Essays in behavioral finance

Author:
Guo, Wenxing

Publication Date:
2018

DOI:
https://doi.org/10.26190/unsworks/3450

Essays in Behavioral Finance

Wenxing GUO

A thesis in fulfilment of the requirements for the degree of

Doctor of Philosophy

UNSW AUSTRALIA

School of Banking and Finance

UNSW Business School

University of New South Wales

April 2018

PLEASE TYPE

THE UNIVERSITY OF NEW SOUTH WALES
Thesis/Dissertation Sheet

Surname or Family name: **Guo**

First name: **Wenxing**

Other name/s: **N/A**

Abbreviation for degree as given in the University calendar: **PhD**

School: **School of Banking and Finance**

Faculty: **UNSW Business School**

Title: **Essays in Behavioral Finance**

Abstract 350 words maximum: (PLEASE TYPE)

This dissertation consists of three independent research chapters in empirical finance.

In the first chapter, I investigate on the aging phenomenon in boardrooms. Independent director age has increased substantially over time, rising 8 percent from 2002 to 2014. Using 8-K filings of all U.S. listed firms from 1994 to 2014, I show that shareholders welcome amendments to corporate charters that increase mandatory retirement age of independent director. However, regressions of firm performance on director age in a sample of S&P 1500 firms show that the effect of independent director age on firm performance is non-uniform. To address potential endogeneity issues, I exploit director sudden death events and the results are consistent with the main sample. Additional tests show director age has costs and benefits. Mandatory retirement policies may preclude firms from retaining talented individuals.

The second chapter investigates the value of CEO succession planning. I explore the effects of CEO succession plans on firm performance. I find firms with succession plans have lower volatility around CEO turnover events, are able to appoint successors in a timelier manner with unexpected CEO departures, and have better performance following CEO turnover events. To isolate the effects of CEO succession planning, I use CEO death events as a natural experiment to randomly force firms to reveal their succession plans and to address the endogeneity problems. Overall, these results provide direct evidence that CEO succession planning is an important part of a board's monitoring function.

In the third chapter, I document the impact of unrelated investor attention and sentiment on stock performance. To do so, I break a company's name into constituent words (name-terms) and compute the weekly unexpected Internet search volume for name-term news that is unrelated to the company. Using the resulting measure, I find that an increase in unexpected name-term attention increases both return volatility and trading in linked securities. Furthermore, consistent with prospect theory, stock returns are significantly low when name-term sentiment is negative, but are not affected by positive name-term sentiment. My results are in line with limited attention theory and sentiment theory.

ORIGINALITY STATEMENT

‘I hereby declare that this submission is my own work and to the best of my knowledge it contains no materials previously published or written by another person, or substantial proportions of material which have been accepted for the award of any other degree or diploma at UNSW or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by others, with whom I have worked at UNSW or elsewhere, is explicitly acknowledged in the thesis. I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic expression is acknowledged.’

Signed ………………………………………………..............

Date ………………………………………………..............

COPYRIGHT STATEMENT

Signed ……………………………………………..........................

Date ……………………………………………..........................

AUTHENTICITY STATEMENT

'I certify that the Library deposit digital copy is a direct equivalent of the final officially approved version of my thesis. No emendation of content has occurred and if there are any minor variations in formatting, they are the result of the conversion to digital format.'

Signed ……………………………………………..........................

Date ……………………………………………..........................

To My Parents

for Their Unconditional Love and Support

Abstract

Wenxing GUO: Essays in Behavioral Finance

(Under the direction of Bohui Zhang and Jo-ann Suchard)

This dissertation consists of three independent research chapters in empirical finance.

In the first chapter, I investigate on the aging phenomenon in boardrooms. Independent director age has increased substantially over time, rising 8 percent from 2002 to 2014. Using 8-K filings of all U.S. listed firms from 1994 to 2014, I show that shareholders welcome amendments to corporate charters that increase mandatory retirement age of independent director. However, regressions of firm performance on director age in a sample of S&P 1500 firms show that the effect of independent director age on firm performance is non-uniform. To address potential endogeneity issues, I exploit director sudden death events and the results are consistent with the main sample. Additional tests show director age has costs and benefits. Mandatory retirement policies may preclude firms from retaining talented individuals.

The second chapter investigates the value of CEO succession planning. I use hand-collected data on CEO succession plans to explore the effects of CEO succession plans on firm performance. I find firms with succession plans have lower volatility around CEO turnover events, are able to appoint successors in a timelier manner with unexpected CEO departures, and have better performance following CEO turnover events. To isolate the effects of CEO succession planning, I use CEO death events as a natural experiment to randomly force firms to reveal their succession plans and to address the endogeneity problems. Overall, these results provide direct evidence that CEO succession planning is an important part of a board’s monitoring function.

In the third chapter, I document the impact of unrelated investor attention and sentiment on stock performance. To do so, I break a company's name into constituent words (name-terms) and compute the weekly unexpected Internet search volume for name-term news that is unrelated to the company. Using the resulting measure, I find that an increase in unexpected name-term attention increases both return volatility and trading in linked securities. Furthermore, consistent with prospect theory, stock returns are significantly low when name-term sentiment is negative but are not affected by positive name-term sentiment. I provide suggestive evidence that institutional investors trade stocks to take advantage of the prevailing sentiment trends. My results are in line with limited attention theory and sentiment theory.

Acknowledgements

This dissertation would not have been possible without the support of a number of people. First, I am heartily grateful to my supervisor, Professor Bohui Zhang, for his patient training and guidance. He has been generous with his time and counsel throughout my doctoral studies. In spite of his busy schedule, he has always checked in on my progress and offered invaluable guidance. Bohui's critical thinking and unflagging support are traits of a true researcher and teacher that I am constantly learning to model after. His expertise, knowledge and experience have been an exceptional training tool and will serve me well for the rest of my career.

I would also like to thank several other faculties at the UNSW Business School. Professor Ronald Masulis, a highly accomplished yet immensely humble scholar who inspired the vision and direction for my thesis. He has been a sounding board for many of my ideas and supported me the guidance of my projects on corporate governance. My first chapter is developed from the independent project of the seminar by Professor Ronald Masulis. Professor Ronald Masulis has also read my results in the first two chapters and helped improve my research. Also, I would like to give special thanks to Dr. Robert Tumarkin for his generous help with my executive and director deaths data collection. He assists me to improve the efficiency of my coding with Ruby and Python and to improve my writing in this thesis. I am grateful for his generous sharing of name matching algorithm—Yente. To Associate Professor Peter Pham, I am indebted to his help with administrative issues and suggestions given in each annual progress review throughout my PhD candidature. At the same time, Professor Renée Adams provides with detailed guidance on my first two chapters. Associate Professor Yang Li, Associate Professor Peter Pham, Associate Professor Jo-Ann Suchard and Dr. Jin Yu have all provided the feedbacks necessary to improve my research papers.

I would also like to thank the department staff Marie-Rose Simmons, Shirley Webster, Theresa Wisniewski, and Courtney Gunn. They have promptly dealt with any administrative issues that I have faced. I would also like to thank my PhD colleagues, Warwick Schneller and Jimmy Tran, who have proofread all my work and also kept me sane through this journey. In addition, Warwick Schneller has provided me several helpful suggestions and insights with the CEO succession plan chapter. I also appreciate the financial support from the department and the university. A three and half year scholarship has helped ease my financial burden significantly.

Finally and most importantly, I would like to thank my parents who have supported me in this long endeavor. They have listened to my ideas and given me many useful suggestions as practitioners. Most importantly, they help me overcome the frustrations inherent in a research career and provide the financial support for my last year. Their love has given me the strength to go on every day.

(This page is intentionally left blank.)

Table of Contents

Chapter 1

Introduction

1.1 Introduction

The thesis investigates two major issues in corporate governance and one major issue in empirical asset pricing. The first chapter examines the costs and benefits associated with an aging board. The second chapter illustrates the value of CEO succession planning during CEO turnover events. Last, the third chapter documents the effect of corporate name related attention and sentiment on stock prices.

1.2 Motivation

The Sarbanes-Oxley Act (SOX) of 2002, namely the Public Company Accounting Reform and Investor Protection Act, is enacted due to a number of major corporate and accounting scandals (e.g. Enron, Tyco International and WorldCom) and continues to reverberate among investors and regulators. The exogenous variations in board structure and corporate governance caused by SOX provide me with an identification strategy to study the effects of aging boards and CEO succession plans on corporate governance and firm performance.

