I use DD estimation to avoid endogeneity concerns.

$$AF_t = \beta_1 Insider\ Controlled\ Board\ Dummy_{2000} + \beta_2 Post\ Regulation + \beta_3 Insider\ Dummy \times Regulation + \beta_i X_{i,t} + \varepsilon_t \quad (1)$$

In the above equation, *AF* is the affected factor, the dependent variable that measures either firm performance or CEO compensation in a given year, as discussed in Chapters II and III, respectively. If a firm has a majority of insiders on the board at the end of fiscal year 2000 (non-compliant firms), the first independent variable is equal to 1; otherwise, it is 0 (compliant firms—those firms that do not have to change the board structure). Similarly, for the years following 2001, the year when the mandate that required a publicly traded company to have a majority of independent board members started gaining momentum, *Post Regulation* will equal 1; otherwise, it is 0. *X* denotes the control variables and the fixed effects used in the equation.

The difference-in-difference (DD) estimator, β_3, is the interaction term between the board dummy and regulation dummy. The DD estimator captures the long-run variation experienced by firms whose boards had to restructure to follow the new rules compared to a scenario in which there was no mandate by estimating the average differential in firm performance or CEO compensation for non-compliant firms following the mandate relative to the average differential for compliant firms. If the regulations had no effect on the affected variable, then the difference would be expected to be insignificant.[1] However, if the difference is significantly positive, that would indicate that the new rules increased relative firm performance and relative total CEO compensation. On the other hand, if the difference is significantly negative, then relative firm performance and relative total CEO compensation decreased in the long run.

[1] The so-called window-dressing view as proposed by Romano (2005).

Limitations

This study has three limitations. Since SOX and board independence mandates were announced around the same time, it is difficult to separate their individual effects. It can be argued that in the absence of the board independence mandate, firms would have switched to independent boards as a result of SOX regulations. Legally speaking, however, a company can have an 11-member board with only 3 financially competent independent directors (only 1 of whom could be a "financial expert"). Since three board members are a standard audit committee, these three could be the only independent members while still complying with the rules of SOX. Even so, as shown by Guo, Mobbs, and Lach (2015), firms that had a low compliance rate for SOX also had a low compliance rate for the mandate. Nonetheless, the only way to separate out the SOX effect would be to look at the composition of committees affected by SOX for each firm, which is not possible at this time given the data available.

In this study, all directors were grouped into two categories: insiders or outsiders. This is consistent with previous studies focusing on the impact of board independence as well as group dynamic studies, indicating that individuals vote with their groups. One can argue, however, that individual directors may make decisions and vote against the group under certain circumstances (see Hermalin & Weisbach (2003) and Adams et al. (2010) for examples). Thus, the impact of board independence mandates may be understated or overstated. Again, given the data available, it was not possible to separate these groups.

As with any long-term study, there is always concern that survivorship bias may exemplify the impact of board independence, as companies that survive during the data period may not be representative of the population. To eliminate this bias, I use the

Heckman 2-step procedure, and the results are qualitatively similar to those presented in the next two chapters. They are available upon request. Even after using this procedure, it is not possible to completely eliminate survivorship bias.

Two Essays

The first essay examines the effect of the passage of an exchange-listed mandate requiring a majority of independent directors on the company's board on long-term firm performance. Agency theorists argue that a strong monitoring mechanism is needed to provide the necessary oversight of executives, who tend to be opportunistic and self-serving (Bebchuk & Fried, 2005). They contend that installing an independent board will increase management monitoring and thereby enhance firm performance. Insider-knowledge theorists do not dispute that the agency problem needs to be addressed, but they believe an insider-control board, with its focus on advising, is better suited to take advantage of firm-specific knowledge. Harris and Raviv (2008) claim that an independent board lacks valuable insider information, which prevents effective advising and, hence, is detrimental to firm performance.

I hypothesize that the direction of firm performance depends on the firm's monitoring and advisory needs. Board composition is a function of balancing the advisory and monitoring roles of the board. However, the increase in the monitoring role, resulting from board control by the majority of independent directors, comes at the cost of the board's advisory role. If the firm needs the monitoring function of the board more than the advisory function, forcing the adoption of an outsider-control board creates value. Conversely, if the firm needs the advisory function of the board more than the

monitoring function, then increasing the monitoring function of the board would be detrimental to firm performance.

Using a difference-in-difference approach, I find a positive relationship between board independence and firm performance, consistent with agency theory. I also conduct subsample analyses to corroborate these findings, finding that the positive impact of the mandate was concentrated in utility and small firms. On the other hand, research-oriented firms suffered from a change in their board composition when they complied with this mandate.

In the second essay, I investigate the effect of the 2003 mandated change in board composition on CEO compensation. Agency theory argues that outside directors will implement greater pay-for-performance sensitivity of CEOs' compensation packages to align CEOs' interests with those of shareholders (Jensen & Murphy, 2010). Consistent with this hypothesis, I find that pay-for-performance sensitivity increased following the mandate. However, it is possible to argue that, as a result of employing greater pay-for-performance sensitivity, total CEO compensation either increases or decreases in the long run.

Under the managerial power view, CEOs have too much influence over inside board members, and as a consequence have too much influence over their own compensation packages (Berger, Ofek, & Yermack, 1997). Proponents of the mandate argue that CEOs are able to extract rent from their firms, allowing management to secure generous monetary gains even when their company's performance is deficient (Bebchuk & Fried, 2005). As a result, the mandate leads to a reduction in total CEO compensation.

Under the complementarity view, as described by Fahlenbrach (2009), governance mechanisms and pay-for-performance contracts complement one another. Opponents of the mandate believe that the current level of CEO compensation is at an equilibrium point in the market for talented CEOs. Due to the increased incentives, CEOs lose the ability to invest their income elsewhere in the market and diversify their investments. As a result of bearing additional firm-specific risks, it is thus necessary to increase the total compensation for CEOs.

Using the difference-in-difference methodology, I find that total CEO compensation increased for firms that were not compliant, indicating that independent boards had to pay more. Additional results from exploring the compensation components responsible for the increase align with the complementarity view, indicating that while firms increased total compensation, that change was through equity compensation and not through cash compensation awarded to CEOs.

Summary

Following the scandals of the early 21st century, regulators decided that much stronger corporate governance was needed to protect shareholders from CEOs and their management. As a result, AMEX, NASDAQ, and NYSE require publicly traded firms to change board composition from insider-control to outsider-control (one with a majority of independent directors). This dissertation examines the long-run effect of this mandate on non-compliant firms via changes in firm performance and CEO compensation.

The results indicate a differential impact on the performance and CEO compensation of insider-control firms following the mandate. The majority of the test results of the first essay are consistent with agency theory. Firms forced to change their

board composition experienced a long-run increase in firm performance. In the second essay, which is also consistent with agency theory, I find that pay-for-performance sensitivity increased. However, despite agency theorists' efforts to reduce CEO compensation, the exchange mandate resulted in an increase in total CEO compensation. This suggests that new independent boards felt that an increase in total CEO compensation was worth the cost to produce increases in long-run firm performance.

The contributions to the literature are as follows: First, this is the first study to compare the long-run effects on traditionally insider-control boards after the mandate was passed by NYSE, NASDAQ, and AMEX. Second, comparing the short-run results of Chhaochharia and Grinstein (2007, 2009) with the long-term results found here should allow the determination of investors' immediate reactions as well as long-run observations. Finally, the results and conclusions of this research should shed light on the long-standing debate regarding the effects of having independent boards or insider boards, suggesting policy implications.

REFERENCES

Adams, R. B., Hermalin, B. E., and Weisbach, M. S. (2010). The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey. *Journal of Economic Literature*, *48*(1), 58-107.

Bebchuk, L. A., & Fried, J. M. (2005). Pay without performance: Overview of the issues. *Journal of applied corporate finance*, *17*(4), 8-23.

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The journal of finance*, *52*(4), 1411-1438.

Chhaochharia, V., and Grinstein, Y. (2007). Corporate governance and firm value: The impact of the 2002 governance rules. *The Journal of Finance, 62*(4), 1789-1825.

Chhaochharia, V., & Grinstein, Y. (2009). CEO compensation and board structure. *The Journal of Finance*, *64*(1), 231-261.

Fama, E. F. (1980). Agency Problems and the Theory of the Firm. *The Journal of Political Economy 88*(2), 288-307.

Gordon, J. N. (2006). The rise of independent directors in the United States, 1950-2005: Of shareholder value and stock market prices. *Stan. L. Rev.*, *59*, 1465.

Guo, L., Lach, P., and Mobbs, S. (2015). Tradeoffs between internal and external governance: Evidence from exogenous regulatory Shocks. *Financial Management, 44*(1), 81-114.

Harris, M., and Raviv, A. (2008). A theory of board control and size. *Review of Financial Studies*, *21*(4), 1797-1832.

Hermalin, B. E., & Weisbach, M. S. (1988). The determinants of board composition. *The RAND Journal of Economics*, 589-606.

Hermalin, B. E., and Weisbach, M. S., (2003). Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature. *Federal Reserve Bank of New York Economic Policy Review, 9*(1), 7–26.

Jensen, M. C., and Meckling, W. H. (1976). Agency Costs and the Theory of the Firm. *Journal of Financial Economics*, *3*(4), 305-360.

Jensen, M. C., and Murphy, K. J. (2010). CEO incentives—It's not how much you pay, but how. *Journal of Applied Corporate Finance*, *22*(1), 64-76.

Mace, M. L. (1971). *Directors: Myth and Reality*. Boston, MA: Harvard Business School Press.

Pandya, D. D. and Bathala, C. T. (2013). Board of Directors and Listing Requirements: Operating Performance of the Traditionally Insider Controlled Boards. *Journal of Applied Financial Research, 1*, 88-102.

Roberts, M. R., & Whited, T. M. (2013). Endogeneity in empirical corporate finance1. In *Handbook of the Economics of Finance* (Vol. 2, pp. 493-572). Elsevier.

Wintoki, M. B. (2007). Corporate boards and regulation: The effect of the Sarbanes–Oxley Act and the exchange listing requirements on firm value. *Journal of Corporate Finance*, *13*(2), 229-250.

CHAPTER II

ESSAY 1: INSIDER KNOWELDGE VS OUTSIDER OVERSIGHT: A STUDY ON THE EFFECTS OF BOARD COMPOSITION ON FIRM PERFORMANCE

Introduction

The primary duties of the board of directors include monitoring and advising top management (Mace, 1971). The monitoring role of the board consists of selecting the appropriate management and evaluate its performance (Hermalin & Weisbach, 2003). In the advisory role, the board guides management in establishing the strategic direction of the firm (Adams & Ferreira, 2007). Agency theorists and insider knowledge theorists have long speculated about which role is more important in maximizing shareholder wealth.

Agency theorists argue that a strong monitoring mechanism is needed to provide the necessary oversight of executives, who tend to be opportunistic and self-serving (Bebchuk & Fried, 2005; Fan, 2004). An outsider-control board (a board with a majority of independent directors) will add the essential supervision needed to better align management actions with shareholder interests.

Insider-knowledge theorists do not dispute that the agency problem needs to be addressed, but they believe an insider-control board (a board with a majority of

management-affiliated directors) is better suited to take advantage of firm-specific knowledge (Adams & Ferreira, 2007; Harris & Raviv, 2008). An insider-control board provides a strong advisory mechanism to assist management in making decisions that maximize shareholder wealth.

In November 2003, following the accounting scandals at Enron, Tyco, WorldCom, and other companies, as well as the passage of the Sarbanes-Oxley Act of 2002 (SOX), the national stock exchanges (AMEX, NYSE, and NASDAQ), under the guidance of the Securities and Exchange Commission (SEC), mandated that all firms have outsider-control boards. The monitoring function of boards increased with independent directors responsible for evaluating management performance, determining management salaries, and ensuring the integrity of the audit process (Chhaochharia & Grinstein, 2007; Wintoki, 2007). The goal of this study is to determine the impact of the mandated changes on board composition and the increased monitoring functions on firm performance.

I hypothesize that the direction of firm performance depended on the firm's monitoring and advisory needs. As a result of the mandate, boards became outsider-controlled and exerted increased monitoring power. Firms that needed more oversight would effectively mitigate agency problems, experiencing a positive effect on firm performance. However, as independent directors are added to the board to form the mandated majority, firm-specific knowledge possessed by inside directors will be marginalized, resulting in diminished strategic advising (Harris & Raviv, 2008). Firms that needed more advising would experience a negative effect on firm performance resulting from a switch to an outsider-control board.

To test the impact of the forced change in board composition on firm performance (measured by operating return on assets), I analyzed the data from 1997 to 2012 while controlling for industry and year fixed effects, book leverage, book-to-market ratio, and total assets. Using the difference-in-difference methodology, similar to Chhaochharia and Grinstein (2009), Duchin et al. (2010), Guo, Lach, and Mobbs (2015), Chung and John (2017), and Lu and Wang (2018), I segregated the changes in performance due to the exogenous shock by taking the difference in the changes in the performance of the insider-control firms (non-compliant firms) and outsider-control firms (compliant firms), thereby reducing endogeneity concerns.

My findings indicate that, overall, long-run performance increased for firms that needed to change their board composition, consistent with agency theory. The magnitude of the increase in operating return was between 0.75% and 0.86% at the 10% significance level. Economically, there was an increase in the relative return on assets of non-compliant firms of at least three-quarters of a percentage point annually compared to compliant firms following the mandate. This long-run result following the mandate has not been previously identified in the literature. The dependent variable is plotted both pre- and post-mandate to confirm that the parallel trend assumption holds. The falsification test shows that the main result is not a delayed reaction of the exchange mandates announced prior to 2003. I also confirmed the main result via the propensity score matching methodology, using return on sales as an alternative way to measure firm performance. The main result holds even after controlling for unobserved firm fixed effects.

The overall positive, but only weakly significant, impact found on firm performance may conceal potential cross-sectional variations in the relationship between board composition and firm performance. My second hypothesis is that the mandate did not affect all firms equally because the increase in the monitoring role resulting from a board controlled by a majority of independent directors came at the cost of the advisory role of the board. For the sub-sample hypotheses, I study the impact of the mandate on utility firms, small firms, and research-oriented firms.

Utility firms have less need for advice because they face profit maximization constraints due to their monopoly position (Vinod & Geddes, 2002). Additionally, according to Hirschey and Pappas (1981), regulations on utility firms create barriers to entry, resulting in market power that can be exploited by management to serve its own purposes. Improved monitoring is needed for utility firms to address agency problems resulting from entrenched management. Since there is less need for the advisory role of the board, the mandate will have a positive effect on the long-run performance of non-compliant utility firms.

For small firms, independent boards focus on monitoring strategies to evaluate management and advisory strategies to improve efficiency. According to Dalton et al. (1998), small firms are less complex, which makes it easier for new independent directors to become sufficiently familiar with the firm to provide advice as needed, as well as making it easier for an outside board to gather information to monitor management and evaluate firm performance. Since there is no loss in the advisory role of the board, the mandate will have a positive effect on the long-run performance of non-compliant small firms.

For research-oriented firms, the advisory role of the board depends on the directors' ability to understand the complexity of the research projects that firms are pursuing. Outside boards do not have sufficient firm-specific knowledge to properly advise management (Coles et al. 2008; Duchin et al, 2010). Eventually, non-compliant research-intensive firms that change board composition will experience a decrease in performance due to a loss of market share to new innovators.

In the sub-sample examinations, I found differential impacts of the mandate on firm performance, such that the positive relationship between board independence and performance was more prominent among non-compliant utilities and small firms. Non-compliant firms with heavy investment in R&D showed a less pronounced impact on firm performance following the mandate.

This study belongs to the body of literature that focuses on changes in board composition following the 2003 stock-exchange mandate. Chhaochharia and Grinstein (2007) found significantly positive announcement returns for firms that changed their board composition. Wintoki (2007) showed that positive announcement returns were related to firm size and age, but found negative announcement returns for growing firms. Chhaochharia and Grinstein (2009) noted that compensation decreased for CEOs at companies affected by the mandate. Duchin et al. (2010) showed that the benefit of an outside board depends on the level of information asymmetry between management and independent directors. Guo et al. (2015) found that additional monitoring provided by an independent board substituted for external corporate governance mechanisms. Chung and John (2017) asserted that CEO compensation was less dependent on firm performance following the mandate. Lu and Wang (2018) discovered a positive relationship between

board independence and corporate innovation. Balsmeier, Fleming, and Manso (2017) observed that new independent boards prefer to exploit existing efficiencies rather than explore new opportunities. Unlike these studies, I examined the effect of the mandate on long-run firm performance. My contribution to this body of literature is in finding that the exchange mandate had an overall positive long-term effect on firm performance, but that cross-sectional variations among different firms was obscured.

This study extends the literature on board composition and has the potential to reconcile agency theory and insider-knowledge theory. For firms in which a monitoring role is more important, outsider-control boards are beneficial to firm performance. For firms in which an advisory role is more important, outsider-control boards are detrimental to firm performance. I make an essential practical contribution by providing evidence that an outsider-control board is not appropriate for all companies.

Section II of this paper is a brief review of the literature. Section III discusses the hypotheses. Section IV describes the data, variables, and summary statistics. Section V explains the models and their use and conducts univariate analyses. The full sample results are presented in Section VI. Section VII conducts robustness tests. Section VIII presents the subsample tests. Section IX concludes.

Literature Review

In this section, I begin by describing a brief history of the changes in board composition. I then examine the relationship between board composition and firm performance in accordance with agency theory and insider-knowledge theory and review research conducted prior to the board-independence mandate. I conclude this section by

examining current research on the impact of the board-independence mandate on firm performance.

History of Board Composition. Through the 1960s, most publicly traded firms had insider-control boards (Gordon, 2006). Since the collapse of Penn Central in 1976, the number of independent (outside) directors serving on boards has been on the rise. During the takeover decade of the 1980s, outside directors were seen as saviors of management from hostile takeover bids, while in the 1990s, the shareholder value maximization principle allowed activist investors to demand a greater majority of outside (independent) directors on the board. Finally, in the early decade of the new millennium, the accounting scandals at Enron, Tyco, and WorldCom prompted the national stock exchanges (AMEX, NYSE, and NASDAQ) to require all firms to have outsider-control boards. Without evidence that increasing the number of independent directors serving on the board would negatively affect firm performance, outsider-control boards looked like the way forward.

Independent Board Research. Previous empirical studies of the impact of outside board members on firm performance have not provided conclusive results (see Hermalin & Weisbach, 2003; Fan, 2004). For example, Baysinger and Butler (1985), Hermalin and Weisbach (1991), and Bhagat and Black (2002) found no relationship between board independence and firms' financial performance over the long run.

There are two reasons for these findings. First, these studies do not adequately control for board composition, which is endogenously chosen according to the needs of the firm. Endogenous decisions, such as having either a majority of insiders or outsiders on the boards, are correlated with other firm-specific characteristics. These decisions

require an external force or shock (treatment) to measure their effects on firm performance. An external force, such as the independent board mandate of 2003, controls for endogeneity concerns and provides an answer regarding the impact of board independence on firm performance. Another reason for these findings is likely due to the simultaneous study of all firms. Examining sub-sample data allows the determination of whether the impact is similar across all firms. A one-size-fits-all model regarding board regulation might not be appropriate for all companies.

Agency Literature. Conventional wisdom suggests that increasing the number of independent board members will lead to an increase in firm performance. This belief is due to the popularity of agency theory, which calls for increased monitoring and oversight of management by outsiders to improve performance. A key tenet of agency theory is that management tends to be opportunistic and self-serving, requiring strong oversight (Fan, 2004), and that insiders are poor monitors because CEOs have too much influence over inside board members (Berger, Ofek, & Yermack, 1997). Bathala and Rao (1995) and Bebchuk and Fried (2004) contended that by increasing the number of independent directors on the board, companies can reduce the CEO's influence over the board and decrease agency costs.

Fama (1980) argued that outside directors want to be impartial. Favoring management would tarnish their reputations in the labor market because most outside directors serve on more than one board. Additionally, there is a high probability that they would not be elected again at the same firm. Moreover, provisions in SOX and the mandate allow board members to be held responsible for failing to identify certain management actions (Chhaochharia & Grinstein, 2007). My study provides evidence of

the impact of outsider-control boards on firm performance and answers lingering questions.

Insider Knowledge Literature. Insider knowledge theorists argue that the advisory role of the board is more important than its monitoring role (Harris & Raviv, 2008). An outside board member is, by definition, someone who has had no or very limited business dealings with the firm. Due to the fear of losing competitive advantage and a perceived or real conflict of interest, independent directors are generally not employed as executives of other firms in the same industry (e.g. Adams (2012) for post-mandate board composition in financial firms). Thus, it might be difficult to find someone outside the industry who can gain a full understanding of the firm and its industry.

As a result, greater independence may not be beneficial because a more independent board may not have sufficient technical expertise and industry-specific knowledge to advise management. Consequently, this would increase the cost of the increased monitoring resulting from a new independent board. Since outside board members do not have enough firm-specific knowledge to be effective advisors, new independent boards will decrease firm performance (Harris & Raviv, 2008). This study provides evidence of cases in which outsider-control boards are detrimental to firm performance.

Board Composition and Firm Performance after 2003. Lee and Carson (2007), in a univariate setting, found a significant difference in operating performance for firms with outsider-board majorities (greater than 75%), suggesting that the required change in

board composition will benefit shareholders. The study failed to perform a multivariate analysis to determine whether board composition has an impact on firm performance.

Chhaochharia and Grinstein (2007) studied the effect of an exchange mandate announcement on firm value, finding that insider-control firms earned positive abnormal returns compared to outsider-control firms during the announcement period. This is not surprising because there is much empirical evidence that changing the board composition indicates a new strategic direction of the firm, leading to positive short-run market gains (see Hermalin & Weisbach, 2003; Gordon, 2007; Adams, Hermalin, & Weisbach, 2010). Hermalin and Weisbach (2003), however, argued that these short-run gains do not necessarily extend into the long term; an announcement impact may be the result of the change itself. It is necessary to study whether this change has a positive impact in the long term.

Furthermore, when separating firms by size, Chhaochharia and Grinstein (2007) find that smaller firms did not earn positive abnormal announcement returns and, in some cases, earned negative returns during the announcement period. Similarly, Wintoki (2007) studied the effect of exchange mandate announcements on firm performance and found positive effects for large and older firms, but negative effects for growing firms. Neither Wintoki (2007) nor Chhaochharia and Grinstein (2007) looked at the effect of the mandate on firm performance over the long run.

Bhagat and Bolton (2013) are among the few researchers to find a negative effect of insider-control boards on firm performance before the mandate, but they found a positive effect of insider-control boards on firm performance after the mandate by separating their data into pre and post-2002 sub-periods. More data are needed to

determine whether the post-2002 results could be sustained over a longer period. The study also lacked a cross-sectional analysis to determine whether the effects were the same for all firms.

It is important to consider other factors that could impact firm performance in the 2002 exchange mandate. Therefore, a study using multivariate analysis is needed. Some studies have identified short-run positive results, but it is not known whether positive short-run results can be sustained. A study that considers firm performance over a longer period is required. It is also important to perform a subsample analysis of different types of firms to determine whether only some or all companies benefited from the exchange mandate. My study addresses all these concerns.

Research Hypotheses

As a response to the Enron, WorldCom, and Tyco scandals of the early 2000s, government officials through the SEC and stock exchanges sided with agency theorists and imposed tougher oversight rules on publicly traded companies. Agency theory posits that adding outside board members will increase firm performance by improving the monitoring function and mitigating agency costs. In contrast, insider knowledge theory argues that adding outside directors will result in a loss of firm-specific knowledge from the board and impair its advisory function, negatively affecting firm performance. What was the effect of the new board composition on the firm performance of non-compliant firms relative to compliant firms? The first hypothesis broadly addresses the overall performance of all publicly traded firms over the same period.[2]

[2] The null hypothesis is consistent with the window-dressing view. Romano (2005) argues that setting numerical targets of board independence will result in "quack corporate governance." Insiders will be able to nominate directors who are independent in the legal sense but sympathetic toward management. Therefore, the mandate will not have a lasting impact on firm performance of non-compliant firms.

$H1_0$: The relative performance of non-compliant firms is not affected by the mandated change in board composition.

$H1_{1a}$: The relative performance of non-compliant firms is negatively affected by the mandated change in board composition.

$H1_{1b}$: The relative performance of non-compliant firms is positively affected by the mandated change in board composition.

While various theories suggest how the new mandate might impact long-run firm performance, it is impossible to argue, a priori, that performance would either stay the same, decrease, or increase, so in this case, the final answer remains an empirical question.

Sub-Sample Hypotheses. Some researchers suggest that different companies require different types of boards (see Almazan & Suarez, 2003; Hermalin & Weisbach, 2003; Adams & Ferreira, 2007; Harris & Raviv, 2008) and that a one-size-fits-all mandate requiring outside board composition will not work for all publicly traded companies. The following types of firms are studied here because they were previously used in other studies: utility firms (Hirschey & Pappas, 1981), small firms (Chhaochharia & Grinstein, 2007), and research-oriented firms (Coles, Daniels, & Naveen, 2008; Lu & Wang, 2015, 2018). A separate hypothesis is presented for each characteristic that is investigated based on their monitoring and advising needs.

Utility firms are heavily controlled by the government. Unlike other firms that face regulation (especially financial firms), the regulation of utility firms creates barriers to entry and provides monopoly power. As argued by Geddes and Vinod (2002), this power lessens the need for the advising role of the board. Additionally, regulations create

substantial market power for utility firms. In such an environment, it is easy for management to pursue its own interests at the expense of shareholder needs (Hirschey & Pappas, 1981). Since independent board members focus on monitoring in utility firms, this mandate will lead to an increase in the performance of non-compliant utility firms following the mandate.

H_2: The relative performance of non-compliant utility firms is positively impacted by the mandated change in board composition.

Dalton et al. (1998) argued that the impact of outside directors on firm performance is inversely dependent on firm size. Small firms are less complex, resulting in a cleaner and faster flow of information between outside board members and employees of the company (Dalton et al., 1998). Outside directors of smaller firms can gather high-quality information to evaluate their management. It is also easier for outside directors to become sufficiently familiar with the operations of small firms to provide effective advice. This will allow independent boards to be capable monitors without hindering their advisory function, leading to an increase in firm performance.

H_3: The relative performance of non-compliant small firms is positively impacted by the mandated change in board composition.

Prior to the mandate it was easier to be classified as independent as the new rules are more restrictive as to what qualifies as an independent director. According to Pandya and Bathala (2013) there are several relationships that impair independence following the mandate. Under the new rules, previously classified independent directors, which were in fact affiliated with the CEO and the firm, will now be classified as inside directors. For instance, both Chhaochharia and Grinstein (2007b) and Duchin et al. (2010) find that

following the mandate, the independent directors on the board who concurrently serve as executives of other firms declined. Furthermore, Chhaochharia and Grinstein (2007b) show that after the mandate, interlocking directors were often replaced by independent directors who had no corporate affiliation whatsoever. These directors were replaced by people who have financial expertise to comply with the SOX act (Chhaochharia & Grinstein, 2007b; Duchin et al., 2010); leading to a situation where the remaining corporate directors may have little or no industry-specific knowledge. As a consequence, it might be difficult for companies to hire new directors with industry-specific knowledge.[3]

In retrospect, the top priority for corporate governance reformers when writing the SOX legislation was to increase the representation of outside board directors to deal with the agency problems that outraged the public in the late 1990s (e.g. Enron and WorldCom). Coles et al. (2008) assert that the role of outside directors is to monitor management while inside directors act as strategic advisors to management. Similarly, Faleye, Hoitash, and Hoitash (2010) find that independent boards generally provide more value as monitors and lower value as advisors. Adams and Ferreira (2007) and Harris and Raviv (2008) find that following the change from a majority of inside directors to majority of independent directors, the firm specific knowledge of inside directors is marginalized. For example, as Duchin et al. (2010) and Fairfax (2010) point out, that as tougher independence guidelines were imposed on publicly traded firms through SOX and exchange mandates, there was a significant decrease in firm-specific knowledge from

[3] While this and other studies assume that outside directors do not have industry specific knowledge, there is anecdotal evidence that in some cases outside directors are in fact industry experts. Unfortunately, the data available to me does not allow one to identify this class of independent directors which constitutes a limitation of the study.

the board. Conversely, a shift towards fewer inside directors will result in a loss of advising that is detrimental to firm performance for those in need of strategic advising.

The firm-specific knowledge of insiders is particularly important for research-oriented firms because their value, to a greater extent, hinges upon well targeted investment in innovative research. Coles et al. (2008) show that research-oriented firms have greater advising needs for which the firm-specific knowledge of inside directors is important. In a related manner, Faleye, Hoitash, and Hoitash (2011) find that excessive monitoring can lead to diminished corporate innovation. Hence, following the mandate research-oriented firms might experience a decrease in firm performance as outside directors do not have sufficient firm-specific knowledge to properly advise management. The impact of the mandated changes to board composition on firm performance might be negative for research-oriented firms due to a reduced level of firm-specific knowledge by new independent board members. Hence, hypothesis #4 reads as follows.

H4: The relative performance of non-compliant research-oriented firms is negatively impacted by the mandated change in board composition.

It is evident from the literature reviewed above that there are arguments that forcing a change to the board will increase firm performance for some firms. There are also arguments that forcing the mandate on some firms will have a deteriorating effect on firm performance. Unlike previous studies, this study considers the complex structure of companies and the monitoring and advising needs of those firms.

Data, Variables, and Summary Statistics

Data. The data for this study were extracted from two sources. Information regarding the board of directors comes from Institutional Shareholder Services (ISS; formerly RiskMetrics), which tracked the record of the S&P 1500 firms in the period 1996–2009, matched with the companies' financial information provided by CompuStat for 1997–2012. Similar to Bhagat and Black (2002) and Chhaochharia and Grinstein (2007), this study includes only publicly traded US firms.

The affected firms were given a couple of years to comply with the mandate. During that time, there might have been other regulations that caused policy shocks that I assumed, similar to Lu and Wang (2018) and Chhaochharia and Grinstein (2009), would impact all firms similarly. Furthermore, there was no shock at the time that affected firms with only insider-control boards (see Chhaochharia and Grinstein, 2007; Wintoki, 2007).

Variables. *Performance* - Hermalin and Weisbach (1998) and Al-Matari, Al-Swidi, and Fadzil (2014) noted that accounting-based performance measures are ideal when the relationship between firm performance and board independence is examined, as these measures present the outcome of management actions. The primary dependent variable I use to measure firm performance is operating return on assets (OROA), similar to Bhagat and Black (2001) and Bhagat and Bolton (2008). It is calculated as the ratio of operating income before depreciation to total assets.

As an alternative accounting-based performance measure, I use return on sales as a dependent variable to measure firm performance. It is calculated as the ratio of net income to total sales.

Inside Board is a constant variable used to determine the compliant and non-compliant groups based on board composition prior to the 2002 exchange mandate. The compliant (non-compliant) group consists of all firms that had outsider (insider) control and, therefore, were unaffected (affected) by the mandate. Once the compliant and non-compliant groups are established, changes in board composition in subsequent years should be the result of the event, which forced companies to change from insider-control boards to outsider-control boards.

Inside Board is primarily defined as firms with a majority of inside directors in the year 2000, similar to Chhaochharia and Grinstein (2007), Duchin et al. (2010), and Guo et al. (2015). The value for *Inside Board* is 0 if the ratio of outside directors to the total number of directors on the board is greater than 0.5, and the value is 1 if the ratio is equal to or less than 0.5 in the year 2000.

To test the robustness of the independent variable, I changed the definition for *Inside Board*. There is a concern that the first definition used to partition firms into compliant and non-compliant groups might include a company that had a majority of inside or outside directors for only the year 2000. To mitigate this possibility, I create an alternate definition for *Inside Board*, where I define a non-compliant firm as one that had an insider-control board for two consecutive years prior to 2003.

Specifically, the value for *Inside Board* is 1 if the firm had an inside board (the ratio of outside directors to total directors was less than 0.5) for any two consecutive years between 1996 and 2002.

Post Regulation is a dummy variable equal to 1 for the year 2002 and beyond, similar to the variable used in Guo, et al. (2015). This is the year when the board independence

mandate was announced requiring publicly traded companies to have a majority of outside directors on the board. Some companies preemptively changed their board composition to outside boards in 2002, the announcement year.

Control variables are used to restore randomness because large firms (Dalton et al., 1998), leveraged firms (Strebulaev & Yang, 2013), and growth firms (Bathala & Rao, 1995) are likely to be impacted by the mandate. Furthermore, since these variables determine firm performance in some way, adding those controls also accounts for cross-sectional and time-series variations. Total Assets represents the resources available for firms to generate profit, and is calculated as the natural logarithm of total assets. Market-to-Book Ratio represents the company's growth opportunities. Book Leverage Ratio represents the amount of total long-term debt the firm has. All control variables were winsorized at the top and bottom percentiles. I also use industry and year fixed effects. Appendix A provides more information about the variables.

Propensity Score Matching. The model employed here assumes that firms that have to change their board structure to comply with the mandate are similar to firms that do not have to change their board structure. Even if some of these variables are controlled in the full sample, doing so may not fully address endogeneity concerns. Similar to Guo et al. (2015), I considered a subsample of matched non-compliant and compliant firms to see how firm performance in similar firms that differed in board independence prior to the mandate changed following the mandate. I employed a propensity score methodology with one-to-one matching with replacement, following Lu and Wang (2018).

To apply this strategy, I first estimated a logit model based on all firms during the 1997–2000 time period, where the dependent variable is whether or not the firm had an

insider-control board in the year 2000. The independent variables included all control variables as well as industry and year fixed effects. The logit model was estimated using data for 1997–2000, and the estimation results are reported in Appendix B. The model reported a concordance rate of 71%.[4] Using the predicted values from the logit regression for the year 2000, I applied the nearest-neighbor propensity score matching methodology to yield a matched sample of 615 firms (356 non-compliant firms and 259 compliant firms). The reason for the lower number of compliant firms can be attributed to the replacement methodology used here, as some of these firms were matched with more than one non-compliant firm. As a robustness check, I employed a propensity score methodology with one-to-one matching without replacement and a two-to-one matching without replacement methodology. The results using these methods are presented in Appendices C and D, respectively.

Sample Statistics. Table 1 provides the sample statistics for the full sample using both definitions of Inside Board as well as the matched sample created using the one-to-one with replacement methodology. Panel A provides the summary statistics of the data based on board information about firms in the year 2000, which includes a sample of 1,482 publicly traded firms and 19,103 unique annual observations. The sample firm had average total assets of $11.7 billion, an average market-to-book-ratio of 2.95, an average book leverage ratio of 23.72%, and an average operating rate of return on asset of 13.84%.

[4] The concordant rate denotes the probability that a randomly selected subject who experienced the outcome will have a higher predicted probability of having the outcome occur than a randomly selected subject who did not experience the event (Austin & Steyerberg, 2012). If the model had no predicted power, the concordant rate would be 50%.

Table 1: Summary Statistics

This table shows the summary statistics for the firms with inside boards and independent boards. The statistics include average total assets (in millions of dollars), market-to-book ratio, leverage ratio, and operating return on assets. All firm-specific variables are winsorized at the top and bottom percentile. Panel A shows the summary statistics for the firms grouped based on their corresponding board information at the end of fiscal year 2000. Panel B shows the summary statistics for the firms grouped based on their board composition for two consecutive years prior to 2003. Panel C shows the summary statistics for the firms grouped based on their board composition in 2000. In this sample, the non-compliant firms are matched with compliant firms using the propensity score with one-to-one replacement methodology. The information on firms is from fiscal years 1997 to 2012. T-Statistics between values of Independent Board and Inside Board are shown in column 4. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A: Firms with Inside Board in Year 2000

	Total Firms	Inside Board	Independent Board	*T*-Statistics
Number of Firms	1482	356	1126	
Total Assets	$11,773	$7,226	$13,129	-3.02***
Market-to-Book Ratio	2.95	2.97	2.94	0.23
Leverage Ratio	23.72%	22.23%	24.16%	-1.82*
Operating Return on Assets	13.84%	14.91%	13.52%	2.58***

Panel B: Inside Board for Two Consecutive Years prior to 2003

	Total Firms	Inside Board	Independent Board	*T*-Statistics
Number of Firms	1597	484	1113	
Total Assets	$11,431	$9,773	$12,160	-1.39
Market-to-Book Ratio	2.90	2.71	2.98	-2.29**
Leverage Ratio	23.41%	22.29%	23.90%	-1.71*
Operating Return on Assets	13.87%	14.48%	13.60%	1.88*

Panel C: Inside Board in Year 2000 using Propensity Score Matching

	Total Firms	Inside Board	Independent Board	*T*-Statistics
Number of Firms	615	356	259	
Total Assets	$8,532	$7,226	$10,200	-1.30
Market-to-Book Ratio	3.00	2.97	3.04	-0.37
Leverage Ratio	23.03%	22.23%	24.06%	-1.17
Operating Return on Assets	14.52%	14.91%	14.02%	1.48

Of the 1,482 firms, 356 firms (24%) had insider-control boards with average total assets of $7.3 billion, an average market-to-book ratio of 2.97, an average book leverage ratio of 22.23%, and an average operating return on asset of 14.91%. The other 1,126 firms had outsider-control boards with average total assets of $13.1 billion, an average market-to-book-ratio of 2.94, an average book leverage ratio of 24.16%, and an average operating return on asset of 13.52%.

Column 4 of Table 1 shows the t-statistics for the values of the inside and independent boards clustered across firms. Non-compliant firms in Table 1 Panel A were significantly smaller than compliant firms, as measured by total assets. The market-to-book ratio was slightly higher for non-compliant firms, but not significantly so. Non-compliant firms had significantly less book leverage than compliant firms do. Lastly, non-compliant firms experienced a significantly greater operating return on assets than compliant firms.

Table 1 Panel B provides the summary statistics for firms with Inside Board in Two Consecutive Years Prior to 2003, which includes a sample of 1,597 publicly traded firms. Of those 1,597 firms, 484 firms (30%) had insider-control boards, while the other 1,113 firms had outsider-control boards. Column 4 shows that based on total assets, compliant and non-compliant firms were of similar size. However, non-compliant firms still had a higher operating return on assets and lower leverage ratio. In this sample, insider-control firms also had significantly lower growth opportunities.

As shown in Panels A and B, compliant and non-compliant firms did not have the same firm characteristics. To address this issue, I used a subsample of similar compliant and non-compliant firms using one-to-one matching with the replacement methodology.

Panel C shows the summary statistics for the matched sample. As can be seen in column 4, there was no statistically significant difference between compliant and non-compliant firms, unlike Panels A and B.

Research Method & Univariate DD

Full Sample. When studying the effect of board composition on firm performance, it is necessary to consider simultaneity (a form of the endogeneity problem; Hermalin & Weisbach, 2003). Simultaneity exists when both the dependent and independent variables are jointly determined simultaneously. For instance, Hermalin and Weisbach (1998) have shown that poor performance by an insider-control firm resulting from actions by the current board will lead to a change in board composition, which results in a change in performance. Thus, it can be argued that either firm performance causes changes to board structure or board changes causes changes in firm performance. In other words, board composition and firm performance are determined jointly. I avoided the problem of simultaneity by analyzing the results of a natural experiment—the exchange mandate of 2003—on non-compliant firms (Adams, Hermalin, & Weisbach, 2010).

I used the difference-in-difference (DD) estimation method suggested by Roberts and Whited (2013), which approximates the results of an exogenous shock by comparing the performance of non-compliant firms with compliant firms and removes factors that affect both groups around the time of the mandate. The standard errors are clustered across firms and are robust and heteroscedasticity consistent. The following equation was used for the first hypothesis:

$$Performance_{it} = \beta_0 + \beta_1 Inside\ Board_i + \beta_2 (Inside\ Board_i * Post\ Regulation_t) + \Gamma X_{i,t} + \delta_i + \Upsilon_t + \varepsilon_{it}. \quad (1)$$

The coefficient of the interaction variable Inside Board * Post Regulation, β_2, is the primary variable of interest. It estimates the average differential in firm performance for non-compliant firms following the mandate relative to the average differential in firm performance for compliant firms. In other words, the interaction term measures the effect of the mandate on insider-controlled firms following the regulation. The idea is that if a firm already has an optimal governance structure, then changes in this structure due to regulation should be worse for the firm that has to make the requested change. On the other hand, if management is entrenched, changes in board composition due to the exchange mandate should be beneficial for firms that make the required change.

Delta (δ) indicates industry fixed effects, as categorized by Fama and French into 49 types. Upsilon (Υ) indicates year fixed effects. The coefficient of *Post Regulation* is absorbed by year fixed effects. X represents the control variables mentioned previously. The constant (β_0) is suppressed to avoid the dummy variable trap (similar to Adams & Ferreira, 2009), and epsilon is the error term. All firm-specific variables are winsorized at the top and bottom percentiles.

Subsample Tests. The second objective of this study is to examine whether the impact of the mandate is the same across all firms. For the other hypotheses, I added a firm characteristic variable to the model above:

$$Performance_{it} = \beta_0 + \beta_1 Inside\ Board_i + \beta_2 (Inside\ Board_i * Post\ Regulation_t) + \beta_3 (Inside\ Board_i * Firm\ Characteristic_i) +$$

$$\beta_4 \left(Inside\ Board_i * \ Post\ Regulation_t * \ Firm\ Characteristic_i\right) + \Gamma X_{i,t} + \ \delta_i \ +$$

$$\Upsilon_t + (\Upsilon_t * Firm\ Charcteristic_i) + \ \varepsilon_{it}. \qquad (2)$$

The *Firm Characteristic* examined in this study includes utility companies (firms with SIC code 4), small firms (indicator variable based on those firms with total sales below the median level in the year 2000), and research-oriented firms (continuous variable based on their research intensity in the year 2000). The coefficient of the interactive variable *Inside Board * Post Regulation * Firm Characteristic*, β_4, is the focus of interest. It estimates the additional differential performance of non-compliant treated firms following the mandate.[5]

To further illustrate the intuition behind this specification, we assume that the firm characteristic in question is utility firms. Thus, the control variables and fixed effects measure the average pre-mandate performance of non-utility compliant firms. The coefficient of $Inside\ Board_i$, β_1, represents the mean differential performance of non-utility non-compliant firms prior to the mandate. The first difference-in-difference term, $Inside\ Board_i * \ Post\ Regulation_t$, estimates the change in the differential performance of non-utility non-compliant firms relative to non-utility compliant firms from pre-mandate to post-mandate. The post-mandate differential performance of these firms is determined by adding the coefficients of $\beta_1$and β_2. The sum is the estimated differential firm performance of non-utility non-compliant firms relative to non-utility-compliant firms.

[5] This approach may affect the true differences since the control group of firms include firms that are postulated to be impacted differentially. Therefore, tests on utility firms are replicated without small firms and tests on small firms are replicated without utility firms. The results are qualitatively similar and are presented in Appendix E.

Similarly, the second difference-in-difference term, $Inside\ Board_i *$ $Firm\ Characteristic_i$, estimates the difference between utility firms and non-utility firms in the differential pre-mandate performance of compliant firms over non-compliant firms. The sum of the coefficients of β_1 and β_3 estimates the differential performance of non-compliant utility firms relative to non-utility-compliant firms prior to the mandate.

The coefficient of the triple difference term compares changes from pre-mandate to post-mandate in the differential performance of utility firms for compliant and non-compliant firms, compared to the similar difference for non-utility firms. In other words, β_4 measures the change in differential performance for non-compliant utility firms minus the change in differential performance for compliant utility firms and also minus the change in differential performance for non-utility non-compliant firms. Note that both industry-specific and board-specific time trends are differenced out in the triple difference estimation. The estimated differential performance post-mandate for non-compliant utility firms over non-utility compliant firms is given by adding the coefficients β_1, β_2, β_3, and β_4. The total differential effect on utility non-compliant firms following the mandate is calculated by taking the partial derivative with respect to *Inside Board* and *Post Regulation*. It is sum of the coefficients on β_2 and β_4.