In the post-SOX era, the demand for independent directors increases significantly due to the mandate for a majority independent board enforced by both the Securities and Exchange Commission (SEC) and major stock exchanges in the US1. Moreover, the increased workload and responsibility required by SOX and the Dodd Frank Act can further diminish the supply of independent directors (Linck, Netter, and Yang, 2009; Masulis and Mobbs, 2014). These changes lead to an increase in the average age of independent directors at Standard & Poor's 500 (S&P 500) companies from 60.3 in 1998 to 63.9 in 2014.2 Director aging continues to gain attention in corporate governance as age limits have become a media focus. Proponents argue that old-school boardrooms cannot benefit firms with an influx of creative ideas and perspectives, even though no law, rule, or regulation currently prescribes a maximum age for directors. On the other hand, older

[1] The NYSE and NASDAQ adopt the rule that independent directors must comprise a majority of the board after SOX (for detaileds, see NYSE Listed Company Manual Section 303A.01. and Nasdaq Listing Rule 5605(b) (1)).
[2] For details, please see: http://www.bloombergview.com/articles/2015-01-26/u-s-corporate-directors-are-getting-old

directors can benefit firms through abundant life experience and by better supervising young chief executive officers (CEOs).

Another channel through which the board of directors can influence firms is related to their decisions on CEO turnover. Firms today operate in a business environment in which CEO tenure has declined nearly 40% since 1992. Directors face more frequent CEO turnover events and the challenges of how to navigate the transition from one firm leader to the next. The Securities and Exchange Commission (SEC) asserts that, “One of the board's key functions is to provide succession planning so that the company is not adversely affected due to a vacancy in leadership” (SEC 2009). However, on average, boards dedicate only one hour per year to CEO succession planning (Larcker and Saslow, 2014). It is the board’s function and responsibility to guarantee that firms to have smooth transition and to select a better CEO.

The combination of short tenured CEOs with long tenured and old-school directors motivates my research in this area. Consequently, I conduct the research on director aging and CEO succession planning. Problems in corporate governance arise when managers engage in rent-seeking behavior to extract maximum personal benefits. This agency problem caused by the separation of ownership and control is well documented (Jensen and Meckling, 1976). In addition, information asymmetry worsens this problem. However, an increasing number of regulations are developed with the aim to mitigate the information asymmetry and moral hazard problem.

I then examine another mechanism in which information can affect stock prices, specifically through how information is processed by investors in the presence of limited attention and investor sentiment. Corporate name is a label that encapsulates all past corporate behavior, reputation, performance, and other attributes of the firm, and these names are often accompanied by the behavioral bias associated with the name itself. Prior literature documents the effect of names on asset prices (e.g. Green and Jame, 2013; Kumar, Niessen-Ruenzi and Spalt, 2015). Two major economic channels through which the naming of corporations can affect stock prices are the potential real impacts on firm fundamentals and psychological stereotypes associated with names terms. These two channels have been well studied in the literature (e.g. Tadelis, 1997; Grullon, Kanatas and Weston, 2004; Alter and Oppenherimer, 2006; Green and Jame, 2013). In this paper, I propose an additional channel: unexpected attention and sentiment changes associated with the name term. The key for the third chapter is to create a plausible measure of investor attention and sentiment on name terms and convincingly show that it affects prices not through other risk channels.

1.3 Findings

In the first chapter, I investigate on the aging phenomenon of independent directors. Using 8-K filings of all listed firms from 1994 to 2014, I show that shareholders welcome amendments to corporate charters that increase independent director mandatory retirement age. However, regressions of firm performance on director age in a sample of S&P 1500 firms show that the effect of independent director age on firm performance is non-uniform. To address potential endogeneity issues, I exploit director sudden death events. My results show that director age has both costs and benefits. Mandatory retirement policies may preclude firms from retaining talented individuals.

The second chapter investigates the value of CEO succession planning. I explore the effects of succession plans on firm performance. I find that firms with succession plans around CEO turnover events tend to have lower volatility, are able to appoint successors in a timelier manner and have better performance following turnover events. To isolate the effects of CEO succession planning, I use CEO death events as a natural experiment to randomly force firms to reveal their succession plans and to address the endogeneity problems. Overall, these results provide direct evidence that CEO succession planning is an important part of a board's monitoring function.

In the final chapter of my dissertation, I depart from my investigation on corporate governance issues to another issue in finance: behavioral finance. I document the impact of investor attention and sentiment, raised by non-related news but sharing the same name-term of corporation, on stock performance. Using a unique measure to track unexpected investor attention, weekly unexpected Internet search volume density, I find that increased of unrelated name-term attention escalates the return volatility and facilitates the trading activities of linked securities. By further differentiating the unexpected attention into positive and negative sentiment, I find that investors react to sentiment change regarding the firm itself, but more irrationally to the unexpected negative name sentiment. Arbitrageurs appear to be limited in their ability to eliminate these deviations from firm fundamentals, but I observe some evidence of revisions. These findings are consistent with limited attention theory and sentiment theory.

1.4 Contribution

This thesis contributes to the existing literature in several ways. First, the director age chapter falls into category of research, which examines the impact of heterogeneity in demographic characteristics among independent directors with respect to decision-making. To my best knowledge, this study is one of the first to demonstrate the impact of the aging phenomenon among independent directors on firm performance, and the first to document the non-linear relationship between independent director age and firm value. In addition, I provide empirical evidence to policymakers, shareholders, and boards of directors regarding to whether they should abort the mandatory retirement age policy in their corporate charters or corporate bylaws. My results suggest that the aging phenomenon in boardroom has both costs and benefits. Mandatory retirement policies for independent directors should be qualified by the fact that there is a limited supply of qualified candidates, along with any instability that the transition period may induce.

Second, the chapter regarding CEO succession plan answers an important research question: how firms with or without CEO succession plans are affected by CEO turnover events. CEO turnover research generally examines either the factors affecting the likelihood of CEO turnover (e.g. Eisfeldt and Kuhnen, 2013; Guo and Masulis, 2015; Jenter and Kanaan, 2015), or the impacts of CEO turnover on firm performance (e.g. Denis and Denis, 1995; Weisbach, 1995; Huson, Malatesta, and Parrino, 2004; Fee, Hadlock, and Pierce, 2013). I believe that I offer a more complete view of the turnover process and the value of CEO succession planning.[3]

In addition, I provide five proxies to identify CEO succession plans. Identification challenges occur because firms are not legally required to disclose succession plan details.[4] Identifying whether or not a firm has a CEO succession plan is empirically challenging for three reasons. First, a legal requirement to disclose detailed information about CEO succession plans[5] is absent. Second, boards have an incentive not to reveal CEO succession plans. Revealing CEO succession plan information impacts on the incentives for firm members' efforts (Fama and Jensen, 1983), the likelihood of remaining in the firm and the willingness to acquire firm specific knowledge (Acharya, Myers, and Rajan, 2011). In addition, the CEO succession plans can have external effects including signaling high quality labor and prompting competitors to induce "successors" to move firms (Shen and Cannella, 2003). CEO deaths events provide a good opportunity to force firms to reveal information about their succession plans. Notably, I extend on the current approaches by scraping all 8-K filings and collecting information on firms' succession processes, such as the transition period duration, interim successor, external or internal successor as well as whether the firms indicates ex-ante whether they have a succession plan. Furthermore, this identification approach is more robust than the methods used in the previous literature which infers the existence of succession plans or potential candidates by using proxies such as number of executive titles. The use of these proxies in isolation creates measurement error as one-third of the

[3] Naveen (2006) and (Mobbs and Raheja 2012) examine succession planning from an alternate perspective to this paper. Naveen (2006) examines how the complexity of the firm affects the likelihood of an internal successor. Mobbs and Raheja (2012) study the structure of the internal labor market.

[4] During 2008 – 2012, there were 32 shareholder sponsored proposals for information relating to firm succession plans. The management teams always recommend "Against" and all proposals failed to achieve sufficient support. Please see Appendix Table A1-2 for more detailed information. However, some of firms adopt CEO succession plans after successive shareholder proposals without the majority voting results.

[5] 100 percent (32) of shareholder proposals seeking succession planning disclosure information between 2008 – 2013 failed to pass. See Appendix Table A1-2

heirs apparent leave firms prior to CEO turnover events (Shen and Cannella, 2003) and also restricts succession planning to the internal labor market only.