Along with the industry and year fixed effects, equation (2) also includes the interaction of the sensitivity variable with year (Y_t * *Firm Characteristic*$_i$) as a fixed effect. This interaction term will allow year fixed effects to vary by subsample.

Figure 1 Average Proportion of Outside Directors on the Board Over Time

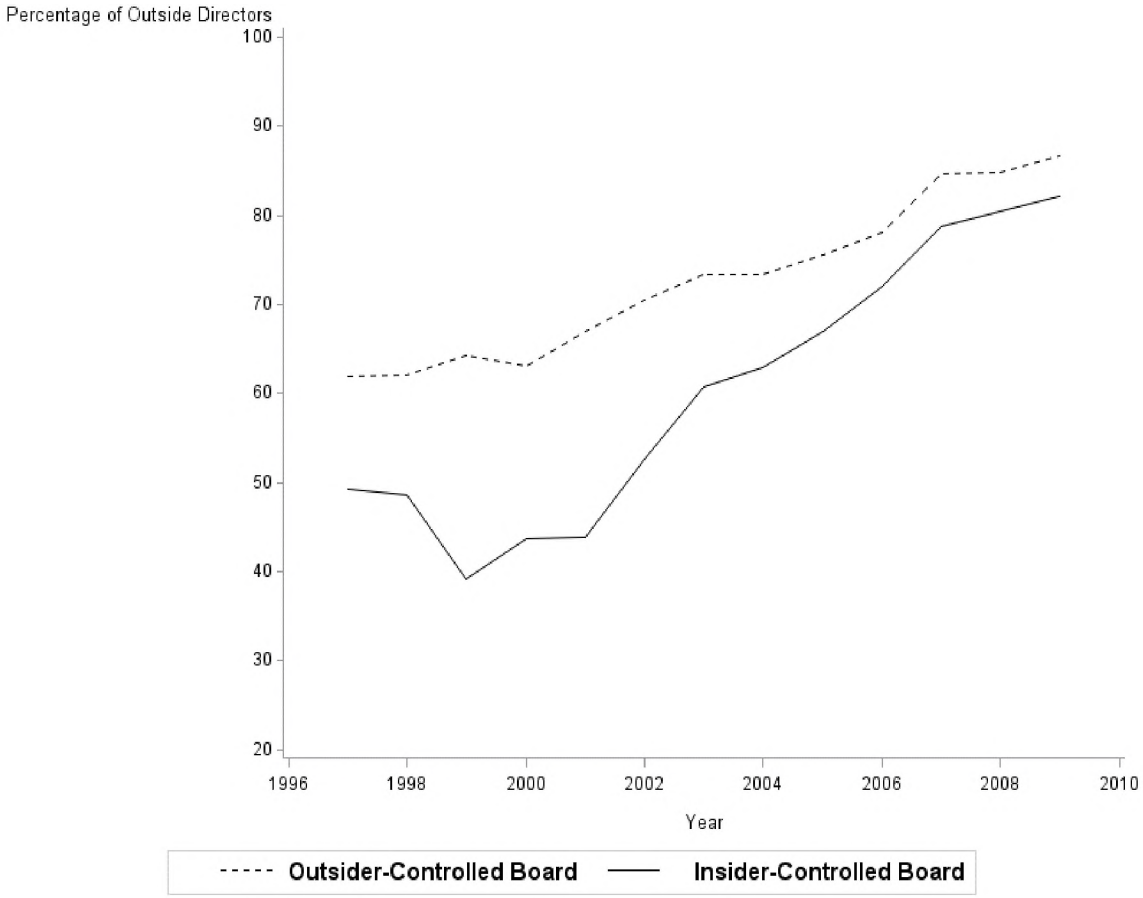

Figure 1: A time series plot of the mean percentage of outside directors on the board over time. An Insider-Controlled Board (Outsider-Controlled Board) is one that has (does not have) a majority of inside directors in the year 2000.

Exogenous Shock.

To determine the exogenous shock (treatment effect), similar to Lu and Wang (2018), I plotted the mean percentage of outside directors during 1996–2009 in Figure 1 using the primary criteria for Inside Board. Figure 1 indicates that there was a significant difference in board composition prior to 2000. The dotted line indicates compliant firms (outsider-control boards), while the solid line indicates non-compliant firms (insider-control boards). Visual inspection of the figures verifies the exogenous shock to board

independence. As firms brought on more outside directors, the two lines came closer together, indicating a change from insider-control to outsider-control boards in order to comply with the 2003 exchange mandate. The solid line, representing non-compliant firms, shows that the number of independent directors almost doubled from 2001 to 2009. Firms that were already compliant prior to the new regulation were not affected by the mandate (a modest increase from 65% to 80%; an equivalent of adding one more independent director), making them the obvious control group in a DD estimation approach.

Univariate Difference-in-Difference.

The first purpose of this study is to determine whether the 2002 exchange mandate, which forced companies to change board composition from insider-control to outsider-control, impacted those companies' (non-compliant firms) performance compared to firms that did not have to change board composition (compliant firms). Table 2 reports the results of applying the univariate difference-in-difference methodology to firm performance between compliant and non-compliant firms before and after the 2003 board independence mandate.

Panel A of Table 2 reports the results of operating return on assets using the primary definition of Inside Board. Firm performance decreased for all firms following the mandate, possibly reflecting the time trend. The difference-in-difference estimator is positive and significant (0.894), indicating that operating performance decreased significantly less for non-compliant firms than for compliant firms.

Table 2: Univariate DD – Firm Performance

The following table shows the univariate difference-in-difference estimates of the effect of the new exchange regulations on firm performance for all firms for 1997-2012. In Panel A, the full sample uses operating return on assets to measure firm performance. Panel B presents the results for operating return on assets for the matched sample of treatment and control firms created with the propensity score methodology. Panel C presents the results for operating return on assets where *Inside Board* is defined as firms having insider-control boards for two consecutive years prior to the year 2003. In Panel D, firm performance is measured through return on sales. Statistical significance of the difference-in-difference estimate at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A – Full Sample

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	15.158	12.554	-2.604
Non-Compliant Firms	15.952	14.243	-1.709
Difference	0.794	1.689	**0.894****

Panel B – Matched Sample

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	15.802	12.930	-2.872
Non-Compliant Firms	15.952	14.243	-1.709
Difference	0.150	1.313	**1.163*****

Panel C – Alternative Definition for the Independent Variable – Inside Board for Two Consecutive Years prior to 2003

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	15.302	12.582	-2.774
Non-Compliant Firms	15.782	13.705	-2.077
Difference	0.480	1.123	**0.643***

Panel D – Alternative Definition for the Dependent Variable – Return on Sales

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	1.752	0.440	-1.312
Non-Compliant Firms	-1.963	3.045	5.008
Difference	-3.715	2.605	**6.32***

Using the matched sample in Panel B, the DD estimator is positive at the 1% significance level. Using the alternate definition of Inside Board in Panel C, the DD estimator is still positive and significant. Using return on sales as a measure of firm performance in Panel D, the DD estimator is also positive (6.32), which indicates that the return on sales for non-compliant firms increased by more than 6%. The changes observed in firm performance support the agency view that a new independent board will cause a relative increase in firm performance following a change in board composition compared to compliant firms.

Multiple Regression Results – All Firms

To confirm the results in Table 2, I conducted multiple regression analyses of the effects of the forced change to outsider-control boards on firm performance during the period 1997–2012 using difference-in-difference estimates. The results are presented in Table 3. The coefficient for *Inside Board in Year 2000* in column 1 is positive but not significant (0.495), suggesting that after controlling for size, leverage, and growth opportunities, there was no statistical difference between non-compliant and compliant firms on average after using the control variables. The interactive coefficient for *Inside Board * Post Regulation* is statistically significant and positive (0.766), suggesting that relative firm performance for insider-control firms increased by approximately three-fourths of a percentage point due to the forced change in their board structure over the long run following the mandate. Compared to the univariate DD result, adding control variables lowers the coefficient value; however, the impact is still statistically significant at the 10% level.

Table 3: Full Sample Analysis

The following table shows the result of least square regression analysis of the effects of the new exchange regulations on performance of all firms for 1997-2012 using difference-in-difference estimates. The dependent variable and the independent variables are described in Appendix A. Column 1 shows the primary results of the analysis using operating return on assets as the dependent variable. Column 2 presents the results for operating return on assets where propensity score matching is used to find firms that had similar characteristics based on the nearest neighbor methodology with replacement. In column 3, the dependent variable is changed to return on sales. Column 4 presents the results for operating return on assets where the main independent variable - *Inside Board* - is defined as firms having insider-control boards for two consecutive years prior to 2003. All firm-specific variables are winsorized at the top and bottom percentile. All regressions use industry (Fama & French 49 industries) and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm level. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) Primary Results (OROA)	(2) Propensity Score Matching	(3) Alternative Definition for Dependent Variable Return on Sales	(4) Alternative Definition for Inside Board
Inside Board in Year 2000	0.495 (0.492)	0.058 (0.590)	-1.452 (2.676)	
Inside Board in 2 Consecutive Years Prior to 2003				0.430 (0.340)
Inside Board * Post Regulation	0.766* (0.471)	0.857* (0.526)	6.186* (3.435)	0.771* (0.490)
Book Leverage Ratio	-0.079*** (0.024)	-0.030* (0.016)	-0.475*** (0.118)	-0.072*** (0.023)
Market-to-Book Ratio	0.561*** (0.065)	0.514*** (0.094)	0.475*** (0.164)	0.588*** (0.066)
Total Assets	0.801** (0.364)	0.016 (0.252)	2.303*** (0.472)	0.664** (0.326)
Obs.	19103	7674	19103	20593
R-Square	0.184	0.198	0.024	0.181
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1482	615	1482	1597

Of the control variables, *Book Leverage Ratio* shows negative associations with firm performance in contrast to *Total Assets* and *Market-to-Book-Ratio*, which each have a positive association with firm performance. Overall, the results described in Table 2 support the agency point of view that most boards were not optimally structured prior to 2002.

In column 2 of Table 3, I re-estimate equation 1 using the matched sample created using the one-to-one with replacement propensity score methodology. The interaction term *Inside Board * Post Regulation* is still positive and statistically significant, suggesting that insider-control firms benefited due to the forced change in board composition over the long run, indicating that the full sample result presented in column 1 of Table 3 is not due to differences between compliant and non-compliant firms.
In column 3, I changed the definition of firm performance from operating return on assets to return on sales. The results indicate that relative accounting performance, as measured by return on sales, increased by more than 6% for non-compliant firms compared to compliant firms. It also allows us to establish a causal link between board independence and firm performance.

Column 4 of Table 3 provides the regression results for firms with Inside Board in Two Consecutive Years Prior to 2003. The dependent variable is operating return on assets. The interaction term *Inside Board * Post Regulation* is still positive and statistically significant, suggesting that the results are not data specific and that overall, firms that had to change board composition (non-compliant firms) to comply with the mandate benefited in the long run.

Table 4: Robustness Analysis

The following table shows the result of least square regression analysis of the effects of the new exchange regulations on firm performance of all firms for 1997-2012 using difference-in-difference estimates. The dependent variable is operating return on assets in all four columns. The independent variables are described in Appendix A. In column 1, a generalized difference-in-difference methodology is used with firm fixed effects. In column 2, only data from 1996-2003 are used and the *False Post Regulation Period* starts from the hypothetical event year 2000. In column 3, the main independent variable - *Inside Board* - is defined as firms having insider-control boards for three consecutive years prior to 2003. In column 4, the main independent variable - *Inside Board* - is defined as firms having insider-control boards for any three years prior to 2003. All firm-specific variables are winsorized at the top and bottom percentile. All regressions use industry (Fama & French 49 industry classification) and year fixed effects, except for column (1), which uses firm and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm level. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) Generalized Diff-in-diff	(2) Falsification Test	(3) Alternative Definition for Inside Board	(4) Alternative Definition for Inside Board
Inside Board in Year 2000		0.547	0.838*	0.703
		(0.471)	(0.472)	(0.476)
Inside Board * Post Regulation	0.806*		0.887*	1.167**
	(0.457)		(0.473)	(0.472)
Inside Board * False Post Regulation		-0.019		
		(0.400)		
Book Leverage Ratio	-0.095***	-0.072***	-0.078***	-0.077***
	(0.024)	(0.015)	(0.026)	(0.476)
Market-to-Book Ratio	0.237***	0.529***	0.689***	0.688***
	(0.042)	(0.066)	(0.072)	(0.072)
Total Assets	1.310*	0.232	0.698*	0.693*
	(0.705)	(0.195)	(0.389)	(0.387)
Obs.	19103	9805	18265	18313
R-Square	0.561	0.225	0.201	0.201
Industry Dummy	NO	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1482	1482	1389	1393

Robustness Tests

To confirm these results, I performed several robustness tests. First, I controlled for unobserved firm fixed effects, then tested the data for the parallel trend assumption and performed a falsification test. Finally, alternative definitions were used as primary independent variables.

Alternative Methodology. Equation 1 uses only industry and year fixed effects. As an alternative specification, column 1 of Table 4 employs a generalized DD methodology using firm and year fixed effects.[6] The positive and significant coefficient of the interaction term provides further assurance that the results shown in Table 3 are not due to unobserved firm fixed effects and firms that had to change board structure benefit over the long run.

Parallel Trend Assumption. The validity of the difference-in-difference approach depends on the parallel trend assumption (Roberts & Whited, 2013). In the absence of the exchange mandate, which passed in 2003, the assumption is that the difference between the long-run performance of compliant and non-compliant firms is constant over time. To test this assumption, I plotted the changes in operating returns for non-compliant firms following the mandate, following Autor, Donohue III, and Schwab (2006) and Acharya, Baghai, and Subramanian (2014) in constructing this graph. The graph plots the point estimates and 95% confidence interval for lambda (λ) using the following equation:

$$OROA_{it} = \delta_i + \Upsilon_t + \sum_{t=1996}^{2012} \lambda_t \ (\Upsilon_t * Inside\ Board_i) + \varepsilon_{it}. \qquad (3)$$

Delta (δ) and upsilon (Υ) are, respectively, vectors of industry and year dummies to control for cross-sectional dependency. *Inside Board* is a dummy that assumes a value

[6] The coefficients of *Inside Board* and industry fixed effects are absorbed by firm fixed effects.

of 1 if the firm has an insider-control board in the year 2000. Errors are clustered at the firm level. Conceptually, this equation removes the variation caused by economy-wide shocks by running the regression with industry and year fixed effects and keeping only the residuals. Additionally, the point estimate line is close to zero prior to the mandate tests for the parallel trend assumption. The graph is shown in Figure 2.

Even without the control variables, Figure 2 indicates that the parallel trend assumption holds, since no change is observed among the compliant and non-compliant firms prior to 2003 (joint F-statistic for the years 1997–2002 is 0.38, with a p-value of 0.54). Furthermore, it provides visual evidence that firm performance increased for firms that had to change their board structure after the passage of the mandate. The post-mandate F-statistic for the joint test of significance is 2.25, which is significant at the 5% level ($p = 0.034$). This result is consistent with the results presented in Table 3.

Falsification Test. To further validate the research method, I repeat the DD analysis of the pre-event years (1997–2003) with a hypothetical event year in between to prove that the observed change in board composition was the result of the exchange mandate and not the result of an alternative force. Duchin et al. (2010) argued that corporate governance reform by exchanges started in 1999 with the audit committee independence mandate. If this is the case, we should observe the effect on firm performance prior to the mandate year. I selected the year 2000 as the hypothetical event year, which is two years prior to the actual event year, 2002. The results of this test are presented in Column 2 of Table 4. As expected, the DD variable is not statistically significant, suggesting that there was no event prior to the mandate that could have had an effect on firm performance.

Figure 2 Operating ROA of Insider Controlled Firms over Time

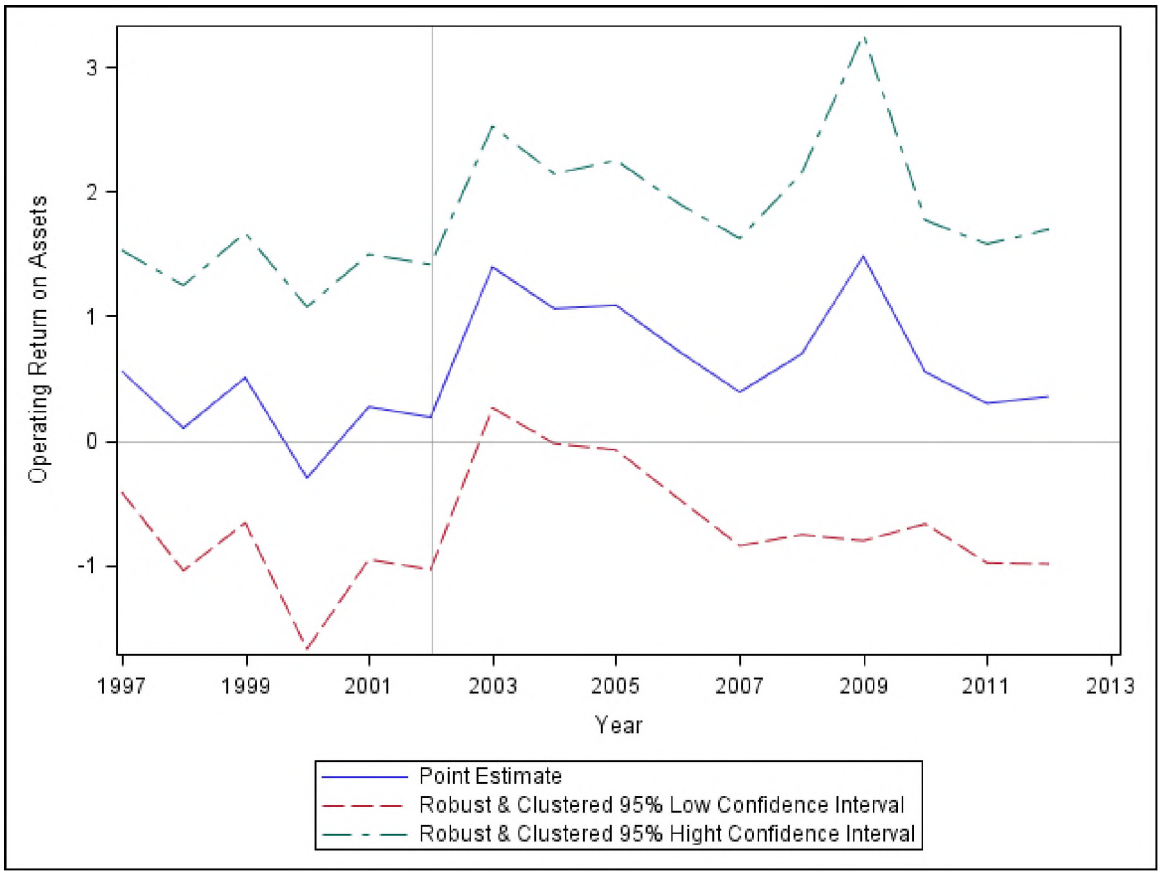

Figure 2. This figure shows a visual difference-in-differences analysis of the effect of the passage of the 2003 board independence mandate on relative firm performance of non-compliant firms. On the y-axis, the graph plots operating return on assets; the x-axis shows the the year of mandate (ranging from 5 years prior to adoption until 10 years after the passage). The vertical line (for year 2002) indicates the year when the mandate was announced. The dashed lines in the figure correspond to the 95% confidence intervals based on standard errors that are clustered firms.

Two cautions are warranted when interpreting this result. First, this test does not prove causality that the board independence mandate caused changes in firm performance. The falsification test fails to reject the null hypothesis that the pre-event trend was zero. Additionally, it does not accept the null hypothesis for the parallel trend assumption. Second, the low number of years with data available to perform the falsification test (7 years) leads to noise in the data, which may hinder the detection of any violation of the parallel trends when there is one, possibly leading to over-rejection of the null hypothesis in the full sample (Kahn-Lang & Lang, 2018; Roth 2020). Nonetheless, this falsification test plays an important role in validating the parallel trends assumption underlying the DD methodology.

Alternative Definitions for the Independent Variable. To further test the robustness of the independent variable, I changed the definition of non-compliant firms. First, the definition of non-compliant firms was changed to include only firms that had insider-control boards for three consecutive years prior to 2003. The results are presented in column 3 of Table 4. Lastly, the definition of non-compliant firms was changed to include only firms that had insider-control boards for any three years prior to 2003. The results are presented in column 4. The effect of each definition on firm performance is similar to the general result reported in column 1 of Table 3, regardless of how relaxed or stringent the definitions for Inside Board are. It is also reasonable to interpret the results of Table 3 as causal effects of the required change from insider-control to outsider-control boards.

Table 5: Subsample Summary Statistics

This table shows the summary statistics for the sub-sample. The third row indicates the percentage of subsample firms with an independent board at the end of fiscal year 2000. The fourth row indicates the percentage of subsample firms with an independent board at the end of fiscal year 2009. The sample statistics include average total assets (in millions of dollars), market-to-book ratio, leverage ratio, and operating return on assets for the period 1997–2012. All firm-specific variables are winsorized at the top and bottom percentile. Panel A shows the summary statistics for utility and non-utility firms. Panel B shows the summary statistics for small and large firms. Panel A shows the summary statistics for research oriented and non-research-oriented firms. T-Statistics between values of the control and treatment firms are shown in column 4. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A: Utility & Non-Utility Firms

	Utility Firms	Non-Utility Firms	T-Statistics
Number of Firms	177	1305	
Number of Observations	2260	16843	
Firms with Independent Board Pre-Mandate	82.49%	76.10%	
Firms with Independent Board Post-Mandate	100%	100%	
Total Assets	$12,580	$11,665	0.356
Market-to-Book Ratio	2.05	3.07	-5.76***
Leverage Ratio	36.35%	22.02%	10.70***
Operating Return on Assets	12.23%	14.05%	-2.59***

Panel B: Small & Large Firms

	Small Firms	Large Firms	T-Statistics
Number of Firms	740	742	
Number of Observations	9109	9994	
Firms with Independent Board Pre-Mandate	71.76%	80.19%	
Firms with Independent Board Post-Mandate	100%	100%	
Total Assets	$2,904	$19,857	-10.63***
Market-to-Book Ratio	2.93	2.97	-0.34
Leverage Ratio	21.38%	25.85%	-5.01***
Operating Return on Assets	13.24%	14.38%	-2.53***

Panel C: Research Oriented & Non-research Oriented Firms

	Research Oriented	Non-Research Oriented	T-Statistics
Number of Firms	622	860	
Number of Observations	8153	10950	
Firms with Independent Board Pre-Mandate	77.33%	75.00%	
Firms with Independent Board Post-Mandate	100%	100%	
Total Assets	$7,931	$14,634	-4.01***
Market-to-Book Ratio	3.56	2.49	9.43***
Leverage Ratio	20.66%	25.99%	-5.92***
Operating Return on Assets	14.43%	13.40%	2.25**

Subsample Results

The second purpose of this study is to determine whether the effects of the board independence mandate on long-run firm performance are the same across all types of publicly traded companies. Which firms performed better as a result of monitoring and advising by new independent boards? Based on the weakly significant results found in the previous two tables, I hypothesized that the effect on firm performance was not similar for all firms, as the needs of their boards would differ. The effect of the mandate depends on the monitoring and advisory needs of firms.