Next, I use CEO and director death events as natural experiment to address the endogeneity concerns. Estimating the effect of aging independent directors and CEO succession plans faces both identification and selection issues. Similarly, since most CEO turnover and director selection are endogenous, examining all turnover events and full panel data may lead to self-selection and omitted variable bias, potentially inducing biases when drawing statistical inferences. In this thesis, I use a natural experiment, namely CEO and director sudden deaths event that cause unexpected CEO turnover and unexpected change of board structure. I hand-collect CEO and director sudden deaths sample. This empirical strategy to catch exogenous shock is originally employed by Johnson, Magee, Nagarajan, and Newman (1985) and become popular with more recently publications in the corporate governance literature (e.g. Fee, Hadlock, and Pierce, 2013; Pan, Wang, and Weisbach, 2015). Consequently, I can confidently draw causal conclusions about the impact of succession plans and director age.

Last, my findings of the third chapter confirm the conjectures from the combination of limited attention theory and sentiment theory. Name bias affects the trading behavior of individual and institutional investors, and has a real impact on asset prices. This chapter contributes to the behavioral finance literature. First, I create a direct measure of investor attention to a specific name term. Internet Search engines (e.g. Google) provide a measure of attention by counting the density of search volume regarding to the market trends (Da, Engelberg and Gao, 2015) or to individual securities. I use Google search density provided by Google Trends[6] as a direct measure of retail investor attention. This measure of individual attention to each firm can be identified with greater frequency (weekly basis). The primary difficulty in proving the behavioral story in finance is nonexistence of proper measures for investor sentiment for individual firms. Baker and Wurgler

[6] Detailed information will be discussed in Session Data and Empirical Design.

(2006) propose that the question in behavioral finance is not whether investor sentiment affects stock price, but how to measure investor sentiment and quantify its effect. In this paper, I provide a solution to the measurement of sentiment for individual firms: investor sentiment directly measured by the internet search behavior of individuals. By adding in a set of positive or negative search keywords, the search volumes can further capture the unexpected sentiment intensity changes of individual stocks for both optimistic and pessimistic attitudes. Our active measure of sentiment is more accurate and direct as the internet searches is conducted by investors themselves.

1.5 Structure of the Dissertation

The dissertation is structured as three standalone chapters and a conclusion. Each chapter of Chapters 2–4 is self-sufficient and contains its own detailed introduction, literature review, empirical analysis and conclusion. More specifically, the rest of this thesis is organized as follows. Chapter 2 investigates the aging phenomenon among independent directors and its impact on corporate governance and firm performance. Chapter 3 studies the value of CEO succession plan. Chapter 4 tests the conjectures of unexpected corporate name related attention and sentiment on stock price base on Internet search volume density. Chapter 5 concludes the thesis with the main findings.

1.6 References

Acharya, V.V., Myers, S.C. and Rajan, R.G., 2011. The internal governance of firms. *The Journal of Finance*, *66*(3), pp.689-720.

Alter, A.L. and Oppenheimer, D.M., 2006. Predicting short-term stock fluctuations by using processing fluency. *Proceedings of the National Academy of Sciences*, *103*(24), pp.9369-9372.

Baker, M. and Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. *The Journal of Finance*, *61*(4), pp.1645-1680.

Da, Z., Engelberg, J. and Gao, P., 2015. The sum of all fears investor sentiment and asset prices. *Review of Financial Studies*, *28*(1), pp.1-32.

Denis, D.J. and Denis, D.K., 1995. Performance changes following top management dismissals. *The Journal of finance*, 50(4), pp.1029-1057.

Eisfeldt, A.L. and Kuhnen, C.M., 2013. CEO turnover in a competitive assignment framework. *Journal of Financial Economics*, *109*(2), pp.351-372.

Fee, C.E., Hadlock, C.J. and Pierce, J.R., 2013. Managers with and without style: Evidence using exogenous variation. *Review of Financial Studies*, *26*(3), pp.567-601.

Green, T.C. and Jame, R., 2013. Company name fluency, investor recognition, and firm value. *Journal of Financial Economics*, *109*(3), pp.813-834.

Grullon, G., Kanatas, G. and Weston, J.P., 2004. Advertising, breadth of ownership, and liquidity. *Review of Financial Studies*, *17*(2), pp.439-461.

Guo, L. and Masulis, R.W., 2015. Board structure and monitoring: New evidence from CEO turnovers. *Review of Financial Studies*, *28*(10), pp.2770-2811.

Huson, M.R., Malatesta, P.H. and Parrino, R., 2004. Managerial succession and firm performance. *Journal of Financial Economics*, *74*(2), pp.237-275.

Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, *3*(4), pp.305-360.

Jenter, D. and Kanaan, F., 2015. CEO turnover and relative performance evaluation. *The Journal of Finance*, *70*(5), pp.2155-2184.

Johnson, W.B., Magee, R.P., Nagarajan, N.J. and Newman, H.A., 1985. An analysis of the stock price reaction to sudden executive deaths: Implications for the managerial labor market. *Journal of Accounting and Economics*, *7*(1-3), pp.151-174.

Kumar, A., Niessen-Ruenzi, A. and Spalt, O.G., 2015. What's in a Name? Mutual Fund Flows When Managers Have Foreign-Sounding Names. *Review of Financial Studies*, p.hhv017.

Larcker, D.F. and Saslow, S., 2014. Report on Senior Executive Succession Planning and Talent Development Survey. *Institute of Executive Development and Stanford University*.

Linck, J.S., Netter, J.M. and Yang, T., 2009. The effects and unintended consequences of the Sarbanes-Oxley Act on the supply and demand for directors. *Review of Financial Studies*, *22*(8), pp.3287-3328.

Masulis, R.W. and Mobbs, S., 2014. Independent director incentives: Where do talented directors spend their limited time and energy?. *Journal of Financial Economics*, *111*(2), pp.406-429.

Pan, Y., Wang, T.Y. and Weisbach, M.S., 2015. Learning about CEO ability and stock return volatility. *Review of Financial Studies*, p.hhv014.

SEC. 2009. Staff Legal Bulletin No. 14E (Shareholder Proposals). Staff Legal Bulliten .

Shen, W. and Cannella, A.A., 2003. Will succession planning increase shareholder wealth? Evidence from investor reactions to relay CEO successions. *Strategic Management Journal*, *24*(2), pp.191-198.

Tadelis, S., 1997. What's in a Name? Reputation as a Tradeable Asset.

Weisbach, M.S., 1995. CEO turnover and the firm's investment decisions. *Journal of Financial Economics*, *37*(2), pp.159-188.

Chapter 2

Are Directors like Fine Wine?

Abstract[7]

The average age of directors has increased substantially over time, rising 8% from 2002 to 2014. This begs the question of whether all firms should have mandatory retirement age policies for directors. Using 8-K filings of all listed firms from 1994 to 2014, I show that shareholders welcome amendments to corporate charters that increase independent director mandatory retirement age. However, regressions of firm performance on director age in a sample of Standard & Poor's 1500 firms from 1996 to 2014 show that the effect of independent director age on firm performance is non-uniform. To address potential endogeneity issues, I exploit director sudden death events. My results suggest that age has both costs and benefits. Mandatory retirement policies may preclude firms from retaining talented individuals.

[7] I am grateful to Renée Adams, Ran Duchin, Huasheng Gao, Angie Low, Ronald Masulis, David Reebs, Warwick Schneller, Kelly Shue, Laura Starks, Robert Tumarkin, Ralph Walkling, Fei Xie, Jun Yang, David Yermack, Bohui Zhang and Le Zhang for their generous help and insightful suggestions. I also thank Jeffrey L. Coles, Naveen D. Daniel and Lalitha Naveen for providing me the code cleaning for the RiskMetrics datasets. All comments are welcomed. I remain responsible for any remaining errors or omissions.

Goldman Sachs increased the retirement age of directors by three years to 75 in December 2009 in order to retain John H. Bryan who is the presiding independent director and adds wisdom and maturity to the board according to explanation of Goldman Sachs spokesman.

Bloomberg

2.1 Introduction

Director aging continues to gain attention in corporate governance as age limits have become a media focus. Proponents argue that old-school boardrooms cannot benefit firms with an influx of creative ideas and perspectives, even though no law, rule, or regulation currently prescribes a maximum age for directors. On the other hand, older directors can benefit firms through abundant life experience and better supervision for young chief executive officers (CEOs). In this paper, I show that director age limits are misguided and counterproductive, regardless of age discrimination.

In the post-Sarbanes-Oxley Act (SOX) era, the demand for independent directors has increased significantly due to the mandate for a majority independent board enforced by both the Securities and Exchange Commission (SEC) and major stock exchanges in the US. 8 However, the supply of independent directors remains unchanged (Knyazeva, Knyazeva， and Masulis, 2013). In addition, more than half of S&P 500 companies limit outside directorships for their CEOs and top executives, and 53% of S&P 500 CEOs serve on no outside corporate boards. 9 Moreover, the increased workload and responsibility required by SOX and the Dodd Frank Act can further diminish the supply of independent directors (Linck, Netter, and Yang, 2009; Masulis and Mobbs, 2014). Consequently, to maintain or to form a majority independent board, firms must decrease independent director turnover, increase the mandatory director age, and pay more compensation

[8] The NYSE and NASDAQ adopt the rule that independent directors must comprise a majority of the board after SOX (for detaileds, see NYSE Listed Company Manual Section 303A.01. and Nasdaq Listing Rule 5605(b) (1)).
[9] Spencer Stuart. Spencer Stuart U.S. Board Index. 2008. For detailed, please see: https://www.spencerstuart.com/research-and-insight/board-indexes

to attract qualified and talented independent directors. In 2014, 53% of new independent directors are retired senior-age executives and professionals, compared to 39% of new directors in 2009. Conversely, active executives or professionals now represent 47% of new independent directors, down from 61% in 2009. 10 These changes have resulted in the average age of independent directors at Standard & Poor's 500 (S&P 500) companies rising from 60.3 in 1998 to 63.9 in 2014.11

Senior-age directors generally embrace robust social ties and social support, and have more life and professional experience. However, they may contribute fewer creative ideas to the boardroom and have less concern about their reputation and future careers, which can potentially demotivate behavior as a director. In this study, I examine whether the aging phenomenon in boardrooms, especially among independent directors, has an economically and statistically significant impact on firm value and major corporate policy decisions.

The paper contributes to the literature. First, I identify the factors that have resulted in the aging problem among independent directors. SOX rules play an important role in board aging phenomenon. In addition, the aging of nominating committees and CEOs has also facilitated an age increase in recent appointed independent directors. Board members in nominating committees are more willing to appoint new independent directors with cohorts as they share more demographic similarities.

Second, I examine whether senior-age independent directors are actively involved in board monitoring and advisory decision-making. I use board meeting attendance and committee preferences to illustate the performance gap among different age groups of independent directors. After controlling for personal and firm characteristics, I find that the senior-age directors on average have fewer attendance problems compared to other age groups. I observe that directors at retirement

[10] Spencer Stuart Board Index 2014. For details, please see https://www.spencerstuart.com/research-and-insight/spencer-stuart-us-board-index-2014
[11] For details, please see: http://www.bloombergview.com/articles/2015-01-26/u-s-corporate-directors-are-getting-old

age for their primary job (62-67) have the most severe attendance problems. I indicate that director attendance relates to proximity to retirement from the primary job rather than age. Next, I find that poor attendance is partially driven by health issues associated with the increased age among retirement-age directors.

Then, I investigate the board committee commitment of senior-age directors. After SOX, all US-listed firms are required to have an independent nominating committee, an independent compensation committee, and an independent audit committee in addition to the majority independent board required by the SEC and major exchanges.12 Consistent with my hypotheses, I observe an aging phenomenon across these committees, especially nominating committees, except for the audit committees. Using director fixed effect models to mitigate potential endogeneity issues (unobserved factors) caused by a firm encouraging actively engaged directors to stay, I identify the personal preference of independent directors when a busy director choose to leave a certain board. These senior-age directors are more willing to stay in a firm that has more senior-age directors as well as a senior-age CEO. In addition, they tend to leave the boards if they have fewer committee commitments and the board size is relatively large. I find that senior-age directors are more willing to appoint senior-age independent directors, to force more performance-based CEO turnovers. I find that senior-age directors have no effect on the determinant of executive director age since the nomination of executive director is a decision more driven by CEO and executives (Westphal and Zajac, 1995). In addition, senior-age directors are generally better at controlling firm risk associated with negative events, e.g. frauds. Consequently, firms with more senior-age independent directors or CEOs have lower stock return volatility.

Fourth, I conduct a pilot study to show shareholders' reaction to a change in mandatory retirement age for the board members. The result indicates that investors, on average, react positively around both the effective dates and filing dates on which firms increase the mandatory retirement age or

[12]Board Independence of Listed Companies - Final Report. For details, please see: https://www.iosco.org/library/pubdocs/pdf/IOSCOPD238.pdf

eliminate the mandatory retirement policy, especially to keep their talented and important independent directors in boardrooms. However, the accumulated abnormal returns are, on average, negative but not significant for a decrease in the mandatory retirement age or the establishment of a mandatory retirement policy. Consequently, the cumulative abnormal returns associated with relaxing the mandatory retirement rule are significantly higher than for tightening the mandatory retirement rule, which indicates that senior-age directors create value for firms. These results confirm the comment from the Goldman Sachs spokesperson quoted at the beginning of this paper.13

After the event study, I conduct comprehensive examinations on the effects of independent director age. Using multi-variant regression, I find that, ceteris paribus, independent director aging, on average, negatively affects firm value. The appointment of new retirement-age directors can be detrimental to firm value. This finding first appears to contradict the results observed in the event study analysis. However, further analysis reveals that the relationship between director age and firm value is non-uniform. Specifically, negative impacts on firm value are driven by an age increase among about retirement age directors (aged between 62 and 67). Outside of this age boundary, I observe a positive relationship between director age and firm value. Last, senior-age CEOs are also adept at maintaining high operating performance, as measured by return on assets (ROA), but not so adept at creating growth opportunities, as measured by Tobin's Q.

To address potential endogeneity issues, I adopt a natural experiment study and an instrumental variables regression study. First, I exploit shareholder reactions to director sudden deaths among different age groups. I find that shareholders react more negatively following the deaths of senior-age independent directors, ceteris paribus. Next, I use the average age of local director candidate pools as an instrument variable. The two-stage least square (2SLS) results confirm my findings. To sum up, my results show the nonlinear relationship between independent director age and firm

[13] http://www.bloomberg.com/news/articles/2012-04-02/goldman-sachs-s-john-bryan-lois-juliber-to-step-down-from-board

performance. At the same time, I provide evidence against establishing mandatory retirement age rules for independent directors.

Finally, I investigate the cost associated with hiring senior-age independent directors. A key reason for independent directors' willingness to stay on boards after retirement from their primary job is the director compensation. The independent directors S&P 500 firms earn $242,385 in 2014, on average, up 15% in the last five years. This compensation is earned by attending only about eight board meetings a year (Spencer and Stuart, 2015). Through examination of a large sample of DEF-14A filings after 2006, I find that compensation plans for directors are evolving from a meeting-based one-off cash payment to a comprehensive executive-like payment package that includes retirement benefits. The empirical evidence shows that companies pay more to senior-age directors, including senior CEOs. In addition, CEOs with senior-age directors on their compensation committee generally receive more in their total compensation package.

This chapter falls into category of research, which examines the impact of heterogeneity in demographic characteristics among independent directors with respect to decision-making. The aging problem has been well studied and documented in other fields, such as anthropology, psychology and actual study. At the same time, the aging phenomenon among board members has drawn attention from both mass media and shareholders. However, I find few studies in the corporate governance literature focusing on behavioral differences among directors at different life stages, especially in boardrooms. To my best knowledge, this study is one of the first studies to demonstrate the impact of aging phenomenon among independent directors on firm performance and the first to document the non-linear relationship between independent director age and firm value. Consequently, this chapter contributes to the board and corporate governance literature.

This chapter contributes to the existing literature in several ways. First, I use a stronger identification approach to address endogeneity through the deployment of an instrument variable regression and a natural experiment analysis. Using the average age of potential pool of director candidates as an instrument, I find consistent result with panel regression. Second, I conduct an event study on changes to the mandatory retirement age and find that investors on average react positively if firms increase or eliminate the mandatory retirement age to retain their important directors. Then I use SOX and corresponding changes in the New York Stock Exchange (NYSE) and NASDAQ listing requirements for board independence as a quasi-natural experiment to identify a subsample of my firms that are subject to an exogenous shock to independent director age. I use the estimated exogenous shocks to independent director age to regress on firm performance and the results are similar. In a final attempt to address endogeneity, I hand collect a relatively comprehensive sample of director sudden deaths as an exogenous shock to independent director age. Director sudden deaths are widely used as a quasi-natural experiment to study the characteristics of independent directors (e.g. Nguyen and Nielsen, 2010; Salas, 2010; Falato, Kadyrzhanova, and Lel, 2013). I find that shareholders react more negatively to the deaths of senior-age directors. The cumulated abnormal returns (CARs) are negatively correlated with director age, controlling all possible factors, especially in the senior-age director sample, but more positively correlated with about-retirement-age directors. In addition, my results are robust to different measures of age to mitigate the possibility of measurement errors and outliers. Overall, my results hold both qualitatively and quantitatively after my best attempts to control for endogeneity.