Table 5 shows subsample summary statistics in three separate panels. Panel A shows the sample statistics of the utility firms and the difference between utility and non-utility firms. For the fiscal year 2000, 82% of utility firms had independent boards and 76% of non-utility firms had independent boards. As firms were required to follow the mandate, by the end of 2009 all utility firms had independent boards. As can be gleaned from the total assets row, in Panel A, the difference in size between the two types of firms was not statistically significant. As expected, utility firms had statistically lower growth opportunities, as they are in a stable industry (2.05 vs 3.07). They also had higher leverage (36% vs 22%) and lower operating return (12% vs 14%) than non-utility firms.

Panel B shows the sample statistics for the small and large firms. Small firms included a lower percentage of firms with independent boards than large firms prior to the mandate (72% vs. 80%). This is not surprising in light of previous research (Chhaochharia & Grinstein, 2007) showing that hiring independent directors might be cost-prohibitive for small firms. By the end of fiscal year 2009, all firms had independent boards reflecting the impact of the board independent mandate. As expected, small firms

had lower assets than large firms ($3 billion vs. $19 billion). However, small firms did not have statistically higher growth opportunities (2.93 vs. 2.97) but did have statistically lower operating return on assets (13.24% vs. 14.38%). In addition, small firms had lower long-term debt (21% vs. 26%).

Panel C compares research-oriented and non-research-oriented firms. For the fiscal year 2000, 77% of research-oriented firms had independent boards, and 75% of non-research-oriented firms had independent boards. After the passage of the mandate, all the firms had an independent board. Research-oriented firms were smaller (total assets: $8 billion vs. $15 billion) and had statistically lower debt (21% vs. 26%). However, research-oriented firms had statistically higher growth opportunities (3.56 vs. 2.49) and higher operating return on assets (14% vs. 13%).

Tables 6–8 show the regression analyses for the effects of the forced change to outsider-control boards on the performance of different types of publicly traded using difference-in-difference-in-difference estimates. All tables use two different definitions of Inside Board (columns 1 and 4), have matched samples created using one-to-one with replacement methodology based on propensity scores (column 2), and use return on sales as an alternate measure of accounting return (column 3). The mean difference of the mandate on non-compliant subsample firms and other firms is given by adding the three-term coefficient to the two interaction terms and the Inside Board term.

Table 6: Subsample Analysis for Utility Firms

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on performance of utility firms (SIC code 4) from 1997-2012 using difference-in-difference estimates. The dependent variable and the independent variables are listed in Appendix A. Column 1 shows the primary results of the analysis using operating return on assets as the dependent variable. Column 2 presents the results on operating return on assets where propensity score matching process is used to find firms that have similar characteristics based on the nearest neighbor methodology with replacement. In column 3, the dependent variable is changed to return on sales. Column 4 presents the results for operating return on assets where the main independent variable - *Inside Board* - is defined as firms having insider-control boards for two consecutive years prior to the year 2003. All firm-specific variables are winsorized at the top and bottom percentile. All regressions use industry (Fama & French 49 industry classification) and year fixed effects. The fourth-to-last row in each column estimates the differential performance for non-compliant subsample firms over compliant control firms post-mandate. The third-to-last row calculates the differential performance in the non-compliant control firms post-mandate. The second-to-last row calculates the differential performance for the non-compliant subsample firms and compliant control firms prior to the mandate. The last row calculates the total differential effect of the mandate in these firms. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) OROA	(2) Matched Sample	(3) Return on Sales	(4) Alternative Definition for Inside Board
Inside Board in Year 2000	0.372	0.265	1.905	
	(0.540)	(0.671)	(1.653)	
Inside Board in 2 Consecutive Years Prior to 2003				0.081
				(0.464)
Inside Board * Post Regulation	0.629	0.534	3.724	0.196
	(0.539)	(0.745)	(2.299)	(0.584)
Book Leverage Ratio	-0.080***	-0.030*	-0.486***	-0.073***
	(0.024)	(0.016)	(0.122)	(0.023)
Market-to-Book Ratio	0.554***	0.508***	0.425***	0.581***
	(0.064)	(0.093)	(0.163)	(0.065)
Total Assets	0.809**	0.030	2.217***	0.683**
	(0.365)	(0.253)	(0.473)	(0.327)
Inside Board * Utility Firms	-3.535**	-3.482*	-41.677	-0.519
	(1.727)	(1.970)	(26.154)	(1.387)
Inside Board * Post Regulation * Utility Firms	4.405**	3.103**	35.579*	2.531*
	(1.767)	(1.207)	(20.591)	(1.312)
Obs.	19103	7674	19103	20593
R-square	0.189	0.207	0.040	0.185
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Year * Utility Firms	YES	YES	YES	YES
Number of Firms	1482	615	1482	1597
$\beta_1 + \beta_2 + \beta_3 + \beta_4$	1.871*	0.420	-0.469	2.289**
$\beta_1 + \beta_2$	1.001**	0.799*	5.629*	0.277*
$\beta_1 + \beta_3$	-3.168**	-3.217*	-40.737	-0.323
$\beta_2 + \beta_4$	5.034***	3.637**	35.049*	2.727**

Utility Firms.

For this test, I identified utility firms with SIC codes beginning with 4. In column 1 of Table 5, the interactive coefficient for *Inside Board * Post Regulation * Utility Firms* is positive and statistically significant (4.405). As utility firms face profit maximization constraints, regulations create an environment in which the advisory skills of boards are less valued. Since board members focus on monitoring in a firm where monitoring costs are low (as the firm have fewer advisory needs), this mandate had a pronounced impact on the performance of utility firms.

The differential firm performance post-mandate of non-compliant non-utility firms (1.001) is statistically significant. Additionally, there was also a statistically significant negative differential firm performance of non-compliant utility firms relative to non-utility compliant firms prior to the mandate (−3.168). On the other hand, the estimated differential performance post mandate for non-compliant utility firms relative to compliant non-utility firms is 1.87%. The last row in each column indicates the total differential effect of the mandate in these firms. In this case, there is a relative increase in firm performance of non-compliant utility firms by 5%.

The results are robust whether the matched sample, an alternative definition for the inside board, or an alternative definition are used for the dependent variable, indicating a positive benefit for utility firms that are forced to change to outsider-control boards. The results suggest that legislators were successful in affecting the monitoring function in utility companies with SOX and other related mandates (since Enron and WorldCom were considered utility firms).

Table 7: Subsample Analysis for Small Firms

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on the performance of small firms from 1997-2012 using difference-in-difference estimates. Sales is used as a proxy for size and *Small Firms* are those firms that have below median net sales in the fiscal year 2000. The dependent variable and the independent variables are listed in Appendix A. Column 1 shows the primary results of the analysis using operating return on assets as the dependent variable. Column 2 presents the results for operating return on assets where propensity score matching is used to find firms that have similar characteristics based on the nearest neighbor methodology with replacement. In column 3, the dependent variable is changed to return on sales. Column 4 presents the results for operating return on assets where the main independent variable - *Inside Board* - is defined as firms having insider-control boards for two consecutive years prior to 2003. All firm-specific variables are winsorized at the top and bottom percentile. All regressions use industry (Fama & French 49 industry classification) and year fixed effects. The fourth-to-last row in each column estimates the differential performance for non-compliant subsample firms over compliant control firms post-mandate. The third-to-last row calculates the differential performance in the non-compliant control firms post-mandate. The second-to-last row calculates the differential performance for the non-compliant subsample firms and compliant control firms prior to the mandate. The last row calculates the total differential effect of the mandate in these firms. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) OROA	(2) Matched Sample	(3) Return on Sales	(4) Alternative Definition for Inside Board
Inside Board in Year 2000	0.791	0.092	0.018	
	(0.579)	(0.813)	(1.650)	
Inside Board in 2 Consecutive Years Prior to 2003				0.562
				(0.487)
Inside Board * Post Regulation	0.032	-0.060	0.858	0.095
	(0.511)	(0.831)	(1.880)	(0.441)
Book Leverage Ratio	-0.079***	-0.028*	-0.467***	-0.071***
	(0.024)	(0.016)	(0.114)	(0.023)
Market-to-Book Ratio	0.563***	0.509***	0.412**	0.589***
	(0.065)	(0.093)	(0.162)	(0.067)
Total Assets	0.907*	-0.169	-0.141	0.753
	(0.511)	(0.288)	(1.291)	(0.468)
Inside Board * Small Firms	-0.588	-0.033	-2.847	-0.223
	(0.897)	(1.207)	(4.552)	(0.832)
Inside Board * Post Regulation * Small Firms	1.543*	1.757*	10.408*	1.656*
	(0.924)	(1.034)	(6.345)	(0.997)
Obs.	19103	7674	19103	20593
R-square	0.185	0.202	0.028	0.182
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Year * Small Firms	YES	YES	YES	YES
Number of Firms	1482	615	1482	1597
$\beta_1 + \beta_2 + \beta_3 + \beta_4$	1.778**	1.756**	8.437*	2.090*
$\beta_1 + \beta_2$	0.823	0.032	0.876	0.657
$\beta_1 + \beta_3$	0.203	0.059	-2.829	-0.128
$\beta_2 + \beta_4$	1.575*	1.697*	11.266*	1.751*

Small Firms.

Similar to Coles et al. (2008), I use total sales as a proxy for firm size. As argued by Dang, Li, and Yang (2018), total sales is a backward-looking measure focusing on managerial actions. Using an indicator variable, small firms are defined as those that had net total sales below the median level in 2000.[7] Approximately 28% of small firms had an inside board at the end of fiscal year 2000, which is greater than the percentage of non-compliant firms in the full sample. In column 1 of Table 7, the term for *Inside Board * Post Regulation * Small Firms* is statistically significant and positive (1.460), consistent with the hypothesis that the mandate had a more pronounced impact on smaller firms.

The differential firm performance post-mandate for non-compliant large firms over compliant large firms (0.823) is not statistically significant. Similarly, the differential performance of non-compliant small firms relative to large compliant firms prior to the mandate (0.203) is not statistically significant. On the other hand, the estimated differential performance post-mandate for non-compliant small firms over compliant large firms is 1.78, which is significant at the 5% level. The total differential increase in performance of non-compliant small firms following the mandate is 1.575%. Similar results to column 1 are found if the matched sample is used, firm performance is measured through return on sales, or if non-compliant firms are alternately defined.

These results differ from the announcement results found by Chhaochharia and Grinstein (2007), who argued that SOX and a new exchange mandate would pose an undue burden for small firms in the long run. The long-run observations found here for

[7] According to Harrell (2001), using indicator variables provides certain advantages over using continuous variables, such as avoiding the influence of outliers and imposing less structure on the data (by not assuming a linear form).

small firms suggest that increased monitoring by the new independent board significantly increased firm performance without increasing the cost to the firm, as the advisory role of the board was not sacrificed. Independent directors were able to familiarize themselves with small firms' operations due to their relative lack of complexity.

R&D Intensity.

To measure research intensity, the ratio of R&D expenses to total assets at the end of fiscal year 2000 was used. Consistent with the literature, for firms missing R&D data on CompuStat, R&D expenses were set to 0.[8] In column 1 of Table 7, the interactive coefficient for *Inside Board * Post Regulation * R&D Intensity* is negative and statistically significant (−7.811), consistent with the hypothesis. The differential firm performance of non-compliant non-research-oriented firms over compliant non-research-oriented firms post-mandate (1.012) is statistically significant. However, the differential firm performance of non-compliant research-oriented firms relative to non-research-oriented non-compliant firms prior to the mandate (0.763) is statistically not significant. On the other hand, the differential performance post mandate for non-compliant research firms over non-research-oriented compliant firms is −0.56, which is significant at the 10% level.[9] The differential total decrease in performance of non-compliant research-oriented firm following the mandate is 1.4%. Outside directors are not knowledgeable enough about research-oriented firms to provide adequate advice, leading to a decrease in relative firm performance in non-compliant firms following the mandate compared to compliant firms.

[8] Due to high number of firms with zero R&D Expense, using categorical variables would only include firms with zero R&D expense in the low R&D Intensity category.

[9] The interaction terms are multiplied by the mean value of *R&D Intensity* (0.06) and added to other coefficients.

Table 8: Subsample Analysis for Research Oriented Firms

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on performance of research-oriented firms for 1997-2012 using difference-in-difference estimates. *Research Intensity* is defined as the percentage of total assets devoted to research and development expense in the fiscal year 2000. The dependent variable and the independent variables are listed in Appendix A. Column 1 shows the primary result of the analysis using operating return on assets as the dependent variable. Column 2 presents the results for operating return on assets where propensity score matching process is use to find firms that have similar characteristics based on the nearest neighbor methodology with replacement. In column 3, the dependent variable is change to return on sales. Column 4 presents the results for operating return on assets where the main independent variable - *Inside Board* - is defined as firms having insider-control boards for two consecutive years prior to 2003. All firm-specific variables are winsorized at the top and bottom percentile. All regressions use industry (Fama & French 49 industry classification) and year fixed effects. The fourth-to-last row in each column estimates the differential performance for non-compliant subsample firms over compliant control firms post-mandate. The third-to-last row calculates the differential performance in the non-compliant control firms post-mandate. The second-to-last row calculates the differential performance for the non-compliant subsample firms and compliant control firms prior to the mandate. The last row calculates the total differential effect of the mandate in these firms. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) OROA	(2) Matched Sample	(3) Return on Sales	(4) Alternative Definition for Inside Board
Inside Board in Year 2000	0.070	-0.472	-3.292	
	(0.491)	(0.583)	(3.170)	
Inside Board in 2 Consecutive Years Prior to 2003				0.745*
				(0.434)
Inside Board * Post Regulation	0.942*	1.656***	10.526**	1.087*
	(0.528)	(0.636)	(4.133)	(0.595)
Book Leverage Ratio	-0.080***	-0.033**	-0.488***	-0.072***
	(0.022)	(0.016)	(0.120)	(0.021)
Market-to-Book Ratio	0.575***	0.524***	0.536***	0.595***
	(0.065)	(0.093)	(0.163)	(0.065)
Total Assets	0.699**	-0.067	2.016***	0.555**
	(0.328)	(0.250)	(0.465)	(0.275)
Inside Board * Research Intensity	11.550	18.333	56.918	-17.426
	(12.095)	(17.129)	(47.298)	(12.874)
Inside Board * Post Regulation * Research Intensity	-37.811*	-32.493*	-173.890*	-39.055**
	(18.976)	(20.008)	(104.316)	(17.040)
Obs.	19103	7674	19103	20593
R-square	0.207	0.214	0.028	0.210
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Year * Research Intensity	YES	YES	YES	YES
Number of Firms	1482	615	1482	1597
$\beta_1 + \beta_2 + \beta_3 + \beta_4$	-0.563*	-0.334*	0.216	-1.556**
$\beta_1 + \beta_2$	1.012*	1.184*	7.234**	1.832**
$\beta_1 + \beta_3$	0.763	2.756	0.123	-0.300
$\beta_2 + \beta_4$	-1.399*	-0.355*	-0.234*	-1.389**

The results are qualitatively similar if the matched sample (where 54% firms have inside board), alternative definition for inside board (where a quarter of firms have inside board), or alternative definition for the dependent variable are used. These findings are consistent with the short-run announcement results of Wintoki (2007), indicating that shareholders correctly expected that this mandate would have a negative impact on research-oriented firms.

Conclusion

The general results in Tables 2–4 indicate that, overall, forcing non-compliant firms to adopt outsider-control boards positively impacted firm performance over the long run, which is consistent with the agency view, as explained by Jensen and Meckling (1976) and Bebchuk and Fried (2004), and consistent with the announcement returns observed by Chhaochharia and Grinstein (2007). The sub-sample results of Tables 5–8, however, suggest that the positive results are concentrated in certain non-compliant firms. Utility firms and small firms benefited from the change to outsider-control boards. On the other hand, non-compliant research-oriented firms suffered from changes in their board composition. It is evident that outsider oversight works well for some firms, but for others, it is detrimental. The sub-sample results are consistent with the argument that exchanges should encourage board independence but not make it mandatory (Romano, 2005). Companies should be free to choose their board composition based on their monitoring and advisory needs.

This is the first study to examine board composition and firm performance over a 10-year period following the 2003 exchange mandate. This is also the first study to provide a long-term cross-sectional analysis of different types of firms following the

mandate. Finally, the results and conclusions of the research shed light on the long-standing discussion between agency and insider knowledge theorists over the optimal structure of the board and its impact on firm performance, whereby this research holds policy implications. Future research could examine how the exchange mandate affected firms in other ways, such as the impact on CEO compensation and CEO ownership.

Appendix A: Variable Definitions		
Variable	**Source**	**Definition**
R&D Expense	CompuStat	Costs related to the development of new products and services
Net Income	CompuStat	Net income at the end of fiscal year
R&D Intensity	Compustat	(R&D Expense / Total Assets)
Total Sales	CompuStat	Net total sales at the end of fiscal year
Total Assets	CompuStat	Total assets at the end of fiscal year
Operating Income	CompuStat	Operating income before depreciation at the end of the year
SIC	CompuStat	Office of Management and Budget's Standard Industry Classification Code
Utility Firms	CompuStat	1 if the firm's SIC code begins with 4
Inside Board in Year 2000	RiskMetrics	1 if percentage of outsiders was less than 50% in year 2000
Inside Board in Two Consecutive Years Prior to 2003	RiskMetrics	1 if the percentage of outsiders was less than 50% in two consecutive years prior to year 2003
Return on Sales	CompuStat	(Net Income / Total Sales) * 100
Market-to-Book Ratio	CompuStat	Market capitalization / Common Stock
Operating Return on Assets	CompuStat	(Operating Income / Total Assets) * 100
Book Leverage Ratio	CompuStat	(Debt in Current Liabilities + Long-Term Liabilities) / Total Assets
Post Regulation	-	Denotes 1 for the years 2002 and beyond following the passage of stock-exchange mandate

Appendix B: Propensity Score Model

The following table reports the coefficient estimates of the logit model used to predict a firm having an insider-control board in the year 2000. The dependent variable is 1 if the firm had a majority of insiders on the board of directors in the year 2000 and 0 otherwise. The independent variables are listed in Appendix A. The sample consists of all firm years from 1997–2000. All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parenthesis are heteroscedasticity consistent and clustered along firms. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Variables	Probability of Inside Board
Book Leverage Ratio	0.004**
	(0.002)
Total Assets	-0.233***
	(0.016)
Market-to-Book Ratio	-0.015*
	(0.008)
Percent Concordant	70.8%
Chi Square	1324.94
Industry Dummy	YES
Year Dummy	YES
Number of Observations	5805

Appendix C: PSM without Replacement

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on firm performance of all firms from 1997–2012 using difference-in-difference estimates. Here the propensity score matching process is used to find firms that had similar characteristics based on the one-to-one nearest neighbor methodology without replacement. The dependent variable is operating return on assets in all four columns. The independent variables are described in Appendix A. In column (1), I look at performance of all firms. In column (2), firms with SIC code 4 are designated as *Utility Firms*. In column (3), *Small Firms* have below median net sales in fiscal year 2000. In column (4), *R&D Intensity* as the percentage of total assets devoted to research and development expense in the fiscal year 2000. All variables are winsorized at the top and bottom percentile. All regressions use industry (Fama and French 49 industry classification) and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered along the firms. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) OROA	(2) OROA	(3) OROA	(4) OROA
Inside Board in Year 2000	0.443	0.783	1.490*	-0.455
	(0.610)	(0.639)	(0.775)	(0.601)
Inside Board * Post Regulation	0.951*	0.759	-0.953	0.725
	(0.605)	(0.736)	(0.774)	(0.892)
Inside Board * Utility Firms		-3.855**		
		(1.866)		
Inside Board * Post Regulation * Utility Firms		3.870*		
		(2.255)		
Inside Board * Small Firms			-1.729	
			(1.173)	
Inside Board * Post Regulation * Small Firms			3.353**	
			(1.356)	
Inside Board * R&D Intensity				26.571
				(16.370)
Inside Board * Post Regulation * R&D Intensity				-32.998*
				(13.310)
Book Leverage Ratio	-0.086**	-0.086**	-0.085**	-0.082**
	(0.040)	(0.040)	(0.040)	(0.035)
Market-to-Book Ratio	0.553***	0.550***	0.554***	0.553***
	(0.099)	(0.099)	(0.100)	(0.097)
Total Assets	1.017	1.020	1.356	0.698
	(0.788)	(0.788)	(1.035)	(0.630)
Obs.	8900	8900	8900	8900
R-squared	0.144	0.147	0.148	0.189
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Year*Characteristic Variable	NO	YES	YES	YES
Number of Firms	712	712	712	712

Appendix D: PSM 2-to-1 without Replacement

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on firm performance of all firms from 1997–2012 using difference-in-difference estimates. Here the propensity score matching process is used to find firms that had similar characteristics based on the two-to-one nearest neighbor methodology without replacement: For every non-compliant firm, I use two compliant firms. The dependent variable is operating return on assets in all four columns. The independent variables are described in Appendix A. In column (1), I look at performance of all firms. In column (2), firms with SIC code 4 are designated as *Utility Firms*. In column (3), *Small Firms* have below median net sales in fiscal year 2000. In column (4), *R&D Intensity* as the percentage of total assets devoted to research and development expense in the fiscal year 2000. All variables are winsorized at the top and bottom percentile. All regressions use industry (Fama and French 49 industry classification) and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered along the firms. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
	OROA	OROA	OROA	OROA
Inside Board in Year 2000	0.515	0.781	0.666	-0.034
	(0.517)	(0.533)	(0.614)	(0.526)
Inside Board * Post Regulation	0.749*	0.595	0.039	0.916
	(0.432)	(0.555)	(0.575)	(0.632)
Inside Board * Utility Firms		-3.077*		
		(1.777)		
Inside Board * Post Regulation * Utility Firms		3.794*		
		(1.966)		
Inside Board * Small Firms			-0.285	
			(0.973)	
Inside Board * Post Regulation * Small Firms			1.343**	
			(0.420)	
Inside Board * R&D Intensity				18.066
				(12.853)
Inside Board * Post Regulation * R&D Intensity				-37.666*
				(23.413)
Book Leverage Ratio	-0.069**	-0.070**	-0.069**	-0.069***
	(0.027)	(0.027)	(0.028)	(0.025)
Market-to-Book Ratio	0.536***	0.536***	0.537***	0.545***
	(0.074)	(0.074)	(0.075)	(0.075)
Total Assets	0.747	0.755	0.863	0.615
	(0.513)	(0.514)	(0.701)	(0.459)
Obs.	13575	13575	13575	13575
R-squared	0.152	0.155	0.153	0.178
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Year*Characteristic Variable	NO	YES	YES	YES
Number of Firms	1068	1068	1068	1068

Appendix E: Additional Subsample Analyses

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on firm performance of utility and small firms from 1997–2012 using difference-in-difference-in-difference estimates. For the first column, small firms are removed from the data. For the second column, utility firms are removed from the data. The dependent variable is operating return on assets in all four columns. The independent variables are described in Appendix A. In column (1), firms with SIC code 4 are designated as *Utility Firms*. In column (2), *Small Firms* have below median net sales in fiscal year 2000. All variables are winsorized at the top and bottom percentile. All regressions use industry (Fama and French 49 industry classification) and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered along the firms. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) OROA	(2) OROA
Inside Board in Year 2000	0.934*	1.007*
	(0.507)	(0.607)
Inside Board * Post Regulation	-0.531	-0.515
	(0.495)	(0.515)
Inside Board * Utility Firms	-2.969	
	(2.104)	
Inside Board * Post Regulation * Utility Firms	7.748***	
	(2.173)	
Inside Board * Small Firms		-0.383
		(0.942)
Inside Board * Post Regulation * Small Firms		1.978**
		(0.956)
Book Leverage Ratio	-0.039***	-0.085***
	(0.012)	(0.027)
Market-to-Book Ratio	0.616***	0.582***
	(0.062)	(0.071)
Total Assets	-0.356**	1.131**
	(0.166)	(0.568)
Obs.	9994	16843
R-squared	0.358	0.191
Industry Dummy	YES	YES
Year Dummy	YES	YES
Year*Characteristic Variable	YES	YES
Number of Firms	742	1305

References

Acharya, V. V., Baghai, R. P., & Subramanian, K. V. (2014). Wrongful discharge laws and innovation. *The Review of Financial Studies*, *27*(1), 301-346.

Adams, R. B. (2012). Governance and the Financial Crisis. *International Review of Finance*, *12*(1), 7-38.

Adams, R. B., and Ferreira, D. (2007). A theory of friendly boards. *The Journal of Finance*, *62*(1), 217-250.

Adams, R. B., and Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of financial economics*, *94*(2), 291-309.

Adams, R. B., Hermalin, B. E., and Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of economic literature*, *48*(1), 58-107.

Al-Matari, E. M., Al-Swidi, A. K., & Fadzil, F. H. B. (2014). The measurements of firm performance's dimensions. *Asian Journal of Finance & Accounting*, *6*(1), 24.

Almazan, A., and Suarez, J. (2003). Entrenchment and severance pay in optimal governance structures. *The Journal of Finance*, *58*(2), 519-548.

Austin, P. C., and Steyerberg, E. W. (2012). Interpreting the concordance statistic of a logistic regression model: relation to the variance and odds ratio of a continuous explanatory variable. *BMC medical research methodology*, *12*(1), 1-8.

Autor, D. H., Donohue III, J. J., and Schwab, S. J. (2006). The costs of wrongful-discharge laws. *The review of economics and statistics*, *88*(2), 211-231.

Bathala, C. T., and Rao, R. P. (1995). The determinants of board composition: An agency theory perspective. *Managerial and decision economics, 16*(1), 59-69.

Baysinger, B. D., and Butler, H. N. (1985). Corporate governance and the board of directors: Performance effects of changes in board composition. *Journal of Law, Economics, & Organization*, *1*(1), 101-124.

Bebchuk, L., and Fried, J. (2004). *Pay without performance: The Unfulfilled Promise of Executive Compensation*. Cambridge, MA: Harvard University Press.

Berger, P. G., Ofek, E., and Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The journal of finance*, *52*(4), 1411-1438.

Bhagat, S., and Black, B. S. (2002). The non-correlation between board independence and long-term firm performance. *Journal of Corporation Law*, *27*, 231-273.

Bhagat, S., and Bolton, B. (2008). Corporate governance and firm performance. *Journal of Corporate Finance*, *14*(3), 257-273.

Bhagat, S., and Bolton, B. (2013). Director ownership, governance, and performance. *Journal of Financial and Quantitative Analysis, 48*(1), 105-135.

Chhaochharia, V., and Grinstein, Y. (2007). Corporate governance and firm value: The impact of the 2002 governance rules. *The Journal of Finance, 62*(4), 1789-1825.

Chhaochharia, V., and Grinstein, Y. (2007b). The changing structure of US corporate boards: 1997–2003. *Corporate Governance: An International Review*, *15*(6), 1215-1223.

Chhaochharia, V., and Grinstein, Y. (2009). CEO compensation and board structure. *The Journal of Finance*, *64*(1), 231-261.

Chung, H. J., and John, K. (2017). Board independence, CEO ownership, and compensation. *Asia-Pacific Journal of Financial Studies, 46*(4), 558-582.

Coles, J. L., Daniel, N. D., and Naveen, L. (2008). Boards: Does one size fit all? *Journal of Financial Economics*, *87*(2), 329-356.

Dalton, D. R., Daily, C. M., Ellstrand, A. E., and Johnson, J. L. (1998). Meta-analytic reviews of board composition, leadership structure, and financial performance. *Strategic management journal*, *19*(3), 269-290.

Dang, C., Li, Z. F., and Yang, C. (2018). Measuring firm size in empirical corporate finance. *Journal of Banking & Finance*, *86*, 159-176.

Duchin, R., Matsusaka, J. G., and Ozbas, O. (2010). When are outside directors effective? *Journal of Financial Economics*, *96*(2), 195-214.

Fairfax, L. M. (2010). The uneasy case for the inside director. *Iowa L. Rev.*, *96*, 127.

Faleye, O., Hoitash, R., and Hoitash, U. (2011). The costs of intense board monitoring. *Journal of Financial Economics*, *101*(1), 160-181.

Fama, E. F. (1980). Agency Problems and the Theory of the Firm. *The Journal of Political Economy 88*(2), 288-307.

Fan, P. S. (2004). Review of Literature & Empirical research on corporate governance. *Financial services group training unit monetary authority of Singapore.*

Geddes, R., and Vinod, H. D. (2002). CEO tenure, board composition, and regulation. *Journal of Regulatory Economics*, *21*(2), 217-235.

Gordon, J.N. (2006). The rise of independent directors in the United States, 1950-2005: Of shareholder value and stock market prices. *Stanford Law Review, 59*(6), 1465-1568.

Guo, L., Lach, P., and Mobbs, S. (2015). Tradeoffs between internal and external governance: Evidence from exogenous regulatory Shocks. *Financial Management, 44*(1), 81-114.

Harrell, F. E. (2001). *Regression modeling strategies: With applications to linear models, logistic regression, and survival analysis.* New York: Springer.

Harris, M., and Raviv, A. (2008). A theory of board control and size. *Review of Financial Studies*, *21*(4), 1797-1832.

Hermalin, B. E., and Weisbach, M. S. (1991). The effects of board composition and direct incentives on firm performance. *Financial management, 20*(4), 101-112.

Hermalin, B. E., and Weisbach, M. S. (1998). Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review 88*(1), 96-118.

Hermalin, B. E., and Weisbach, M. S., (2003). Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature. *Federal Reserve Bank of New York Economic Policy Review, 9*(1), 7–26.

Hirschey, M., & Pappas, J. L. (1981). Regulatory and life cycle influences on managerial incentives. *Southern Economic Journal*, 327-334.

Jensen, M. C., and Meckling, W. H. (1976). Agency Costs and the Theory of the Firm. *Journal of Financial Economics*, *3*(4), 305-360.

Kahn-Lang, A., & Lang, K. (2020). The promise and pitfalls of differences-in-differences: Reflections on 16 and pregnant and other applications. *Journal of Business & Economic Statistics*, *38*(3), 613-620.

Knyazeva, A., Knyazeva, D., and Masulis, R. W. (2013). The supply of corporate directors and board independence. *Review of Financial Studies*, *26*(6), 1561-1605.

Lee, S. K., and Carlson, L. R. (2007). The changing board of directors: Board independence in S&P 500 firms. *Journal of Organizational Culture, Communication and Conflict*, *11*(1), 31-41.

Lu, J., and Wang, W. (2018). Managerial conservatism, board independence and corporate innovation. *Journal of Corporate Finance*, *48*, 1-16.

Mace, M. L. (1971). *Directors: Myth and Reality*. Boston, MA: Harvard Business School Press.

Roberts, M. R., and Whited, T. M. (2013). Endogeneity in Empirical Corporate Finance. In *Handbook of the Economics of Finance* (Vol. 2, pp. 493-572). Elsevier.

Romano, R. (2005). The Sarbanes-Oxley Act and the making of quack corporate governance. *Yale LJ*, *114*, 1521-1611.

Roth, Jonathan Daniel. 2020. Essays in Robust Inference. *Doctoral dissertation*. Harvard University, Graduate School of Arts & Sciences.

Strebulaev, I. A., & Yang, B. (2013). The mystery of zero-leverage firms. *Journal of Financial Economics*, *109*(1), 1-23.

Wintoki, M. B. (2007). Corporate boards and regulation: The effect of the Sarbanes–Oxley Act and the exchange listing requirements on firm value. *Journal of Corporate Finance*, *13*(2), 229-250.

CHAPTER III

ESSAY 2: MANAGERIAL POWER VS COMPLEMENTARITY: A STUDY ON THE AGENCY EFFECT OF BOARD COMPOSITION ON CEO COMPENSATION

Introduction

Agency conflicts arise when decision makers do not bear the full consequences of their actions (Jensen & Meckling, 1976). Agency theorists believe that as CEOs are self-serving and unscrupulous (Fan, 2004), a strong governance mechanism resulting from an outsider-control board is needed (a board with a majority of independent directors) to better align the actions of management with shareholder interests. Following the scandals of the early 21st century, stock market regulators decided that stronger corporate governance was needed to protect shareholders from CEOs and their management. As a result, in 2003 the listing exchanges (Amex, NASDAQ, and NYSE), with backing from the Securities and Exchange Commission (SEC), required publicly traded companies to change board composition from insider-control to outsider-control in the belief that independent directors would be better able to monitor CEOs. The goals of this study are to examine the impact of this mandate on CEO pay-for-performance sensitivity and total CEO compensation for firms that had to change board composition.

Agency theorists believe that CEOs of insider-control boards have sufficient influence to determine how much of their compensation is through pay-for-performance sensitivity (incentive-based pay) and how much is in cash (including other forms of non-incentive pay), resulting in compensation packages that are out of line with shareholder interests. Greater pay-for-performance sensitivity should be used to align the interests of CEOs with the goal of shareholder wealth maximization. Jensen and Murphy (1990) showed that increasing pay-for-performance sensitivity forces self-centered CEOs to adopt policies that maximize shareholder wealth. A strong board will be able to create a compensation plan with more incentives (usually in the form of stock grants) to better align the actions of management with shareholder interests (Hartzell, & Starks, 2003). Thus, my first hypothesis is that the CEO pay-for-performance sensitivity of firms that had to change their board structure increased following the mandate.

Similar to Hartzell and Starks (2003), I measure pay-for-performance sensitivity as the change in total compensation as a result of a change in the market value of equity. Similar to Duchin et al. (2010) and Guo et al. (2015), firms were sorted into two groups based on their board composition level in the year 2000: firms that had to change their board structure (non-compliant firms) and firms that did not have to change their board structure (compliant firms). Even after controlling for new disclosure requirements related to executive compensation by the SEC and the mandate of the Fair Accounting Standards Board (FASB) regarding expensing the options awarded, my results were consistent with the agency theory: pay-for-performance sensitivity increased for non-compliant firms following the mandate.[10] However, it is possible to argue that, by

[10] See Appendix B for details regarding the new pay disclosure requirements.

employing greater pay-for-performance sensitivity, total CEO compensation either increases (complementarity view) or decreases (managerial power view) in the long term. The second goal of this study is to examine the impact on total CEO compensation in the long term due to the mandated change in board composition.

Bebchuk and Grinstein (2005) argue that CEOs can extract uneven compensation from the board of directors if the board is controlled by insiders. CEOs have too much sway over inside board members, as CEOs are ultimately responsible for their primary job and pay. Consequently, CEOs have disproportionate influence over their own compensation (Berger, Ofek, & Yermack, 1997). As a result, the current structure of executives' pay has allowed management to secure substantial monetary gains even when their companies' performance is deficient (Bebchuk & Fried, 2005). In other words, the CEO compensation packages are often excessive. Under this view, called the *managerial power view*, we expect the outside board of directors to deal with the agency problem by reducing CEOs' influence from their associated compensation packages (Bebchuk & Fried, 2004, 2005). This means that total CEO compensation for non-compliant firms will be reduced following the board independence mandate.

Fahlenbrach (2009) argues that governance mechanisms and pay-for-performance contracts complement one another. Frydman and Jenter (2010) claim that the existing level of CEO pay is not excessive and is the result of competitive equilibrium in the market of talented CEOs. Increased pay-for-performance sensitivity robs CEOs of the ability to invest their income elsewhere, including the ability to diversify their investments. Additionally, because long-term incentive plans fail to mature unless a definite benchmark is reached, increasing firm-specific risks causes a decrease in the

value of CEO compensation packages (Fahlenbrach, 2009).[11] Thus, to increase the value of an incentive plan for executives, under this *complementarity view*, boards must also concurrently increase total compensation (Core, Guay, & Thomas, 2005).

While both the managerial power and complementarity views suggest how the new mandate might have impacted CEO compensation, in a number of cases it is impossible to argue, a priori, that CEO compensation would likely either decrease or increase, so in these cases the final answer remains an empirical question. In some studies, an independent board is needed to rein in CEO compensation (Bebchuk & Fried, 2004, 2005). Others insist that adoption of an independent board will result in an increase in CEO compensation (Almazan & Suarez, 2003; Core, et al., 2005). The second hypothesis addresses the impact of the mandate on the total CEO compensation of non-compliant firms.

Overall, my findings indicate that total CEO compensation increased in the long run for non-compliant firms following the mandate compared to compliant firms. The result is consistent with the complementarity view that, along with their pay-for-performance sensitivity, incumbent CEOs at non-compliant firms will receive an increase in total compensation, as the new independent boards will reimburse CEOs to bear greater firm-specific risks. This long-term result has not been documented previously in the literature.

I controlled for additional factors that might have confounded the results. First, I controlled for the new disclosure requirements as a result of FAS 123R, which might

[11] The major compensation component of CEO pay-for-performance component is often a long-term-incentive plan (LTIP), which is vested over time and does not mature for several years (Conyon & Murphy, 2000; Goergen & Renneboog, 2011). This is another reason why a long-term study is needed to capture the effect of the mandate on CEO compensation.

have changed the level and structure of CEO compensation. Second, I tested whether prior mandates by listing exchanges affected total CEO compensation through a falsification test. Third, I controlled for the increase in compensation resulting from the signing bonus awarded to new CEOs. Fourth, I also controlled for yearly shocks that might have impacted the supply and demand of CEOs in a particular industry. I found that these confounding factors do not impact the primary results: The board independence mandate increased total CEO compensation in non-compliant firms.

The increase in total CEO compensation can be through cash compensation, non-incentive equities, or additional restricted stock options. If the increase is through cash compensation, one could argue that this increase by an independent board is a sign of the bargaining power of an entrenched CEO (Bebchuk & Fried, 1998; Hermalin & Weisbach, 2004). I performed additional tests on cash and equity compensation to confirm that the results expected under the complementarity view hold. The complementarity view predicts an increase in total compensation due to strong governance mechanisms. Thus, we would expect the increase in total compensation not to be through cash compensation but through equity compensation. I examined total cash compensation and found no change in cash compensation for non-compliant firms following the mandate. When I examined equity compensation, I found that non-compliant firms increased equity compensation compared to compliant firms following the mandate, which is consistent with the complementarity view.

This study belongs to a group of studies that show that board structure is an important variable explaining CEO pay variation. However, I avoided the pitfalls of other such studies. For instance, Fahlenbrach (2009) failed to control for exogenous shocks;

Ryan and Wiggins (2004) and Guthrie, Sokolowsky, and Wan (2012) focused on a short time frame; and Chhaochharia and Grinstein's (2009) study is plagued by a technical irregularity that renders their results inconclusive. In addition, unlike previous studies (see review studies by Hermalin & Weisbach, 2003; Adams, Hermalin, & Weisbach, 2010; Frydman & Jenter, 2010; Goergen & Renneboog, 2011; Murphy, 2013; Edmans, Gabaix, & Jenter, 2017), I present a detailed picture of long-term changes in CEO compensation.

My contributions to the literature are as follows: This is the first study to examine board composition and CEO compensation over the 10-year period following the exchange mandate of 2003. It expands the literature on the effect of changes in board composition on CEO compensation over a longer period than the short-run analyses of Chhaochharia and Grinstein (2009) and Guthrie et al. (2012). The results and conclusions of this research have the potential to reconcile two agency views over the CEO's optimal pay: managerial power and complementarity. This research shows that one of the reasons for variations in CEO compensation is changes in board composition as an effect of the board independence mandate, in which respect this study holds policy implications.

Section II of this paper briefly reviews the literature and discusses the research hypotheses. Section III describes the data, variable usage, and summary statistics. The main results on pay for performance sensitivity are presented in Section IV. Section V conducts tests on total compensation. Section VI presents robustness tests related to total compensation. Section VII reports the results for cash versus equity compensation. Section VIII concludes.

Literature Review

In this section, I describe the 2003 mandate on changes in board structure and how the new independent board might set CEO compensation. Next, I describe the agency theory and its predictions of pay-for-performance sensitivity. I then make a series of predictions regarding decreases or increases in total CEO compensation following a change in board composition based on a body of agency literature related to the relationship between board composition and CEO compensation in accordance with the managerial power and complementarity views.[12]

Board Independence Mandate. Following the scandals of the early 21st century, regulators decided that much stronger corporate governance was needed to protect shareholders from CEOs and their management. As a result, AMEX, NASDAQ, and NYSE required publicly traded companies to change board composition from insider-control to outsider-control (one with a majority of independent directors). Moreover, the monitoring function of boards was increased following the mandate, with independent directors responsible for evaluating management performance, determining management salary (or ratifying and approving salaries if the firm had a compensation committee[13]), and ensuring the integrity of the audit process (Chhaochharia & Grinstein, 2007).[14] An

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[12] It is important to note that these views are part of agency theory. As argued by Murphy (2013), the establishments that exist to minimize agency costs between managers and shareholders (i.e., the complementarity view) have allowed managers to extract rents by exacerbating the agency problem between shareholders and directors (i.e., the managerial power view).

[13] One might argue that examining changes in compensation committee structure might be more important and informative than looking at overall board independence. However, most compensation committees are made up of independent directors because SEC guidelines have required firms since 1994 to have a compensation committee comprised entirely of independent directors in order to be exempt from a $1 million executive salary cap (see Murphy, 2013).

[14] Along with the mandate, Congress also the passed the Sarbanes-Oxley Act of 2002 (SOX). Since SOX and the board independence mandate were passed around the same time, it is impossible to separate the effects of the mandate from those of SOX. For instance, Guo et al. (2015) used board composition levels to study SOX effects, while Chhaochharia and Grinstein (2007) used SOX mandates to study the effects of the mandate.

important distinction to note is that prior to the mandate, the move toward an independent board was largely an endogenous decision by the firm, while the mandate was an exogenous shock. Thus, the passage of the mandate affords us a natural experiment to study the impact of the outside board on CEO compensation.

CEO Compensation Setup. In a typical setup to determine CEO pay, the compensation committee determines the CEO's market wage necessary for executive retention through peer benchmarking, with help from compensation consultants (Ellig, 2001). According to Clifford (2017), who served as a chief executive officer in the broadcasting industry for over 14 years and as board director for 13 different companies, the compensation committee begins the process of determining the compensation package for key executives by first approving a peer group, which can be recommended by management, consultants, or members of the board. The peer group generally consists of firms that are similar in terms of industry, size, and complexity as a means of gauging the market wage of their own CEO necessary to retain that executive (Ellig, 2001; Elson & Ferrere, 2012). More than 85% of firms use some benchmarking criteria to set CEO compensation (Albuquerque et al., 2013). For example, the compensation committee for a food producer may include technology companies, insurance companies, financial firms, and other unrelated firms in their peer group. The compensation committee can decide which companies are included in the peer group. Ultimately, the board of directors can accept, reject, or revise the peer group as they see fit. This example highlights the influence of the board on the benchmarking process.