Second, I use director fixed effect model to determine the preference of independent directors when they choose firms to leave. To my knowledge, this is the best way (avoiding endogeneity problems: the choices of firms) to identify how senior-age directors make their resignation decisions. Then, I further compare the coefficients with the regression result after controlling the firm fixed effects. With the firm fixed effects, the coefficients represent firm decisions (or nominating committee decisions) surrounding independent director turnovers. These two different identifications in the fixed effect models allow me to differentiate the decisions made by independent directors themselves from those of the board nominating committees. I find that the senior-age directors might have conflicting interests with respects to the director job.

Finally, I provide empirical evidence to policymakers, shareholders, and boards of directors regarding whether they should abort the mandatory retirement age policy in their corporate charters or corporate bylaws. Among all the reasons for independent director turnovers, mandatory retirement age and retirement are ranked 2 and 3 (13.82% and 11.69%, respectively), following merger and acquisition (29.69%).14 Among the public listed corporations in the United States, all of the approximately 50,000 directors have an average mandatory retirement age of 72 (Larcker and Tayan, 2011). I suggest waiving or extending the mandatory retirement age to retain senior-age talented and important directors. As the supply of directors is limited, a mandatory retirement policy can lead the nominating committee to appoint less qualified or inappropriate directors and thus worsen the transition period.

The rest of this paper is structured as follows. Section 2 lays out the motivation for the study and develops the various hypotheses. Section 3 describes the data collection process and the experimental design. Section 4 illustrates the empirical results and includes five parts: First, I try to identify the determinants of independent director age based on SOX and other factors. Second, I illustrate the attendance problems and committee preferences of senior-age directors. Third, I explore the benefits of senior-age directors with an event study of mandatory director age change. At the same time, I examine whether senior-age directors are likely to be effective monitors. Fourth, I test the salutary effects of an aging board on firm performance and major corporate policy as manifested in the relationship between independent director age and various performance measures. Fourth, I try to address endogeneity concerns with variation of director age using a sudden-death sample and Instrument Variable (IV) analysis. Fifth, I document the cost associated with an aging board. Section 5 addresses various alternative explanations and presents robustness tests for my findings. Section 6 concludes.

[14] The reason for independent director turnover is self-reported in firms' 8-K filings. The data are collected and further processed and categorized by the Audit Analytics Dataset.

2.2 Motivation, Related Literature, and Hypotheses Development

In this section, to motivate my empirical study, I discuss the related literature and outline the determinants and consequences of the aging phenomenon among independent directors.

2.2.1 Determinants of the Increasing Age among Independent Directors on Board

2.2.1.1 The Effect of SOX on Independent Director Age

Jensen and Meckling (1976) point out that the separation of ownership and control in modern public corporations creates significant conflicts of interest between managers and shareholders. These conflicts of interests must be contained through board monitoring activities. Many regulatory authorities have established rules for directors to overcome these agency problems (e.g., SOX and Dodd Frank Act). However, one of the side effects of the stricter restrictions on board independence is the aging problem among independent directors. Due to the lack of a large pool of qualified, well-experienced, committed, and engaged candidates for independent directors (Masulisa, Ruzzier, Xiao, and Zhao, 2012), nowadays, only 2% of step-down independent directors are dismissed or not re-elected (Larcker and Tayan, 2011). Director age increases as firms that are not compliant with listing requirements for board independence during the pre-SOX period choose to retain older directors on their board (Linck, Netter, and Yang, 2009). Moreover, these stricter rules discourage the nominating committees of compliant firms from dismissing their current independent directors. Hymowitz and Green (2013) show that board turnover in 2012 at S&P 500 companies is the lowest in a decade, with 291 of 5,184 director seats changing hands. This low turnover rate exacerbates the aging phenomenon in the independent director pool.

This leads to my first hypothesis:

Hypothesis 1.1: Independent director supply side constraints result in increases in independent director age.

2.2.1.2 Influences from the CEO and the Nomination Committee

Empirical evidence shows that CEOs (Shivdasani and Yermark, 1999) and nomination committees (Adams, Ragunathan, and Tumarkin, 2013) are actively involved in the selection of new board members and are more likely to appoint new directors who are similar to themselves (Westphal and Zajac, 1995). The concept of similarity occupies an important place in several theories of social relations. Psychology literature shows that it is easier to build connections among individuals of similar age. Byrne and Nelson (1965) demonstrate a positive linear relationship between age similarity and interpersonal attraction. In addition, inclusive fitness theory predicts that natural selection favors altruist genes that are more accurate in targeting altruism only to copies of themselves.

Applying theories of psychology in corporate research, Byoun, Chang, and Kim (2013) find that if the board members share common demographic characteristics with a CEO, they make more effort to provide resources to the CEO and the CEO is more willingly to work in these firms. As the director candidates from the same age cohort of the incumbent CEO are more likely to be socially connected or to build social connections with the CEO, influential CEOs are more likely to appoint directors of a similar age. In addition, after SOX, the fully independent nominating committees gain power in selecting new directors and the aging in nominating committee may be another driver of an older board.

This leads to the second hypothesis.
Hypothesis 1.2: The increases of independent director age are positively associated with CEOs age and Nominating Committee members' age.

2.2.2 Costs and Benefits Associated with Aging Independent Directors

In prior studies, different types of directors are well studied, including foreign directors (Masulis, Wang, and Xie, 2012), banker directors (Guner, Malmendier, and Tate, 2008), female directors

(Adams and Ferreira, 2009), venture capitalists (Baker and Gompers, 2003), CEOs in other firms (Fahlenbrach, Low, and Stulz, 2010), and politically connected (Goldman, Rocholl, and So, 2009). However, the most important demographic characteristic, age, has received limited attention in corporate governance research. Consequently, in this paper, I will examine the effects of director aging on corporate governance and firm performance.

Forbes and Milliken (1999) shows that executives' beliefs are influenced by different demographic characteristics and the variation in beliefs leads to variation in corporate decisions, firm policies and firm performance. Previous researchers have shown that the characteristics of independent directors matter (Malmendier and Tate, 2005; Fama and Jensen, 1983).

2.2.2.1 Incentives of Senior-age Directors - Career Concerns

Independent directors care about their reputations and future career paths (Masulis and Mobbs, 2014; Guo and Masulis, 2015). However, previous literature on career concerns focus more on the age of CEOs rather than the age of the board of directors. Yim (2013) demonstrates that younger CEOs make more acquisitions and receive large, permanent increases in compensation. These financial incentives result in CEOs pursuing acquisitions in their early career. In addition, Li, Low, and Makhija (2011), using US plant-level data, find that younger CEOs are more likely to undertake bolder investment activities, to enter new lines of business, and to make acquisitions, signaling confidence and superior abilities to other firms. Serfling (2013) documents that firms with older CEOs carry out less risk-taking behavior and experience less stock return volatility. Similar to younger CEOs, younger directors are more willing to show their capability in monitoring CEOs (Kim, Kang, and Low, 2016). As older CEOs are better at controlling firm risk, I argue that aging independent directors are better at controlling firm risk.

This leads to the following hypothesis:

Hypothesis 2.1: Senior-aged independent directors are better at risk control than younger independent directors.

2.2.2.2 Drawbacks of Senior-age Directors - Health Issues

Cline and Yore (2012) document that senior-age CEOs can significantly damage firm value due to health issues. Consequently, health issues among senior-age directors are another concern of investors. Deterioration in the health condition of senior-age directors can have a significant impact on director behavior in board activities, although many people believe that the retirement age of 65 is only the new 45 due to improvements in modern medicine.[15]

This leads to the following hypothesis.

Hypothesis 2.2a: An increase in independent director age can be detrimental to firms.

Literature in psychology has shown that people around retirement age behave differently around retirement age. People tend to be anxiety about their retirement life when are they are approaching retirement age and demand time to adjust to their retirement life after retirement. Recent literature uses the change of retirement age in social security system as a natural experiment to show the significant change due to retirement. Bielecki, Goraus, Hagemejer and Tyrowicz (2016) shows raising the retirement age is universally welfare enhancing for all living and future cohorts, regardless of the pension system and fertility. People at about-to-retirement age are willing to work rather than retirement from current occupation. Vermeer, Mastrogiacomob and Soest (2016) shows that people contribute less to their current occupation and busy finding a replacement job. Director and executives are busy worrying their retirement life and hunting potential occupations rather than take more responsibility from current job.

[15] For details, please see: http://www.csmonitor.com/Business/The-Simple-Dollar/2011/0610/Retirement-at-65-But-it-s-the-new-45!

2.2.2.3 Information Sharing

The board's function is focused on the important decisions of the firm rather than the daily operations and independent directors may not have enough time or energy to monitor the day-to-day details of a firm's operation. A close relationship between the CEO and board of directors may lead to better information sharing and this information channel enhances boards' monitoring function (Kim and Lu, 2012). Duchin, Matsusaka, and Ozbas (2010) also show that information transparency significantly influences the effectiveness of outside directors due to the cost of acquiring information about the firm. Directors who are retired from their executive job have more time to observe and acquire information, so they may be better monitors. Therefore, senior-age directors may be more suitable than younger directors because they know more about the firm specific information than younger independent directors.

In addition, according to the functions of the board, senior-age directors can influence corporate governance in two aspects: monitoring and resource provision (Adams and Ferreira, 2007; Adams, Hermalin, and Weisbach， 2010). Adams and Ferreira (2007) find that a friendly board can improve firm performance though the advisory channel. Psychology research has shown that altruism increases with age (Piliavin and Charng, 1990). When older directors are less like to challenge the CEOs, they can provide better advice to the CEO. Mace (1971) confirms that when boards of directors do not challenge the CEOs, they will provide advice and counsel. CEOs may not be willing to share information with tough, young independent boards of directors as they frequently challenge CEO decisions (Kim, Kang, and Low, 2016). A failure in the advisory role of the board can result in underperformance (Fracassi and Tate, 2012). Consequently, senior-age directors can benefit firm value.

In summary, the information asymmetry theories and the friendly board theories support that senior-age independent directors provide benefits to companies.

This leads to the following hypothesis:

Hypothesis 2.2b (contrary hypothesis): Senior-age directors benefit the firm.

Based on a Spencer Stuart Board Index report, unchanged old-school board members are less likely to bring new, unique, and distinct advice to the corporate decision-making process. They might be reluctant to share information opposing the CEO since such challenges might ruin their relationship with the CEO. Thus, start-up firms or high R&D intensity firms may need young directors.

This leads to the following hypothesis:

Hypothesis 2.3: Young directors benefit high R&D intensity firms.

2.2.2.4 The cost of aging independent directors

One of the direct costs for hiring independent directors is the director compensation. After SOX, the compensation structure for independent directors has changed. The compensation package has evolved from a simple meeting fee-based annual cash payment to an executive-like compensation package that includes cash payments, incentive-based stock payments, and even a proportion of retirement benefits. Director can only archive the retirement benefit until they reach the mandatory retirement age.[16] This change partially explains why independent directors are willing to stay on boards. Yermack (2004) uses Fortune 500 firms as a sample to show that director compensation is a major incentive for independent directors to actively participant in value-adding board activities. Furthermore, Adams and Ferreira (2008) show the well-compensated directors are more likely to be actively involved in board monitoring activities, including attending board meetings. Masulis and Mobbs (2014) also document that independent directors are better compensated in prestigious firms and spend more of their limited time and energy in monitoring prestigious firms.

[16] Mandatory retirement policy is discussed in detail in the next section.

This leads to the following hypothesis:

Hypothesis 2.4: Increased independent director age is associated with increased director compensation.

2.2.3 Mandatory Retirement Age Policy

One way to meet the majority independent requirement and keep senior-age directors on boards of directors is to relax or eliminate the mandatory retirement rule for independent directors by modifying company charters or bylaws. Today, boards are raising the mandatory retirement age to allow experienced directors to serve longer: 88% of boards with a mandatory retirement age sets it at 72 or older versus 46 % a decade ago. Nearly 25% of firms have a retirement age of 75 or older versus 3% a decade ago. This might benefit firm value if the firm increases the mandatory director age to retain particular experienced, important, and talented directors. Many corporations, especially during economic downturns, retain existing directors by either extending or waiving the mandatory retirement age rather than by nominating untested new directors (Larcker and Tayan, 2011).

A firm may increase the mandatory retirement age for the greater good due to the firm's inability to recruit directors who are as talented and experienced as the existing independent directors. In addition, the existing mandatory retirement policy may lead to an unstable transitional period. Because of the extra burdens created under these circumstances, the other independent directors cannot spend their limited time and energy on more important issues inside the firms. Uncertainties can also appear when an important independent director with multiple functions on the board faces compulsory retirement. Eliminating a mandatory retirement policy can smooth the transition period and leave firms more time to prepare for qualified candidates with specific skills without vacancy of talent in board leadership.

This leads to the following hypothesis:

Hypothesis 3a: Eliminating the mandatory retirement rule or increasing the mandatory retirement age for independent directors can benefit firms.

However, the mandatory retirement policy can be an efficient way to limit the influence of entrenched powerful directors. Forced retirement can be an effective way to inject new blood to the board and Kim, Kang, and Low (2016) find that this new vitality can be beneficial to firm value.

This leads to the following competing hypothesis:

Hypothesis 3b (contrary hypothesis): Eliminating the mandatory retirement rule or increasing the mandatory retirement age for independent directors can be detrimental to firms.

2.3 Data and Empirical Design

I start this section by illustrating my sample construction and variable calculation methods, including different measurements of age. Then I further describe the experimental design, matching estimator, and fixed effect method.

2.3.1 Data Collection and Main Sample Formation

My major sample contains all S&P 1500 firms (S&P500, S&P MidCap, and S&P SmallCap) covering 1996-2012. The main analysis uses the demographic information of individual directors obtained from RiskMetrics, the information of CEO and major executives from Execucomp, social connections, compensation and other data from BoardEx,[17] firm fundamental and accounting data from Compustat, and daily stock return data from the Center for Research in Securities Prices (CRSP).

[17] The compensation data for directors from BoardEx only covers SP500 firms.

Following Almeida and et al. (2009), I drop firms with missing or negative values for total assets (at), capital expenditures (capx), property, plant, and equipment (ppent), cash holdings (che), and sales (sale). I also drop firms for which cash holdings, capital expenditures, or property, plant, and equipment are larger than total assets. My RiskMetrics director data selection criteria and variable construction approach follow Coles, Daniel, and Naveen (2014),[18] who study the effects of director co-option on board monitoring and firm performance. Although Adams, Hermalin, and Weisbach (2010) argue that spinoffs or mergers and acquisitions (M&As) can shed more direct empirical light on the dynamic nature of the CEO-board relationship, board decisions (e.g., hiring or firing directors), firm activities and behaviors, and performance outcomes during spinoffs or M&As can be constrained by other unobservable factors that I cannot control. Consequently, I exclude firm-year observations with potential M&As, spinoff activities, or other extreme events by further requiring the board to have 50% of its directors remain unchanged and a total asset growth rate less than 100% and exceeding -50%, following Yermark (2004). The final sample contains 22,257 firm-year observations associated with 2,715 unique firms. Details of the sample build-up process are in the appendix.

2.3.2 Variable Construction and Summary of Statistics

The director age-related variables are created based on RiskMetrics, BoardEx and Capital IQ database. In addition, the CEO and executive age variables are generated based on Execucomp and Capital IQ.[19] For the missing values or potential error observations (outliers or different age records for the same director among different databases), I manually correct more than 2,437 observations from various resources, including proxy statements, Google search engine, and other sources. Also, about 10% of the CEO and executive observations in Execucomp do not include age and I manually collect the CEO and executive age values for these observations.

[18] I appreciate Jeffrey L. Coles, Naveen D. Daniel, and Lalitha Naveen for kindly providing me the SAS codes to clean the RiskMetrics and Execucomp databases.
[19] Capital IQ Professional has better coverage and better data quality. I cross-check the key variables of interest using Capital IQ Professional as a supplemental source.