After selecting the peer group, the committee formally benchmarks the CEO's compensation to that of the peers. Firms generally want to signal strength to the market

by selecting a salary that is above average. It is common to benchmark CEOs to the 50th, 70th, or 90th percentile (Elson & Ferrere, 2012). This process can be used to negotiate all or part of the compensation package with the CEO (Clifford, 2017). In addition to negotiating the package, the board must negotiate the performance measures used in consideration of how much of that pay will be through incentives. Even if the board does not decide the size of the bonus, the directors must find a way to connect CEO performance to the incentive plan.

It is natural to question what role the new independent boards could play in determining CEO compensation in this environment. Although the goal should be to compare similar firms in the benchmarking process, Clifford (2017) emphasizes that practice is often different from theory. As shown by Bebchuk and Fried (2004), in most cases, compensation consultants are used to justify exuberant CEO pay. As reviewed by Hermalin and Weisbach (2003), Adams et al. (2010), Frydman and Jenter (2010), and Edmans et al. (2017), the board of directors can influence some or all parts of CEO pay because creating a compensation plan is not a mechanical process. First, as argued by Chhaochharia and Grinstein (2009), following a change in board composition, the whole board decides on the kind of compensation committee to select (whether smart, assertive, docile, or compliant). Second, it is still up to the entire board to agree upon the compensation package and decide whether to ratify or modify the committee's recommendations. Finally, as argued by Elson and Ferrere (2012), the recommendation derived from peer benchmarking is a single data point among many other factors. The process of developing a compensation package for CEOs is a dynamic process. As the board changes, the influence of the board on the compensation package also changes.

Agency Theory. Agency theory argues that since CEOs do not own a majority of shares in companies that they manage, the temptation to consume company resources for their own benefit is very high (Jensen & Meckling, 1976). Since one of the duties of the board of directors is to ratify and approve CEO compensation, CEOs have incentives to control the board so they can determine the amount and method of their pay. Agency theorists believe that CEOs are paid too much in non-incentive pay and not enough in incentive-based compensation. To remedy this, a board of directors is needed that is not affiliated with the management (outsiders) and would like to maintain their current position and reputation in the labor market (Fama, 1980). In this environment, CEOs need to align their performance with shareholder expectations and demonstrate that they have improved shareholder wealth.

Outsider-control boards can reduce agency costs by implementing compensation plans that maximize shareholder wealth and remove unfit executives. One way outside directors can align CEOs' interests with those of shareholders is by increasing the incentive portion of the CEOs' compensation packages. As a result, a restructuring of CEO compensation would take place after the mandate. Thus, I hypothesize that pay-for-performance sensitivity would increase in non-compliant firms following a change in board composition.[15]

Managerial Power View. Under the managerial power view, CEOs have too much influence over inside board members and, as a consequence, too much influence over their own compensation packages (Berger, Ofek, & Yermack, 1997). Proponents of the mandate believe that CEOs can extract rent from their firms as long as they do not invite

[15] The null hypothesis is consistent with Romano's window-dressing theory (2005)—no change will be observed as a result of this mandate.

the outrage of shareholders, involvement of activist investors, or hostile takeover attempts by corporate raiders (Bebchuk & Fried, 2005). These compensation packages have allowed management to secure generous monetary gains, even when their company's performance is deficient. Thus, the CEO compensation packages are often excessive.

Bebchuk and Fried (2004) recommend that companies increase the monitoring function of the board to reduce the influence of CEOs on their compensation and to create remuneration packages that are reasonable. After the 2003 exchange mandate, the presence of independent boards increased the monitoring function of boards. With the elimination of insider-control boards, CEOs' influence over boards was reduced. As a result, total compensation decreased after the mandate.

Complementarity View. Under the complementarity view, as described by Fahlenbrach (2009), governance mechanisms and pay-for-performance contracts complement one another. Frydman and Jenter (2010) argue that the existing level of CEO pay is the result of an equilibrium reached in the market of talented CEOs. Increasing pay-for-performance sensitivity reduces the value of the CEOs' compensation package, since a more incentive-based package reduces the CEOs' ability to diversify their own wealth (Core, et al., 2005; Murphy, 2013).

To illustrate this point, imagine a CEO is offered two choices for annual income. Option 1 is $5 million in cash compensation today and $5 million in stock options maturing at the end of the year with either a $0 or $10 million value. Option 2 is $0 in cash compensation and $10 million in stock options maturing at the end of the year, with

either a $0 or $20 million value. Thus, assuming no trading costs, no taxes, and no inflation, the expected value of either choice is $10 million.

Even though the expected total value of compensation is $10 million for the CEO and the cost to the company is $10 million in either scenario, the CEO prefers Option 1 to Option 2 because, under Option 1, the CEO can take $5 million today and use it for his preferred choice. If the CEO is a risk-taker, he or she can always go and buy the options in the market. If the CEO is risk-averse, then he prefers to invest $5 million somewhere else. Thus, the value that the CEO places in stock options is less than the guaranteed non-incentive income. As a result of greater pay-for-performance compensation, the CEO has become less diversified and more restricted with regard to choices concerning his wealth. To compensate the CEO for bearing additional risks, the outside board will also concurrently increase total compensation when switching to compensation plans with greater pay-for-performance sensitivity.

Almost 15 years have passed since companies converted to outsider-control boards, and we still do not fully understand the impact of independent boards on total CEO compensation. It is impossible to state a priori that total CEO compensation would either increase or decrease following a move toward more incentive-based compensation. As mentioned above, there is evidence to support both sides of the debate regarding the effect on total CEO compensation. The second hypothesis addresses the impact of the mandate on the total CEO compensation of non-compliant firms.

Data & Variables

Data & Endogeneity. The data for this study is extracted from three sources. Information regarding CEO compensation for S&P 1500 firms is extracted from ExecuComp for

1996-2012. Information regarding the board of directors comes from RiskMetrics which tracked the records of S&P 1500 firms from 1996 to 2009. This information is matched with the financial information of publicly traded firms in the United States, provided by CompuStat from 1997 to 2012. I removed Apple, Inc. (formerly Apple Computers, Inc.) and Fossil, Inc. from the data, as Guthrie, et al. (2012) have shown that these companies biased the results of investigating CEO compensation during this time period. All data is winsorized at the top and bottom percentiles.

Controlling for endogeneity is an important issue when studying the impact of board composition (Hermalin & Weisbach, 2003). As pointed out by Graham, Li, and Qiu (2012), omitted variable bias (a form of the endogeneity problem) must be considered when studying CEO compensation. An omitted variable bias exists when an unobservable characteristic affects the independent variable. I was able to avoid endogeneity concerns by analyzing the results of a natural experiment, the exchange mandate of 2003, on non-compliant firms against a control group—compliant firms (Adams, Hermalin, & Weisbach, 2010). If changes to board composition can be attributed to unobservable CEO characteristics, then investigating the independence mandate helps ease this concern.

Variables. The variables used in this study are defined as follows. Appendix A provides more information about the variables.

Compensation Variables - Following the literature, *Total Compensation* is the sum of all salaries, bonuses, stock options, restricted stock grants, and other compensation awarded to the CEO during the fiscal year (Bebchuk & Grinstein, 2005; Fahlenbrach, 2009; Chhaochharia & Grinstein, 2009; Coles et al., 2014).

For the first hypothesis, pay-for-performance sensitivity was measured as the change in total compensation ($\Delta\, Total\ Compensation$) as a result of changes in the market value of equity (similar to Hartzell & Starks, 2003). Jensen and Murphy (1990) argue that a compensation plan that varies the total pay when performance changes provides better management incentives.

I define *Cash Compensation* as the sum of cash and bonus awarded to the CEO for years prior to the disclosure requirement and the sum of cash, bonus, and non-equity incentives awarded to the CEO for years after the new disclosure requirements (see Appendix B). *Equity Compensation* is defined as the difference between total compensation and cash compensation.

Board Independence and Mandate - *Inside Board* is a constant variable indicating the compliant and non-compliant groups based on board composition prior to the board independence mandate. It is defined as those firms that have a majority of inside directors in 2000, similar to Chhaochharia and Grinstein (2007), Duchin et al. (2010), and Guo et al. (2015). The non-compliant (or treatment) firms consist of all firms that were insider-controlled in 2000 and are affected by the exchange mandate. Firms that were already outsider-controlled in 2000 and were not affected by the exchange mandate were compliant (or control) firms. Specifically, the value for *Inside Board* is equal to 1 if the ratio of inside directors to the total number of directors is equal to or greater than 0.5 at the end of fiscal year 2000; the value is 0 if the ratio is less than 0.5.

Post Regulation is a dummy variable equal to 1 for the year 2002 and beyond.[16] Since some companies preemptively changed board composition to outside boards in the announcement year, I use the year 2002 as the event year (see Guo, et al. (2015)).

Control Variables - Adding control variables limits cross-sectional and time-series variations. Firm-specific control variables include total sales, return on assets, and annual return, similar to Jensen and Murphy (1990), Bebchuk and Fried (2005), Chhaochharia and Grinstein (2009), Guthrie et al. (2012), and Coles et al. (2014). *Total Sales* is used to measure firm size and is defined as the natural logarithm of total sales. I use the natural log of return on assets (*Return on Assets*) and the natural log of annualized holding period return (*Annual Return*) to control for firm performance. All control variables are lagged by one year to avoid the endogeneity concern—the effect that compensation has on size and performance.

Exogenous Shock. To visualize the exogenous shock on board composition, the median percentage of outside directors for 1996–2009 is plotted in Figure 1. The dotted line indicates compliant firms, and the solid line indicates non-compliant firms. Figure 1 indicates that there was a significant difference in board composition between the two groups prior to 2000. For instance, in 2000, the median percentage of outsiders in an insider-control firm was less than 40%; by 2009, this figure had increased to more than 70%. Firms compliant before the new regulation showed a more modest increase (from 65% to 75%, equivalent to adding one more independent director). The figure shows why firms with outsider-control boards in the year 2000 are an obvious control group in the DD estimation approach.

[16] The results do not change if 1 is used for 2003 and beyond.

Figure 1: Average Percentage of Outside Directors on Boards over Time

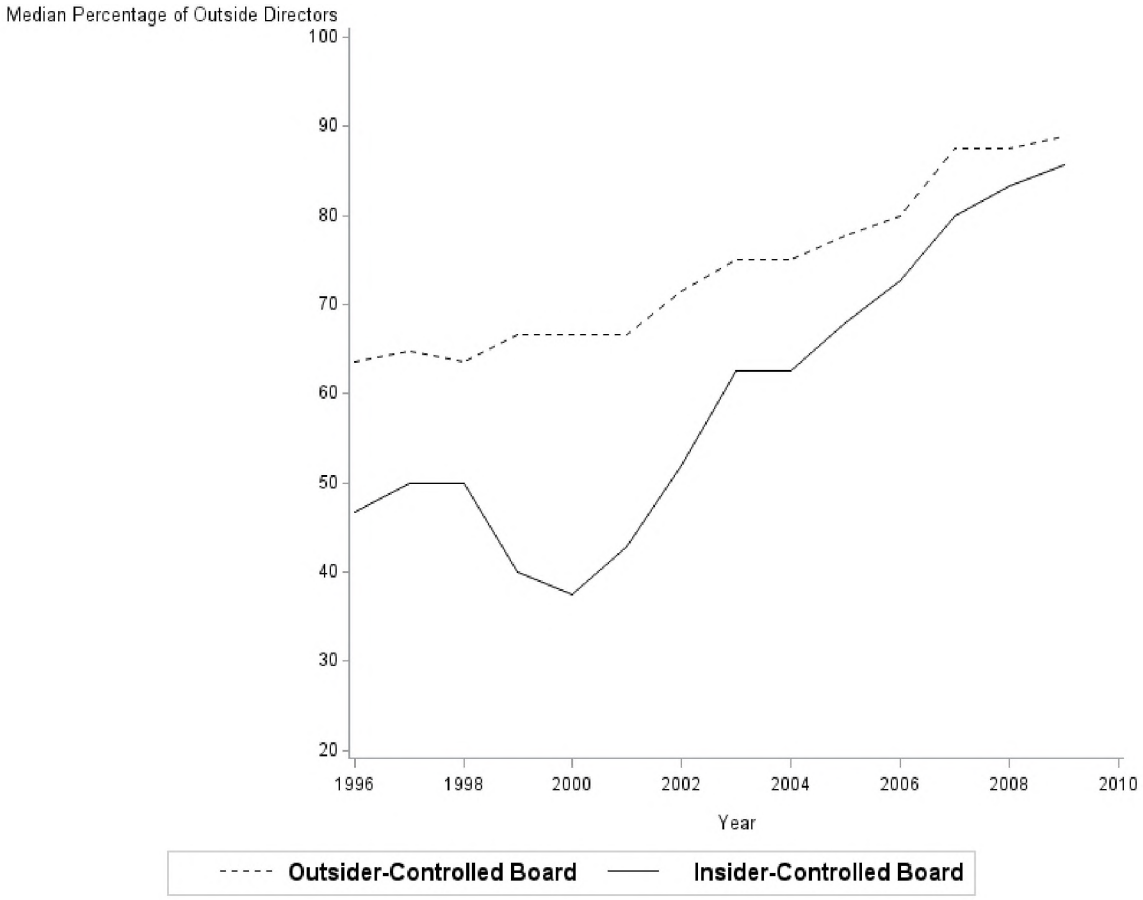

Figure 1: A time series plot of the median percentage of outside directors on the board over time. An Insider-Controlled Board (Outsider-Controlled Board) is one that has (does not have) a majority of inside directors in 2000.

Propensity Score Matching. Similar to Guo et al. (2015), I also examined a subsample of matched non-compliant and compliant firms to determine how similar firms that differed in board independence prior to the mandate adjusted their CEO compensation packages following the mandate. I employed propensity score matching with a one-to-one replacement methodology, following Lu and Wang (2018).

To apply this strategy, I first estimated a logit model in which the dependent variable is whether the firm had an insider-control board in the year 2000. Independent variables include all continuous control variables (without lag), as well as firm and year fixed effects. The logit model was estimated using data for 1997–2000, and the estimation results are reported in Appendix C. A concordance rate was found of 73.6%, well above the 50% rate associated with no predictive power.

Summary Statistics. Table 1 provides summary statistics for the entire sample as well as for the matched sample. Panel A reports the results for the full sample of 1,113 publicly traded firms with 14,424 annual observations. The average firm had total sales of $6.4 billion, a 3.77% average rate of return on assets, and an annual stock return of 15.10%. The average annual total CEO compensation package was $5.5 million, of which $1.8 million consisted of cash compensation and the other $3 million of equity compensation.

Table 1: Summary Statistics

This table shows the summary statistics for all firms, firms with inside boards in year 2000, and with independent board in year 2000. The statistics include total sales (in millions of dollars), average return on assets (in percentage), and average holding period return (in percentage). The table also includes the following compensation variables (all in 000s of dollars): total compensation, cash compensation, and equity compensation. Panel A reports the results for the full sample. Panel B presents the results for the matched sample of treatment and control firms. All variables are winsorized at the top and bottom percentile. The information on the firm is from fiscal years 1997–2012. Column 4 shows the *t*-statistics between Independent Board and Inside Board clustered at firm level. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A—Full Sample

	All Firms	Inside Board in Year 2000	Independent Board in Year 2000	*T*-Statistics
Number of Firms	1113	244	869	
Total Sales (in million)	$6,413	$3,692	$7,155	−3.80***
Return on Assets	3.77%	4.36%	3.60%	1.68*
Annual Return	15.10 %	15.45%	15.00%	0.45
Total Compensation (in 000s)	$5,488	$4,363	$5,794	−4.11***
Cash Compensation (in 000s)	$1,788	$1,545	$1,855	−3.56***
Equity Compensation (in 000s)	$3,701	$2,818	$3,940	−4.01***

Panel B—Matched Sample

	All Firms	Inside Board in Year 2000	Independent Board in Year 2000	*T*-Statistics
Number of Firms	418	244	174	
Total Sales (in million)	$3,714	$3,692	$3,744	−0.07
Return on Assets	3.91%	4.36%	3.28%	0.49
Annual Return	15.47 %	15.45%	15.50%	0.97
Total Compensation (in 000s)	$4,580	$4,363	$4,886	−1.33
Cash Compensation (in 000s)	$1,564	$1,545	$1,590	−0.45
Equity Compensation (in 000s)	$3,017	$2,818	$3,296	−1.50

Columns 2 and 3 of Panel A separate the non-compliant and compliant firms, respectively. Of the 1,113 firms, 244 had insider-control boards. On average, these firms had total annual sales of $3.7 billion, a 4.36% return on assets, and a 15.45% annual stock return. The average annual total CEO compensation package for these firms was $4.4 million, which includes $1.5 million total cash compensation and $2.8 million equity compensation. The other 869 firms had outsider-control boards. On average, these firms had $7.2 billion in annual sales, a 3.6% return on assets, and a 15.5% annual stock return. The average annual total CEO compensation package for these firms was $5.8 million, which included $1.8 million in cash compensation and $3.9 million in equity compensation.

As shown by the *t*-statistics in column 4 of Panel A, non-compliant firms are smaller than compliant firms but experience a significantly greater return on assets than outside-control firms do. During the same period, the annual stock returns for both groups were similar. Although CEOs of non-compliant firms received less compensation, a greater percentage of their package consisted of cash compensation (35% for non-compliant firms vs. 32% for compliant firms).

Panel B shows summary statistics for the matched sample. Using the predicted values from the logit regression, a nearest-neighbor propensity score matching methodology was applied, yielding a matched sample of 418 firms (244 firms with insider-control boards and 174 firms with outsider-control boards).[17] As can be seen from column 4, there was no statistically significant difference between the treatment and control firms, unlike in Panel A.

[17] The reason for the lower number of control firms is because the one-to-one with replacement methodology used here led to some control firms being selected for more than one treatment firm.

Table 2: Pay-for-Performance Sensitivity

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on CEO pay-for-performance sensitivity for all firms for 1997–2012. The dependent variable—*Change in Total Compensation*—is defined as the dollar change in total CEO compensation to measure pay-for-performance sensitivity. Independent variables are described in Appendix A. In Columns (3) & (4), propensity score matching is used to find firms that had similar characteristics based on the nearest neighbor methodology with one-to-one replacement. Following Coles et al. (2014), the first year of the new pay disclosure requirements is removed for Columns (2) & (4). All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) Change in Total Compensation	(2) Change in Total Compensation	(3) Change in Total Compensation	(4) Change in Total Compensation
Inside Board * Post Regulation	494.790**	572.858***	762.007***	864.519***
	(200.607)	(214.318)	(280.508)	(299.095)
Ln (Total Sales)$_{t-1}$	−1688.074***	−1676.386***	−1734.899***	−1714.502***
	(100.726)	(110.436)	(168.823)	(178.974)
Ln (Return on Assets)$_{t-1}$	1341.822*	1537.248*	−557.805	−372.882
	(760.956)	(827.045)	(980.542)	(1117.946)
Ln (Annual Return)$_{t-1}$	32997.746***	36751.580***	20020.820	25459.170
	(11885.685)	(12815.441)	(17679.960)	(18933.820)
Δ (Shareholder Wealth)$_{t-1}$	0.011	0.009	0.002	−0.003
	(0.009)	(0.009)	(0.014)	(0.015)
Inside Board in Year 2000 * Post Regulation * Δ (Shareholder Wealth)$_{t-1}$	0.123*	0.123**	0.141**	0.145**
	(0.065)	(0.060)	(0.067)	(0.062)
Obs.	14424	12691	5290	4317
R^2	0.073	0.091	0.094	0.114
Firm Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1113	1112	418	418
Total Effect	494**	572***	761***	863***

Pay-for-Performance Results

CEOs are smart investors and would prefer to minimize the pay-for-performance sensitivity of their compensation packages and maximize their cash-based compensation. Thus, CEOs can invest their cash in other places, as risky policies in the companies they head might not only lead to dismissal but also cause the loss of their equity investment. Jensen and Murphy (2010) recommend implementing a pay-for-performance plan that aligns CEOs' interests with those of shareholders. To confirm the hypothesis that independent boards are better at implementing this plan and increasing pay-for-performance sensitivity, I investigated the impact of the change in shareholder wealth on relative change in total CEO compensation in non-compliant firms by estimating the following equation:

$$\Delta\, Total\ Compensation_{it} = \propto + \beta_1\ (Inside\ Board_i * \ Post\ Regulation_t) + \beta_2\ (\Delta Shareholder\ Wealth_{t-1}) + \ \beta_3\ (\Delta Shareholder\ Wealth_{t-1} * \ Inside\ Board_i * \ Post\ Regulation_t) + \delta_i \ + \ \Upsilon_t \ + \Gamma X_{i,t} + \ \varepsilon_{it} \quad (1)$$

In equation 1, the dependent variable is defined as the dollar change in the current total CEO compensation from the previous year. As recommended by Graham et al. (2012), I use firm-fixed effects (δ_i) to control for unobservable cross-sectional factors such as firm culture, CEO seniority, and current board composition. I also use year fixed effects (Υ_t) to control for unobservable time-invariant factors. I cluster the standard errors at the firm level. I also use robust and heteroscedasticity-consistent standard errors. Alpha is the intercept term, which is suppressed to avoid the dummy variable trap, similar to Adams and Ferreira (2009), and epsilon is the error term.

Following Hartzell and Starks (2003), I calculate *Shareholder Wealth* as shares outstanding (in millions) times the fiscal year-end stock price (mean value = $9.1 billion). Thus, a change in shareholder wealth ($\Delta Shareholder\ Wealth$) is defined as the variation in shareholder wealth from the previous to the current year. The mean value for the change in shareholder wealth was −9.35. All other variables were defined previously.

The coefficient of the three-term interaction term, β_3, indicates the relative change in the sensitivity of changes in total CEO compensation following the mandate to changes in shareholder wealth for non-compliant firms. The coefficient of the two-term interaction term, β_1, indicates the relative dollar change in total CEO compensation of insider-control firms following the mandate through other measures, including but not limited to cash compensation, pension payments, and restricted stock grants. The total effect on these firms is given by adding the coefficients of β_1 and the product of the mean value of the change in shareholder wealth and β_3.

Column 1 of Table 2 presents the results of equation 1. The coefficient of the three-term interaction, $\Delta Shareholder\ Wealth_{t-1} * Inside\ Board_i * Post\ Regulation_t$ is significant and positive, indicating that incentive-based compensation increased for non-compliant firms' CEOs following the mandate. This result differs from the short-term results of Chung and John (2017), who find that outside directors do not change the incentive pay following the mandate. The lack of significance in their study can be attributed to the shorter time frame of their analysis. The results here indicate that a long-term analysis may find a different impact of the mandate on CEO pay-for-performance sensitivity. In terms of economic significance, for an average CEO, a new independent board is associated with a greater than 12% increase in the sensitivity

of changes in total compensation to changes in shareholder wealth relative to compliant firms following the mandate. For every $1 million change in shareholder wealth for non-compliant firms, there is a change in total CEO compensation of $472 relative to compliant firms based on the information provided in column 1.

In 2004, the Fair Accounting Standards Board (FASB) published FAS 123R, requiring firms to expense options awarded differently than before. Additionally, the SEC mandated expanded disclosure guidelines for executive compensation at the same time. The majority of the companies switched to the new format in 2006, and the remaining companies did so in 2007 (see Appendix B). To deal with this issue, Coles et al. (2014) suggest removing the first year when firms switched to new reporting standards from the analysis of changes in total compensation. Column 2 of Table 4 shows the results. By removing these observations, the coefficient of the three-term interaction is the same, but has greater significance. This result indicates that changes in disclosure requirements cannot explain the increase in pay-for-performance sensitivity of non-compliant firms' CEOs following the mandate.

Propensity Score Matching. The model employed here assumes that firms that had to change their board composition to comply with the mandate are similar to firms that did not have to change their board composition. As shown in Panel A of Table 1, this is not the case. Even if these variables are controlled in the full sample, doing so may not fully address endogeneity concerns. To address this issue, I employed one-to-one propensity score matching with replacement in columns 3 and 4 of Table 2.

Column 3 of Table 2 re-estimates equation 1 using this sample. The interaction term $\Delta Shareholder\ Wealth_{t-1} * Inside\ Board_i * Post\ Regulation_t$ is still positive

and statistically significant, suggesting that new independent boards increase the CEO pay-for-performance sensitivity of non-compliant firms. Similar to column 2, I also controlled for the new pay disclosure requirements in column 4, finding qualitatively similar results. The results in columns 3 and 4 indicate that the full sample results presented in columns 1 and 2 of Table 2 are not due to differences between the compliant and non-compliant groups.

In summary, the results in Table 2 indicate that CEO pay-for-performance sensitivity in non-compliant firms increased following the mandate. The next hypothesis examines the impact of this increase on total CEO compensation.

Total Compensation Results

The second purpose of this study is to determine the effect of the independence mandate on the total CEO compensation of non-compliant firms over the long run. I used a difference-in-difference (DD) estimation method, similar to that used in Chhaochharia and Grinstein (2009), Duchin et al. (2010), Guo, Lach, and Mobbs (2015), Chung and John (2017), and Lu and Wang (2018), which approximates the result of the natural experiment and compares it to the control group.[18]

I start by providing a visual summary of the total CEO compensation in non-compliant firms. I followed Autor, Donohue III, and Schwab (2006) and Acharya, Baghai, and Subramanian (2014) in constructing this graph. The graph plots the point estimates and the 95% confidence interval for lambda (λ) from the following equation:

[18] Additionally, the affected firms were given a couple of years to comply with the mandate. I assume, similar to Chhaochharia and Grinstein (2009) and Guo et al. (2015), that other policy shocks, including SOX, during that time had similar impacts on the sample firms and the control firms. Furthermore, there were no shocks at the time that affected firms with only inside-controlled boards (Chhaochharia & Grinstein, 2007; Wintoki, 2007).

$$Ln\,(Total\ Compensation)_{it} = \delta_i + \Upsilon_t + \sum_{t=1996}^{2012} \lambda_t\ (\Upsilon_t * Inside\ Board_i) + \varepsilon_{it}. \quad (2)$$

The dependent variable is the natural log of total compensation. By taking the natural log, a one-unit change in the independent variable indicates the effect it has on the percentage change in total CEO compensation. Delta (δ) and upsilon (ϒ) are, respectively, vectors of firm and year dummies to control for cross-sectional dependency and time-specific variation. *Inside Board* is a dummy that assumes a value of 1 if the firm had an insider-control board in the year 2000 (non-compliant firms). Errors are clustered at the firm level. Conceptually, this equation removes the variation caused by unobserved firm characteristics as well as economy-wide shocks by running the regression with firm and year fixed effects and keeping the residuals.

Even without the control variables, Figure 2 provides initial evidence that CEO compensation increased for insider-control firms following the mandate.[19] Specifically, if there is no treatment effect, the difference between CEO compensation for non-compliant firms and compliant firms would be the same over time. As seen in Figure 2, this was not the case, and one can notice an increase in compensation for insider-control firms following the mandate. The *F*-statistic for the post-mandate (years 2003–2012) joint test is 1.76, which is statistically significant (*p*-value = 0.04).[20] To confirm the results presented in Figure 2, I estimated the regression analysis of total compensation over the

[19] The wide confidence level bands caution against making strong inferences from this figure. However, this equation does not include the control variables. At the same time, the univariate and multiple regression analyses of total compensation performed next suggest results similar to those given by the figure.

[20] Additionally, the point estimate line in Figure 2 being close to zero prior to the mandate tests for the parallel trend assumption. The *F*-statistic for the pre-mandate (years 1997–2002) joint test of significance is 1.46 and is not significant at traditional levels (*p*-value = 0.23), suggesting that the difference-in-difference approach would be appropriate.

long run. Table 3 reports the result of performing univariate difference-in-difference tests on total CEO compensation between the compliant firms and non-compliant firms prior to and after the 2002 board independence mandate.

Panel A of Table 3 reports the results for the full sample. Total CEO compensation increased for all firms following the mandate, possibly reflecting the time trend. The difference-in-difference estimator is positive and significant (0.34), indicating that the relative total CEO compensation for non-compliant firms increased following a change in board composition. This result differs from the short-term results of Chhaochharia and Grinstein (2009) and Guthrie et al. (2012), indicating that a long-term analysis may indicate a different impact of the mandate on CEO compensation. Using the matched sample in Panel B, the DD estimator is positive at a 5% significance level. The changes observed in total CEO compensation support the complementarity view that a new independent board will increase total CEO compensation concurrently with pay-for-performance sensitivity to reimburse CEOs for bearing greater firm-specific risks.

Figure 2: CEO Compensation of Insider-Controlled Firms over Time

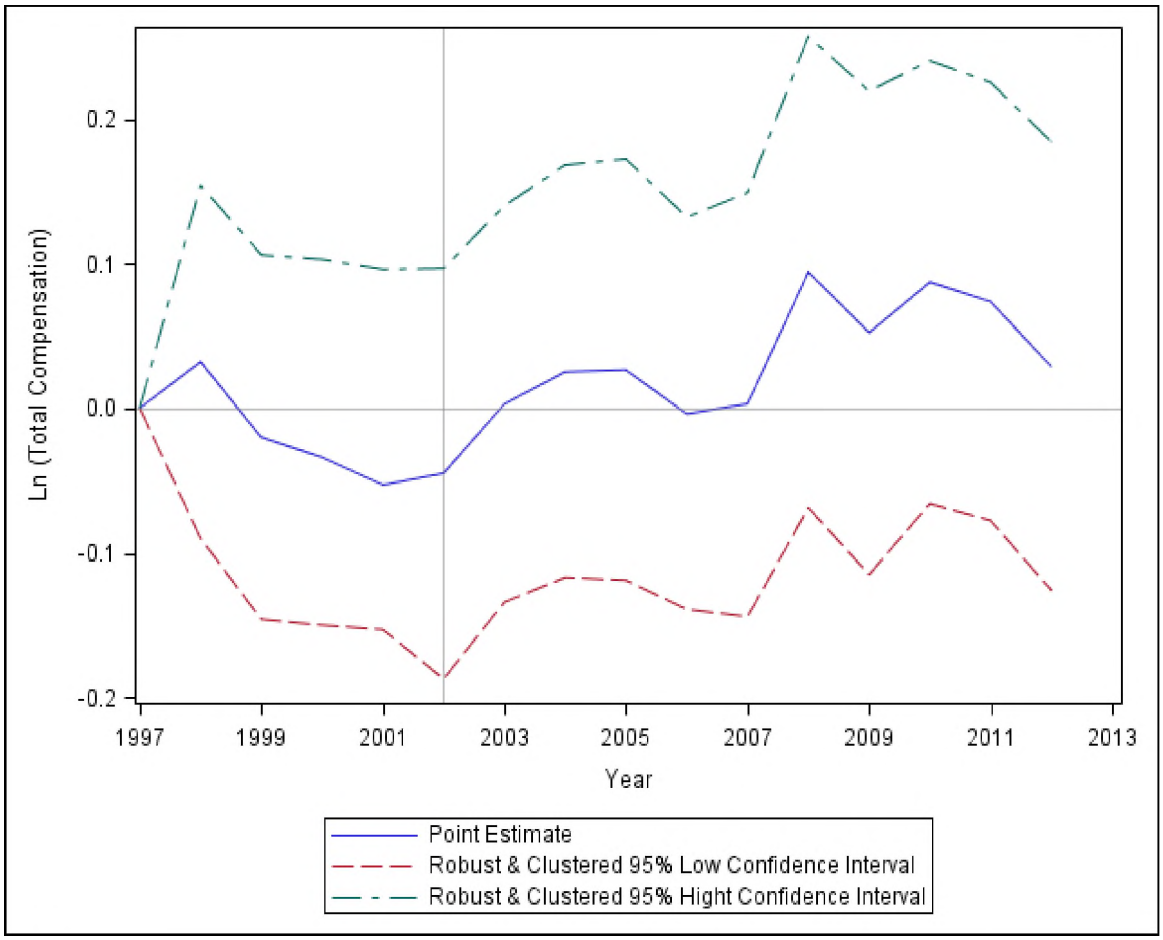

Figure 2: This figure shows a visual difference-in-differences analysis examining the effect of the passage of the 2003 board independence mandate on CEO Compensation in traditionally insider-control firms to compliant firms. On the *y*-axis, the graph plots the natural log of total compensation; the *x*-axis shows time (ranging from 5 years prior to adoption until 10 years after the passage). The vertical line (for 2002) indicates the year when the mandate was announced. The dashed lines in the figure correspond to the 95% confidence intervals based on standard errors that are clustered at firm levels.

Table 3: Univariate DD—Total Compensation

The following table shows univariate difference-in-difference estimates of the effect of the new exchange regulations on the natural log of total CEO compensation for 1997–2012. Total compensation is defined as the sum of all salary, bonuses, stock options, restricted stock grants, and other compensation awarded to the CEO during the fiscal year. Panel A reports the results for the full sample. Panel B presents the results for the matched sample of treatment and control firms. Statistical significance for the difference-in-difference estimate at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A—Full Sample

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	7.899	8.263	0.364
Non-Compliant Firms	7.564	8.019	0.455
Difference	−0.335	−0.245	**0.090****

Panel B—Matched Sample

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	7.829	8.083	0.349
Non-Compliant Firms	7.564	8.019	0.455
Difference	−0.264	−0.064	**0.200*****

Table 4: Multivariate DD—Total CEO Compensation

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on total CEO compensation of all firms for 1997–2012 using difference-in-difference estimates. The dependent variable—*Total Compensation*—is defined as the natural log of total CEO compensation. Independent variables are described in Appendix A. Column (1) shows the main results of the analysis. Column (2) repeats the primary analysis by collapsing the data into two cross-sectional averages: one pre-mandate and one post-mandate. In column (3), propensity score matching is used to find firms that had similar characteristics based on the nearest neighbor methodology with one-to-one replacement. Column (4) presents the results where the main independent variable—*Inside Board*—is defined as firms having insider-control boards for two consecutive years prior to the year 2003. All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parenthesis are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) **Full Sample**	(2) **Collapsed Time Series**	(3) **Matched Sample**	(4) **Alternative Definition for Inside Board**
Inside Board in Year 2000 * Post Regulation	0.076*	0.080*	0.154**	
	(0.045)	(0.046)	(0.060)	
Inside Board in 2 Consecutive Years Prior to 2003 * Post Regulation				0.085**
				(0.037)
Ln (Total Sales)$_{t-1}$	0.074***	0.181***	0.076***	0.077***
	(0.012)	(0.029)	(0.021)	(0.010)
Ln (Return on Assets)$_{t-1}$	0.443***	1.265***	0.421***	0.449***
	(0.084)	(0.315)	(0.149)	(0.081)
Ln (Annual Return)$_{t-1}$	16.179***	34.419***	15.483***	15.440***
	(1.318)	(6.482)	(2.031)	(1.227)
Obs.	14424	2226	5297	16747
R^2	0.698	0.897	0.6627	0.696
Firm Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1113	1113	418	1283

Further analyses, including multiple regression analysis, will help to determine whether the changes in total CEO compensation are significant for all firms. To confirm the univariate results shown in Figure 2 and Table 3, the following multivariate DD equation was estimated:

$$Ln\,(Total\ Compensation)_{it} = \propto + \beta_1\,(Inside\ Board_i * Post\ Regulation_t) + \Gamma X_{i,t} + \delta_i + \Upsilon_t + \varepsilon_{it} \quad (3)$$

The interaction variable, *Inside Board * Post Regulation*, is the DD estimator that indicates the relative change in CEO compensation for non-compliant firms. This estimator can be seen as taking the difference between the treatment and control groups and subtracting the post-regulation effect from the treatment group to obtain the coefficient β_1. In other words, the interaction term measures the effect of the mandate on non-compliant firms following the regulation by capturing the difference between actual CEO compensation for non-compliant firms and the same firms if there was no treatment following the mandate. The coefficients on both *Inside Board* and *Post Regulation* are absorbed by firm (δ_i) and year (Υ_t) fixed effects, respectively. Again, the intercept was suppressed to avoid the dummy variable trap.

Table 4 displays the multivariate DD analysis of the total compensation. Column 1 shows the regression analysis for the effects of the forced change to outsider-control boards on total CEO compensation during the period 1997–2012 using difference-in-difference estimates. The interactive coefficient for *Inside Board * Post Regulation* is positive and significant (0.076), indicating that overall compensation increases for CEOs of insider-control firms. Specifically, there is a relative 7.6% increase (though only weakly significant) in the compensation of non-compliant firms as a result of this

mandate. This result is consistent with the complementarity argument that incumbent CEOs at insider-control firms receive more compensation as a result of the new independent board. All control variables (*Total Sales, Return on Assets*, and *Annual Return*) show a positive association with total compensation, which is consistent with prior literature.

To confirm this result, several tests were performed. First, I collapsed the panel data into two cross-sectional pieces of data. Second, I used a matched sample of similar compliant and non-compliant firms. Finally, I changed the definition used to separate firms into compliant and non-compliant groups.

Alternate Methodology. Bertrand, Duflo, and Mullainathan (2004) found that significance levels can be seriously overestimated if the dependent variable is serially correlated. To mitigate this concern, I followed Guo et al. (2015) and collapsed the data into two cross sections: one pre-event cross section containing the average of all variables from the pre-event data, and one post-event cross section containing the average of all variables from the post-event data. I re-estimated equation 3 using this data in column 2 of Table 4 and found qualitatively similar results. Specifically, following the mandate of 2003, CEO compensation increased in firms that had to change their board composition to comply with the mandate.

Propensity Score Matching. Control variables may not be able to capture all the differences between compliant and non-compliant firms. Along with using control variables, column 3 of Table 4 estimates equation 2 for the matched sample created by the propensity score methodology used in the previous section. The interaction term, *Inside Board * Post Regulation*, is still positive and statistically significant, suggesting

that the new independent board increases relative total CEO compensation in non-compliant firms following the mandate. As a robustness check, I employed propensity score matching with one-to-one without replacement methodology and two-to-one without replacement methodology. The results for the total compensation using these methods are presented in Appendix D.[21]

Alternative Definition for the Independent Variable. Column 4 of Table 4 shows the result for the robustness of the independent variable by using a different definition to sort firms into compliant and non-compliant groups. I changed the definition of *Inside Board* to firms that had an insider-control board for two consecutive years prior to 2003. Specifically, the value for *Inside Board* is 1 if the ratio of outside directors to total directors was less than 0.5 for any two consecutive years between 1996 and 2002. The second definition yielded 1,283 firms to test the hypothesis that relative total CEO compensation increases for non-compliant firms following the mandate. The result for the DD variable is qualitatively similar to the main results in column 1.

In summary, the results in Table 4 indicate that total CEO compensation for non-compliant firms increased relative to total CEO compensation for compliant firms following the board independence mandate in the long run. This result has not been documented previously in the literature.

[21] Results for other tests are available upon request.

Table 5: Total CEO Compensation—Additional Robustness Tests

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on total CEO compensation of all firms for 1997–2012 using difference-in-difference estimates. The dependent variable—*Total Compensation*—is defined as the natural log of total CEO compensation. Independent variables are described in Appendix A. In column (1), *New Format* controls for changes in new pay reporting requirements in ExecuComp based on FAS 123R and SEC expanded disclosure mandate. In column (2), only data from 1996–2003 are used and the *False Post Regulation Period* starts from 2000. In column (3), *CEO Replaced* controls for signing bonuses awarded to new CEOs. In column (4), *Industry × Year FE* is added to control for CEO demand and supply for a particular industry in a particular year. All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) Ln (Total Compensation)	(2) Ln (Total Compensation)	(3) Ln (Total Compensation)	(4) Ln (Total Compensation)
Inside Board * Post Regulation	0.077*		0.060*	0.110**
	(0.045)		(0.035)	(0.046)
Ln (Total Sales)$_{t-1}$	0.074***	0.012	0.081***	0.063***
	(0.012)	(0.011)	(0.012)	(0.012)
Ln (Return on Assets)$_{t-1}$	0.444***	0.394***	0.426***	0.418***
	(0.084)	(0.133)	(0.085)	(0.088)
Ln (Annual Return)$_{t-1}$	16.212***	15.304***	16.358***	13.835***
	(1.318)	(1.834)	(1.334)	(1.416)
New Format	0.144***			
	(0.048)			
Inside Board in Year 2000 * False Post Regulation		−0.111		
		(0.147)		
CEO Replaced			0.030	
			(0.024)	
Industry × Year FE				YES
Obs.	14424	6264	14424	14424
R^2	0.698	0.756	0.699	0.721
Firm Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1113	1113	1106	1113

Robustness Tests

Additional robustness tests are performed to confirm the total CEO compensation results. Factors other than the independence mandate may have caused an increase in CEO compensation. These factors include the new compensation reporting format, controlling for previous mandates, CEO replacement decisions, and industry effects. The results are presented in Table 5.

New Reporting Standards. As explained in Appendix B, new pay disclosure requirements might have resulted in ExecuComp, one of the databases used in this study, reporting increases in compensation even if the actual compensation was unchanged. ExecuComp formally adopted the new standards when companies started reporting them. To control for these changes in reporting, I added a dummy variable (*New Format*) to equation 3, beginning with the year when a particular firm started using these standards. The results are presented in column 1 of Table 5. Even though the new variable is statistically significant, the DD variable still shows a (weakly) significant sign, indicating that the new disclosure requirements do not confound the primary results that CEO compensation of insider-control firms increased following the mandate.

Falsification Tests. Duchin et al. (2010) argue that the board independence mandate is the sum of all corporate governance measures imposed by the exchanges since 1999. If that is the case, then we would expect to see the effect on CEO compensation prior to the mandate year. I thus selected the year 2000, two years prior to the actual event year 2002, as the hypothetical event year. Column 2 estimates equation 1 on pre-event years to demonstrate that there was no event prior to the mandate that could account for a change in CEO compensation other than the mandate that passed in 2003. As expected, the

interaction variable is not statistically significant for total compensation, suggesting that the observed change in relative CEO compensation is the result of the board independence mandate and not the result of prior mandates.

Two cautions are warranted when interpreting this result. First, the null hypothesis for this test is whether the pre-event trend is zero. The falsification test failed to reject the null hypothesis. This does not prove causality that board independence caused changes in total CEO compensation. Second, the low number of years available to perform the falsification test (1997–2003) led to noise in the data, which might have prevented detection of violations of a parallel trend when there is one and can lead to over-rejection of the null hypothesis in the full sample (Kahn-Lang & Lang, 2018; Roth 2020). Nonetheless, this falsification test plays an important role in validating the parallel trends assumption underlying the DD methodology.

CEO Replacement. To attract highly talented and well-sought-after CEOs, companies routinely give out extravagant signing bonuses, which are included in the total compensation reported for the first year when the new CEO is hired. To control for these signing bonuses, I add a dummy variable for years in which the CEO is replaced. The results, presented in column 3 of Table 5, show that the DD variable is still positive and significant, suggesting that even after controlling for CEO replacement decisions, relative total CEO compensation for non-compliant firms still increased following the mandate compared to compliant firms.

Industry Effects. Chhaochharia and Grinstein (2009) argue that CEO compensation for a particular industry depends on the supply and demand factors associated with that industry in a particular year. For instance, the demand for CEOs able to manage a new

economy firm was higher in the 1990s, encouraging high levels of pay during that decade in that particular industry. Following the dot-com burst in early 2000, the demand fell and the supply of those CEOs increased, putting downward pressure on their compensation.

To control for these supply and demand factors, I follow Chhaochharia and Grinstein (2009) by including Fama and French's 49 industry classifications multiplied by year dummies in equation 1. The results are presented in column 4 of Table 5.[22] Even after controlling for industry shocks affecting different industries in different years, the DD variable is still positive and significant, suggesting that industry shocks cannot explain the relative increase in CEO compensation for non-compliant firms following the mandate.

Cash & Equity Compensation

The results in Table 2 indicate that along with pay-for-performance sensitivity, other forms of CEO compensation also increased for non-compliant firms following the board independence mandate. The interactive term *Inside Board * Post Regulation* in Table 2 is positive and significant across all four columns, suggesting that increasing CEO incentives require the board to concurrently increase other forms of compensation to encourage the CEO to take additional risks. This increase includes, but is not limited to, cash compensation, pension payments, and restricted stock grants.