2.3.2.1 Different Measures of Director Age

First, I use director-level variables to measure the age of directors: *Age* (raw age measured by years) and *Log (Age).* However, these measures are highly collinear with other variables, such as director tenure, because they all increase by one every year. Therefore, I transfer the raw ages into different dummy variables. The *Retired Age* dummy is an indicator of whether an executive or a director is at retirement age: older than 67 years old. The *Young Age* dummy is an indicator of whether an executive or director is younger than 50 years old. Then I use the *Retirement Status* to measure the potential end of professional life. Retirement can create a big change in income and professional social networks. *Retirement Status* is an indicator variable that shows the retirement status record in RiskMetrics Database, BoardEx Database, and other data sources like Google, NNDB, Fectiva, and Who is Who. Then I add *Initial Age on Board* to address the preference of aging nominating committee members and aging CEOs. The *Initial Age on Board* is the age of a director when he/she is first appointed to the current board. Moreover, prior literature shows that early-life experiences (e.g., Depression baby) of the CEO can result in different preferences regarding corporate financial policies (Malmendier, Tate, and Yan, 2011; Malmendier and Nagel, 2011). Custodio, Ferreira, and Matos (2012) also show that CEO lifetime experiences influence the firm's compensation decision. The behavior of independent directors with respect to different cohorts may have different impacts on firm performance. Therefore, I use dummy variables to describe the directors in different cohorts. The detailed definitions are provided in Table AI. Figure I summarizes the average independent director ages of S&P 1500 firms from 1996 to 2012. Figure II illustrates that the retired ratio increases significantly during 2002-2004, when non-compliant firms are required to meet the requirement to have a majority of independent directors on the board. Fahlenbrach, Low, and Stulz (2010) point out the dark side of outside directors: They may quit ahead of trouble to protect their reputation and to avoid an increase in their workload. Consistent with their results, Figure I shows a drop in age of both CEOs and other type of directors just before a crisis or law change (e.g., SOX in 2002, Global Financial Crisis in 2007). It is a good strategy for retirement-age directors to leave a firm to save their reputation.

<Insert Figure I here.>

<Insert Figure II here.>

Next, I create aggregate age information of a board at the firm-year level. I calculate the average age of executive directors and independent directors separately. In addition, I calculate the proportion of independent directors in each age group. As shown in Table I, the average age for independent directors is 61.328, which is much higher than the average executive director age of 55.973. As previous literature has shown that the diversity of board directors plays an important role in determining the firm policies and firm performance (Miller and del Carmen Triana, 2009; Rhode and Packel, 2014), I calculate the age diversity among independent directors and find an increasing trend of age diversity (not reported).

<Insert Table I here.>

<Insert Table II here.>

Furthermore, to identify the non-linear effect of director age, I use the average age among different age groups inside the board to determine the effect of an age increase inside different age groups. Age groups for the nonlinear piecewise regression are defined as younger than 50, 51-62, 63-67, and older than 67. The discontinuity points of performance-age relationships are 50, 62, and 67, respectively (Age Group I, II, III, and IV). Next, I calculate the age similarity among independent directors and with the CEO. Coles, Daniel, and Naveen (2014) find that co-opted directors (directors who are appointed after the appointment of CEOs) are more likely to have a strong alliance to the CEO and become less effective in monitoring top management. I measure the age difference between the CEO and board of directors to measure the potential strength of this alliance by the *mean difference*, *average absolute difference*, *distance* (Shue, 2013), *squared mean,* and *conditional/unconditional distribution*.

2.3.2.2 Dependent Variables

I use Tobin's Q as a market measure of firm performance and ROA as an accounting measure of firm performance. To proxy the firm risk, I use annual stock return volatility. To test the relationship with board meeting attendance, I follow Adams and Ferreira (2009) and use an attendance problem dummy that is equal to one if the director is identified in the proxy as having attended less than 75% of meetings during the previous fiscal year. *Forced turnover* is created following Parrino (1997). First, a turnover is classified as forced if the proxy statements or current reports state that the CEO is fired, forced from the position, or departs due to unspecified policy. These data are partially retrieved from the Audit Analytics database, and the rest are retrieved from Edgar using Ruby codes. For the remaining turnovers, the turnover is classified as forced if the departing CEO is under the age of 60 and the turnover meets the following criteria: The firm performance is lower than the industry average, the proxy statement does not report the reason for the departure as involving retirement, death, or health, and no other executive positions can be identified by Execucomp or BoardEx. The latter circumstances of departures are further investigated by online searching of relevant press release articles to reduce misclassifications of CEO turnover reasons. Next, *Director Total Compensation* is calculated using BoardEx. The information is constrained to the sample of S&P 500 firms due to the limitation of database coverage. *Director Total Compensation* includes all cash and stock-based compensation.

2.3.2.3 Major Controls

The following explanatory variables are included as controls. Firm size is measured by total assets because the size of the organization can affect the board structure. Board independence is captured by the *Independent Director Ratio*. I also follow Coles, Daniel, and Naveen (2008, 2014[20]) by controlling for board size, female director ratio, as well as CEO power and entrenchment

[20] I would like to thank Coles, Daniel and Naveen for providing the code to clean the RiskMetrics director database.

measures such as CEO-founder, CEO-duality, CEO tenure, and CEO age. The average *CEO tenure* is 7.6 years. I use log value to address the right skewness and the skewness of CEO tenure is 64.47. I also use the data of the top five executives from Execucomp to further test the age effect in the executive suite. For details, please see Appendix.

I add corporate governance control variables, including corporate governance mechanism measures (charters) such as anti-takeover provisions. Other measures for independent directors, firm fundamental information, and other information are also included. These variables are correlated with age of independent directors and have a significant impact on firm performance. I measure shareholder rights by using the E-index (Bebchuk, Cohen, and Ferrell, 2009) including six provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, supermajority requirements for mergers, and supermajority requirements charter amendments. This index provides similar results as the GIM Index (Gompers, Ishii, and Metrick, 2001). Due to the difficulty of constructing the G-Index after 2007, I use the E-Index instead of the GIM-Index. Different firms may have different needs for advisory or monitoring jobs. I need to control for advisory need density and information transparency. The time-invariant firm characteristics are controlled by the firm fixed effect. Other firm fundamentals information, like firm age, is also included.

2.3.3 Empirical Design

2.3.3.1 Quasi-Experiment

A key challenge in corporate governance empirical research is that the CEO-executives-directors mechanism is endogenously determined. To address this problem, I use the methods to mitigate for the endogeneity issue: natural experiment and instrumental variables regression.

2.3.3.1.1 Change of Mandatory Retirement Age Policy

I use the events of firm amendments of mandatory retirement age policy as a preliminary test to show the reaction of shareholders. Increased mandatory retirement age can help firms increase the average age of independent directors. This provides opportunities to discover the effect of age change, as it only leads to a potential change of independent director age in the future but no actually changes to the firm during the announcements. In sum, efficient capital markets will incorporate this effect into stock prices immediately and the effect will be captured by cumulative abnormal returns following this event.

2.3.3.1.2 Sudden Death of Executives and Directors

Second, I use the sudden deaths of individual directors as a natural experiment to observe the effect of director age on firm performance. As sudden death treatments are randomly assigned to all directors and officers, these shocks are well recognized as a valid tool to observe the casual effect of exogenous changes in the boardroom resulting from sudden deaths. The causal effect is calculated by the average treatment effects (Falato, Kadyrzhanova, and Lel, 2013). The deaths of executives or directors can create a random and exogenous shock to executive or director age. One potential problem with this quasi-natural experiment is sample bias because more death events happen to older directors. However, after using the human language analysis tool provided by Ruby to construct a relatively comprehensive death sample,[21] the summary statistics show that the age distribution of sudden deaths is similar to the regression sample. Consequently, director death is a valid experiment to test the effect of director age on firm performance.

2.3.3.1.3 Sarbanes-Oxley Act

To isolate the effects of SOX as an exogenous shock to director age, I apply a difference-in-differences (DiD) approach to confirm my observation about increasing director age due to SOX by statistical test. In 2003, the NYSE and NASDAQ adopt new exchange listing rules when the

---

[21] For detailed information about the death sample, refer to the Appendix: Death Sample. The detailed method of how I collect the sudden death data and the summary statistics from the death sample are provided in the appendix. The basic death event information and the processing code will be provided on request.

corporate governance of U.S. public firms was undergoing intense scrutiny and experiencing substantial change due to corporate accounting scandals involving such firms as Enron and WorldCom; these circumstances provide a quasi-natural experiment for corporate governance studies. The treatment in this study complies with the majority independent board requirement, no CEO on nominating committee, and independent nominating committee in 2001. As changes happen due to the treatment during 2002 and 2003, I use the board structure in 2001 as the baseline, following Kim and Lu (2012) and Guo and Masulis (2015) to benchmark the effect and calculate the changes of age of board of directors with the DiD estimator to eliminate the time trend effect. I use a control group (majority independent board, no CEO on nominating committee, or independent nominating committee in 2001) to remove any co-founding time-specific factors so as to isolate the treatment effect.