It is imperative to check whether the increase in total compensation mentioned above occurred via cash compensation or equity compensation. Jensen and Murphy (2010) argued that cash compensation can misalign CEOs' interests with respect to those of shareholders. There could be an argument that if the increase is through cash

[22] For reasons of brevity, individual interactions of industry multiplied by year dummies are not shown.

compensation, then this is not a sign of a strong board but rather of the bargaining power of an entrenched CEO. The complementarity view predicts that the increase in total compensation was due to strong governance mechanisms resulting from the independent board. Thus, we expect that the increase in total compensation was through equity compensation.

To explore this hypothesis, I defined total cash compensation as the sum of cash and bonus for years prior to the new disclosure requirement and the sum of cash, bonus, and non-equity incentives for years after the new disclosure requirement (see Appendix B). Equity compensation is the difference between the total compensation and cash compensation.

Table 6 shows the results of the univariate DD analysis for cash compensation using both the full sample (Panel A) and the matched sample (Panel B). The results indicate that there is no change in relative cash compensation for non-compliant firms following the mandate. To further confirm these results, I changed the dependent variable in equation 3 to the natural log of cash compensation.

Table 6: Univariate DD—Cash Compensation

The following table shows univariate difference-in-difference estimates of the effect of the new exchange regulations on the natural log of the cash compensation of the CEO compensation package for all firms for 1997–2012. *Cash Compensation* is defined as the sum of salary, bonus, and (for years with new reporting standards) annual cash incentives. Panel A reports the results for the full sample. Panel B presents the results for the matched sample of treatment and control firms. Statistical significance for the difference-in-difference estimate at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A—Full Sample			
	Pre-Mandate	**Post-Mandate**	**Difference**
Compliant Firms	6.902	7.343	0.441
Non-Compliant Firms	6.721	7.199	0.478
Difference	0.181	-0.144	**0.037**
Panel B—Matched Sample			
	Pre-Mandate	**Post-Mandate**	**Difference**
Compliant Firms	6.809	7.203	0.394
Non-Compliant Firms	6.721	7.199	0.478
Difference	−0.088	−0.004	**0.084**

The multivariate DD analyses for cash compensation are presented in Table 7. The results for the full sample are shown in column 1 of Table 7. The results indicate no change in the relative cash compensation for CEOs of non-compliant firms following the mandate. I also confirmed these results by removing the observations for the first year when companies started reporting compensation following the new reporting standards. Column 2 presents the results. I also used the matched sample created using the propensity score methodology in column 3. In column 4, along with using the matched sample, I also controlled for the new pay disclosure standards. The results are qualitatively similar to those of column 1. The results in Table 7 indicate that following the board independence mandate, non-compliant firms did not increase cash compensation.

Table 7: Multivariate DD—Cash Compensation

The following table shows the results of least square regression analysis of the effect of the new exchange regulations n the cash component of the CEO compensation package for all firms for 1997–2012 using difference-in-difference estimates. The dependent variable in all four columns—*Cash Compensation*—is defined as the sum of salary, bonus, and (for years with new reporting standards) annual cash incentives to measure cash compensation. Independent variables are described in Appendix A. In Columns (3) & (4), propensity score matching is used to find firms that have similar characteristics based on the nearest neighbor methodology with one-to-one replacement. Following Coles et al. (2014), the first year of the new pay disclosure requirements is removed for Columns (2) & (4). All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) Ln (Cash Compensation)	(2) Ln (Cash Compensation)	(3) Ln (Cash Compensation)	(4) Ln (Cash Compensation)
Inside Board * Post Regulation	0.044	0.048	0.090	0.100
	(0.034)	(0.035)	(0.073)	(0.082)
Ln (Total Sales)$_{t-1}$	0.041***	0.040***	0.016	0.015
	(0.009)	(0.009)	(0.015)	(0.015)
Ln (Return on Assets)$_{t-1}$	0.311***	0.339***	0.396***	0.395***
	(0.069)	(0.073)	(0.112)	(0.121)
Ln (Annual Return)$_{t-1}$	10.861***	9.902***	10.057***	9.245***
	(0.979)	(0.995)	(1.333)	(1.400)
Obs.	14424	12691	5297	4672
R^2	0.669	0.666	0.656	0.656
Firm Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1113	1112	418	418

Table 8: Univariate DD—Equity Compensation

The following table shows univariate difference-in-difference estimates of the effect of the new exchange regulations on the natural log of the equity component of the CEO compensation package for all firms for 1997–2012. Equity compensation is defined as the difference between total compensation and cash compensation. Panel A reports the results for the full sample. Panel B presents the results for the matched sample of treatment and control firms. Statistical significance for the difference-in-difference estimate at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Panel A—Full Sample

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	6.857	7.317	0.460
Non-Compliant Firms	6.274	6.864	0.590
Difference	−0.583	−0.453	**0.130***

Panel B—Matched Sample

	Pre-Mandate	Post-Mandate	Difference
Compliant Firms	6.711	7.010	0.299
Non-Compliant Firms	6.274	6.864	0.590
Difference	−0.437	−0.146	**0.291****

Table 8 shows the results of the univariate DD analysis for equity compensation using both the full sample (Panel A) and the matched sample (Panel B). The results indicate that the new independent board increased equity compensation for CEOs in non-compliant firms following the mandate. To further confirm these results, I changed the dependent variable in equation 3 to the natural log of equity compensation.

Table 9: Multivariate DD—Equity Compensation

The following table shows the results of least square regression analysis of the effect of the new exchange regulations on the cash component of the CEO compensation package for all firms for 1997–2012 using difference-in-difference estimates. The dependent variable—*Equity Compensation*—is defined as the difference between total compensation and cash compensation. The independent variables are described in Appendix A. In Columns (3) & (4), propensity score matching is used to find firms that had similar characteristics based on the nearest neighbor methodology with replacement. Following Coles et al. (2014), the first year of the new pay disclosure requirements is removed for Columns (2) & (4). All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) Ln (Equity Compensation)	(2) Ln (Equity Compensation)	(3) Ln (Equity Compensation)	(4) Ln (Equity Compensation)
Inside Board * Post Regulation	0.088*	0.102*	0.193*	0.192*
	(0.053)	(0.062)	(0.116)	(0.108)
Ln (Total Sales)$_{t-1}$	0.041***	0.102***	0.129	0.123
	(0.009)	(0.025)	(0.041)	(0.047)
Ln (Return on Assets)$_{t-1}$	0.102***	0.789***	0.792**	0.814**
	(0.249)	(0.201)	(0.331)	(0.349)
Ln (Annual Return)$_{t-1}$	17.512***	16.941***	12.242**	11.217**
	(2.832)	(2.955)	(4.837)	(5.052)
Obs.	14424	12691	5297	4672
R^2	0.544	0.548	0.502	0.505
Firm Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Number of Firms	1113	1112	418	418

The multivariate DD analyses for equity compensation are presented in Table 9. The results for the full sample are shown in column 1 of Table 9. I also confirmed these by controlling for new reporting standards. Column 2 presents the results. I also used the matched sample in column 3, while in column 4, along with using the matched sample, I also controlled for the new pay disclosure standards. The results are qualitatively similar to those of column 1. The results in Table 9 indicate that following the board independence mandate, boards of non-compliant firms increased total CEO compensation through additional equity compensation.

The results indicate that relative equity compensation for CEOs of non-compliant firms increased following the mandate, which is consistent with the complementarity view. The new independent board increased the total compensation along with CEO pay-for-performance sensitivity. However, the increase in total compensation is due to an increase in equity compensation. Thus, outside boards do not consider a strong governance mechanism a substitute for incentive pay. Consistent with the complementarity view, independent boards increased equity compensation when enforcing strong governance mechanisms.

Conclusion

In this paper, I investigated the impact of changes in board composition on CEO compensation as a result of the exchange listed mandate of 2003. The general results indicate that total compensation increased following an increase in CEO pay-for-performance sensitivity over the long run for non-compliant firms compared to compliant firms. This increase in total CEO compensation did not come through cash compensation, but through equity compensation. These results are inconsistent with the short-run results

found by Chhaochharia and Grinstein (2009) and Guthrie et al. (2012), but are consistent with the expectations of the complementarity view.

There are two potential avenues for future research. First, it is imperative to analyze the behavior of boards when negotiating pay with CEOs. CEO pay is usually the largest remuneration paid by any corporation. If CEO pay is misaligned with shareholders' interests and, concurrently, has increased many-fold over the last two decades (see Bebchuk & Grinstein, 2005), the obvious question is why the independent board focuses mainly on controlling the first problem (i.e., aligning CEOs' interests with those of shareholders by increasing pay-for-performance sensitivity). One could argue that independent boards are taking the easy way out by focusing on the alignment of shareholders' interests with those of CEOs and not on reducing compensation, since outside directors do not want to create a bad working environment with CEOs by reducing their compensation. Further research could focus on this behavior and decision-making by independent boards.

Second, future research could also examine how the exchange mandate affected CEOs in other ways, such as the impact on CEO ownership. How do CEOs deal with additional stock options awarded as a result of an increase in pay-for-performance sensitivity? Chung and John (2017) suggest that in the short term, CEOs reduce their personal holdings. However, a long-term study is needed to analyze CEO behavior. Additionally, the agency implication of that decision will shed light on whether shareholders consider strong governance a substitute for stock holdings.

Appendix A: Variable Definitions

Variable	Source	Definition
Annual Return	CompuStat	Annualized holding period return during the fiscal year
Cash Compensation	ExecuComp	Sum of Salary, Bonus, and (for years when ExecuComp reported under new disclosure rules) Non-Equity Incentives
CEO Replaced	ExecuComp	1 if CEO was replaced during that fiscal year
Change in Shareholder Wealth	CompuStat	The dollar change calculated as the fiscal year end stock price times shares outstanding (in millions) from previous year to the current year
Change in Total Compensation	ExecuComp	Difference between current Total Compensation and last year's Total Compensation
Equity Compensation	ExecuComp	Total Compensation – Cash Compensation
Extraordinary Income	CompuStat	Net income before extraordinary items at the end of the year
Inside Board	Risk Metrics	1 if the firm has inside board in the year 2000 (percentage of outsiders has to be less than 50%)
New Format	ExecuComp	1 if ExecuComp reported compensation based on FAS 123R and expanded SEC guidelines on reporting pay
Post Regulation	-	Denotes 1 for the years 2002 and beyond following the announcement of new exchange-listed requirements
Return on Assets	CompuStat	Extraordinary Income / Total Assets
Shares Outstanding	CompuStat	Net number of all common shares outstanding at year end (in millions)
Stock Price	CompuStat	Fiscal year-end price for a company's stock
Total Compensation	ExecuComp	The value listed under the variable tdc1 in the ExecuComp database
Total Sales	CompuStat	Net sales at the end of the year

Appendix B: Pay Disclosure Changes

One of the main changes in pay disclosure mandates by FASB 123R relates to options and restricted stock awards. Specifically, firms are required to expense options at fair market value following the disclosure mandate. Since firms were not required to disclose expense option awards before, ExecuComp calculated options based on their Black-Scholes calculation. Post the disclosure mandate, ExecuComp started recording options as reported by the firm (which may not be based on the Black-Scholes formula). Thus, the traditional calculation of pay-for-performance measures using equity compensation used in Chhaochharia and Grinstein (2009), Guthrie et al. (2012), and Graham et al. (2012) are not comparable to the updated measures following the disclosure mandate (See Coles et al. (2014) for detailed explanation of the pay reporting changes). As shown by Murphy (2013), following these disclosure requirements, companies limited the use of broad-based option plans.

Along with FASB 123R, the SEC also required firms to disclose expanded compensation information related to incentive and non-incentive-based compensation. Thus, ExecuComp changed how they report incentive-based cash compensation. Specifically, cash-based payments from formulaic plans are combined post-disclosure mandate compared to previous reporting standards when ExecuComp separated the annual cash-based incentive payments from multiyear cash-based incentive payments. Thus, the traditional calculation of cash compensation using the sum of cash and bonus used in Hartzell and Starks (2003) and Graham et al. (2012) is not comparable to the updated measures following the disclosure mandate without some assumptions. To compare the cash compensation measures before and after the disclosure mandate, I

assume that multiyear formulaic cash payments were zero for all firms. This is not a bad assumption when one considers that most CEO contracts are renewed every three years and most incentive plans are based on stock options and restricted stock grants.[23]

[23] Nonetheless, I caution readers not to draw strong inferences from the results presented in Tables 6–9.

Appendix C: Propensity Score Model

The following table reports the coefficient estimates of the logit model used to predict a firm having an insider-control board in the year 2000. The dependent variable is 1 if the firm has majority of insiders as board of directors in the year 2000 and 0 otherwise. The dependent variable and the independent variables are described in Appendix A. The sample consists of all firm years from 1997–2000. All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parentheses are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

Variables	Probability of Inside Board
Ln (Total Sales)	−0.293***
	(0.032)
Ln (ROA)	0.879*
	(0.449)
Ln (Annual Return)	−5.310
	(6.564)
Percent Concordant	73.7%
Chi Square	982.76
Firm Dummy	YES
Year Dummy	YES
Number of Observations	4101

Appendix D: Robustness PSM—Total CEO Compensation

The following table shows the results of least square regression analysis of the effects of the new exchange regulations on total CEO compensation of all firms for 1997–2012 using difference-in-difference estimates. The dependent variable—*Total Compensation*—is defined as the natural log of total CEO compensation. Independent variables are described in Appendix A. In column (1), propensity score matching is used to find firms that had similar characteristics based on the nearest neighbor methodology with one-to-one without replacement. In column (2), propensity score matching is used to find firms that had similar characteristics based on the nearest neighbor methodology with two-to-one without replacement: For every non-compliant firm, I use two compliant firms. All variables are winsorized at the top and bottom percentile. All regressions use firm and year fixed effects. Standard errors reported in parenthesis are heteroscedasticity consistent and clustered at firm levels. Intercept has been suppressed to avoid the dummy variable trap. Statistical significance at 10%, 5%, and 1% is denoted by *, **, and ***, respectively.

	(1) **1-to-1 PSM w/o Replacement**	(3) **2-to-1 PSM w/o Replacement**
Inside Board in Year 2000 * Post Regulation	0.128* (0.053)	0.097* (0.047)
Ln (Total Sales)$_{t-1}$	0.088*** (0.019)	0.086*** (0.015)
Ln (Return on Assets)$_{t-1}$	0.455*** (0.100)	0.363*** (0.096)
Ln (Annual Return)$_{t-1}$	17.604*** (1.808)	16.665*** (1.508)
Obs.	6190	9349
R^2	0.692	0.683
Firm Dummy	YES	YES
Year Dummy	YES	YES
Number of Firms	488	732

REFERENCES

Acharya, V. V., Baghai, R. P., and Subramanian, K. V. (2014). Wrongful discharge laws and innovation. *The Review of Financial Studies*, *27*(1), 301-346.

Adams, R. B., and Ferreira, D. (2007). A theory of friendly boards. *The Journal of Finance*, *62*(1), 217-250.

Adams, R. B., and Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of financial economics*, *94*(2), 291-309.

Adams, R. B., Hermalin, B. E., and Weisbach, M. S. (2010). The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey. *Journal of Economic Literature*, *48*(1), 58-107.

Albuquerque, A. M., De Franco, G., and Verdi, R. S. (2013). Peer choice in CEO compensation. *Journal of Financial Economics*, *108*(1), 160-181.

Almazan, A., and Suarez, J. (2003). Entrenchment and severance pay in optimal governance structures. *The Journal of Finance*, *58*(2), 519-548.

Autor, D. H., Donohue III, J. J., and Schwab, S. J. (2006). The costs of wrongful-discharge laws. *The review of economics and statistics*, *88*(2), 211-231.

Bebchuk, L., and Grinstein, Y. (2005). The growth of executive pay. *Oxford review of economic policy*, *21*(2), 283-303.

Bebchuk, L., and Fried, J. (2004). *Pay without performance: The Unfulfilled Promise of Executive Compensation*. Cambridge, MA: Harvard University Press.

Bebchuk, L. A., and Fried, J. M. (2005). Pay without performance: Overview of the issues. *Journal of applied corporate finance*, *17*(4), 8-23.

Berger, P. G., Ofek, E., and Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The journal of finance*, *52*(4), 1411-1438.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How much should we trust differences-in-differences estimates?. *The Quarterly journal of economics*, *119*(1), 249-275.

Bhagat, S., and Bolton, B. (2013). Director ownership, governance, and performance. *Journal of Financial and Quantitative Analysis, 48*(1), 105-135.

Chhaochharia, V., and Grinstein, Y. (2007). Corporate governance and firm value: The impact of the 2002 governance rules. *The Journal of Finance, 62*(4), 1789-1825.

Chhaochharia, V., and Grinstein, Y. (2009). CEO compensation and board structure. *The Journal of Finance*, *64*(1), 231-261.

Chung, H. J., and John, K. (2017). Board independence, CEO ownership, and compensation. *Asia-Pacific Journal of Financial Studies, 46*(4), 558-582.

Clifford, S. (2017, July 14). How Companies Actually Decide What to Pay CEOs. *The Atlantic*. https://www.theatlantic.com/business/archive/2017/06/how-companies-decide-ceo-pay/530127/

Coles, J. L., Daniel, N. D., and Naveen, L. (2014). Co-opted boards. *The Review of Financial Studies*, *27*(6), 1751-1796.

Conyon, M. J., and Murphy, K. J. (2000). The prince and the pauper? CEO pay in the United States and United Kingdom. *The Economic Journal*, *110*(467), 640-671.

Core, J. E., Guay, W. R., and Thomas, R. S. (2005). Is US CEO compensation inefficient pay without performance?. *Michigan Law Review, 103*(6), 1142-1185.

Duchin, R., Matsusaka, J. G., and Ozbas, O. (2010). When are outside directors effective?. *Journal of financial economics*, *96*(2), 195-214.

Edmans, A., Gabaix, X., and Jenter, D. (2017). Executive compensation: A survey of theory and evidence. In *The handbook of the economics of corporate governance* (Vol. 1, pp. 383-539). North-Holland.

Ellig, B. R. (2001). *The complete guide to executive compensation*. McGraw Hill Professional.

Elson, C. M., and Ferrere, C. K. (2012). Executive superstars, peer groups, and overcompensation: Cause, effect, and solution. *J. Corp. L.*, *38*, 487.

Fan, P. S. (2004). Review of Literature & Empirical research on corporate governance. *Financial services group training unit monetary authority of Singapore.*

Fahlenbrach, R. (2009). Shareholder rights, boards, and CEO compensation. *Review of Finance*, *13*(1), 81-113.

Frydman, C., and Jenter, D. (2010). CEO compensation. *Annual Review of Financial Economics.*, *2*(1), 75-102.

Goergen, M., and Renneboog, L. (2011). Managerial compensation. *Journal of Corporate Finance*, *17*(4), 1068-1077.

Gillan, S., Hartzell, J. C., and Starks, L. T. (2003). Explaining corporate governance: Boards, bylaws, and charter provisions. *Working Paper*.

Gordon, J.N. (2006). The rise of independent directors in the United States, 1950-2005: Of shareholder value and stock market prices. *Stanford Law Review, 59*(6), 1465-1568.

Graham, J. R., Li, S., and Qiu, J. (2012). Managerial attributes and executive compensation. *The Review of Financial Studies*, *25*(1), 144-186.

Guo, L., Lach, P., and Mobbs, S. (2015). Tradeoffs between internal and external governance: evidence from exogenous regulatory shocks. *Financial Management*, *44*(1), 81-114.

Guthrie, K., Sokolowsky, J., and Wan, K. M. (2012). CEO compensation and board structure revisited. *The Journal of Finance*, *67*(3), 1149-1168.

Hartzell, J. C., and Starks, L. T. (2003). Institutional investors and executive compensation. *The journal of finance*, *58*(6), 2351-2374.

Hermalin, B. E., and Weisbach, M. S. (1998). Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review 88*(1), 96-118.

Hermalin, B. E., and Weisbach, M. S., (2003). Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature. *Federal Reserve Bank of New York Economic Policy Review, 9*(1), 7–26.

Jensen, M. C., and Meckling, W. H. (1976). Agency Costs and the Theory of the Firm. *Journal of Financial Economics*, *3*(4), 305-360.

Jensen, M. C., and Murphy, K. J. (2010). CEO incentives—It's not how much you pay, but how. *Journal of Applied Corporate Finance*, *22*(1), 64-76.

Kahn-Lang, A., and Lang, K. (2020). The promise and pitfalls of differences-in-differences: Reflections on 16 and pregnant and other applications. *Journal of Business & Economic Statistics*, *38*(3), 613-620.

Knyazeva, A., Knyazeva, D., and Masulis, R. W. (2013). The supply of corporate directors and board independence. *Review of Financial Studies*, *26*(6), 1561-1605.

Lu, J., and Wang, W. (2018). Managerial conservatism, board independence and corporate innovation. *Journal of Corporate Finance*, *48*, 1-16.

Murphy, K. J. (2013). Executive compensation: Where we are, and how we got there. In *Handbook of the Economics of Finance* (Vol. 2, pp. 211-356). Elsevier.

Roberts, M. R., and Whited, T. M. (2013). Endogeneity in Empirical Corporate Finance. In *Handbook of the Economics of Finance* (Vol. 2, pp. 493-572). Elsevier.

Romano, R. (2005). The Sarbanes-Oxley Act and the making of quack corporate governance. *Yale LJ*, *114*, 1521-1611.

Roth, Jonathan Daniel (2020). Essays in Robust Inference. *Doctoral dissertation*. Harvard University, Graduate School of Arts & Sciences.

Ryan Jr, H. E., and Wiggins III, R. A. (2004). Who is in whose pocket? Director compensation, board independence, and barriers to effective monitoring. *Journal of Financial Economics*, *73*(3), 497-524.

Wintoki, M. B. (2007). Corporate boards and regulation: The effect of the Sarbanes–Oxley Act and the exchange listing requirements on firm value. *Journal of Corporate Finance*, *13*(2), 229-250.