Then I conduct a multi-variants analysis. I use the DiD estimator with matching sample to run a regression. The empirical model is as follows:

$$
\begin{aligned}
&Independent\ Director\ Age \\
&\qquad = \beta_0 + \beta_1 \times Non\text{–}Compliant_j + \beta_{12} \times Non\text{–}Compliant_j \times\ Post\text{–}SOX \\
&\qquad + \beta_2\ \times\ POST\text{–}SOX +\ f(Other\ Controls) + \gamma_1 \times \delta_t\ + \gamma_2 \times\ \delta_i + \gamma_3 \times \delta_f \\
&\qquad + \varepsilon_{it}
\end{aligned}
$$

I follow the typical DiD setups for examining the impact of SOX on independent director age: Regress independent director age on three dummy variables: *Post-SOX*, *Non-Compliant*, and the interaction term *Post-SOX* × *Non-Compliant*. *Non-Compliant* is an indicator variable that equals to one if firm i is non-compliant with exchange listing rule j in year 2001 and zero otherwise. The non–compliant dummies are for non-compliance with SOX for CEO on nomination committee, non–compliant with SOX for non-independent nomination committee, and non–compliant with SOX for non-majority independent board for three models, respectively. Also, *Post-SOX* is an indicator variable that equals one if the year is 2004 or later and zero otherwise. δt is a vector of year fixed effects, δ_f is a vector of firm fixed effects, and δ_i a vector of industry fixed effects based on the SIC4 industry classification. In the above equation, β_0 measures the difference in independent director age between the treatment and control firms in the absence of the treatment, where treatment refers to the change in board structure imposed by the particular new exchange-listing rule. Similarly, β_1 measures the difference between the treatment and control firms in the absence of the treatment. β_{12} captures change in independent director age from the pre- to post-SOX period. The effect of the new exchange-listing rule on independent director age is captured by β_{12}. If the new exchange-listing rule leads to an increase in director age in treatment firms, then I expect to observe a positive and statistically significant β_{12}. Since a firm can be noncompliant with more than one new exchange-listing rule, I also estimate specifications in which I simultaneously include the treatment effects of all three listing rules together. I replace *Non-Compliant* by indicator variables that correspond to all three listing rules. The treatment effect of the individual listing rule is identified by cross-sectional and time series variations in compliance with the three listing rules.

2.3.3.2 Fixed Effect Model

Yim (2013) addresses the reverse causality problem of the acquisition-prone firm preferring young CEOs using the firm fixed effect. I include firm/industry and year fixed effects in the panel regression model to deal with the inconsistency caused by the unobserved time-invariant characteristics (technology-driven factors). These differences in industry or firm level may explain my results. Also, I include the year fixed effect to address changing tax regimes, changing periods of business cycles, and other time relevant problems caused by micro or macro environmental change during my sample period.

2.3.3.3 Instrumental Measures and LATE

Although my specifications are with either firm or director fixed effect controls for time-invariant unobserved firm characteristics, I address the residual endogeneity concern that unobserved time-variant firm characteristics may drive my results. To lessen any concerns that age of CEO and board of directors is correlated with potentially time-varying omitted factors, I use an instrumental variable approach. For an instrument to be valid, it must be relevant and satisfy any exclusion restriction. In other words, I need variables that are potentially correlated to independent director age (relevancy condition) but affect any given corporate decision only through their effect from executive and director age (exclusion restriction); that is, I need variables that are orthogonal to (unobserved) firm characteristics. The education ranking in a certain state, consumer price index (CPI), and gross domestic product (GDP) growth rate in the birth year are valid instruments for age. The relative ages of the whole population of CEOs, executives, and boards of directors or the state's population are also good measures. However, the age distribution of the local director labor market provides a better instrument variable. Knyazeva, Knyazeva, and Masulis (2013) demonstrate the impact of the local director labor market and local directors' talent on corporate board structure. According to Guner, Malmendier, and Tate (2008), the most common sources for independent director supply are executives at another nonfinancial firm, at another financial firm, and expertise with non-corporate backgrounds (e.g., professor, lawyers, attorney). The source shows that the major supply of independent directors is executive officers in surrounding firms. I document the exogenous effects of independent director age captured by the local director supply market as an instrument leading to the change in age with respect to firm performance and corporate policies.

However, the only problem with this measure is that the predicted change in age captures the local average treatment effects (LATE) rather than the average treatment effects (ATE). Imbens and Angrist (1994) document that the effect of a variable is only revealed for the subpopulations affected by the observed changes in the instruments and that subpopulations which respond most to changes in the instruments have the largest effects on the magnitude of the IV estimate. Due the mandatory retirement policy for executives, most executives in the candidate pool are younger than 67 year-old. This automatically excludes a great proportion of senior-age directors who have passed retirement age. Thus, the age effect captured by this instrument is driven by variations among independent directors younger than 67. To mitigate the LATE, I use a combination of the RiskMetrics, BoardEx, and Capital IQ Professional databases. However, if an executive is retired from all jobs, including director jobs in private firms, I do not reserve him/her in the local director pool as I cannot locate this person's address or retrieve any information regarding this person.

2.3.3.4 Counterfactual Matching Approach

I use matched samples to test the age effect on firm value. I construct the matching estimators using nearest neighbor and propensity score matching methods with the variables of firm size, firm age, and industry. The advantage of matching estimators unlike ordinary least squares (OLS) estimators is that it does not heavily rely on extrapolation and the estimators provide better line of fit. For instant, Abadie and Imbens (2007) point out that parametric estimators can be problematic if there is imperfect overlap in the covariate distribution of the treated and control groups.

2.4 Empirical Results

In this section, I present the empirical results of my study. I examine the determinants of the aging board as well as the costs and benefits associated with the aging. The analysis is broken up into four sub-sections. The first sub-section considers the determinants of the increasing age of independent directors. The second sub-section looks at board-level governance by examining the boardroom activities: attendance problem and board committee preference. The third sub-section considers whether the senior director exacerbate agency problems by looking at the monitoring outcomes: firm performance. The final section discusses the cost associated with the senior-age independent directors: director compensation.

2.4.1 The Determinant of Independent Director Age

2.4.1.1 The effects of SOX Act

I deploy the Diff-in-Diff approach to isolate the effect of SOX on the independent director age. Prior empirical research shows that the board structure is not likely to change year by year. However, after SOX, I find that the age and other characteristics regarding the boardroom have changed. Due to the lack of a pool of highly qualified, well-experienced, committed, and engaged independent directors (Masulisa, Ruzzier, Xiao and Zhao, 2012), firms in the treated group reduce the number of executives on boards, extend the tenure of current independent directors (less turnover), or hire more retirement-age directors (for details, see Appendix A3). I use the univariate DiD method to isolate the effect of SOX on the independent director age and find a quantity increase of retirement-age directors in boardrooms of both treated and control groups.

<Insert Table III-A here.>

<Insert Table III-B here.>

<Insert Table III-C here.>

The result of univariate DiD tests shown in Table III-A confirms that the board restructuring required by SOX triggers an increasing demand for independent boards of directors. Firms that are not compliant with the majority independent rules appoint even more retirement-age directors to their boards. Table III-B demonstrate that the treated firms without majority independent boards before SOX have a significant increase with the number of retired age independent director on board comparing to the complaint firms after SOX. The increasing number of retirement-age independent directors leads to an aging problem in the boardroom. Moreover, the stricter knowledge and expertise requirements for directors resulting from the Dodd Frank Act exacerbate this process. Last but not least, this phenomenon partially results from the non-complaint firms appointing elder directors after SOX (Table III-C). The average age of newly hired independent directors in the treated firms is significantly higher than in the control firms, which indicates that SOX is a driver of change in the age structure of independent directors.

<Insert Table III-D here.>

The results of multi-variant regressions shown in Table III-D also confirm this effect. By controlling other explanatory variables with panel regression, the results are consistent with the univariate tests. The DiD estimator shows the age increase of independent directors among non-complaint firms (treated group) which need more independent director directors on average is higher than that in complaint firms (control group). Although the independent ratio of nominating committee and whether the CEO sits on the nominating committee might have different associations with the age of newly appointed independent directors, I find SOX, on average, has a positive impact on independent director age. However, the last treatment - CEO on nominating committee - does not have a statistically significant result because the non-compliant firms might only need to appoint one independent director to replace the CEO rather than three or four independent directors on the committee. This lesser demand can reduce the average treatment effect of SOX on independent director age.

2.4.1.2 Determinants of the Age of Newly Appointed and Departing Directors

<Insert Table IV here.>

Second, I try to mediateendogeneity problems in the director selection process: I focus on the determinants of age for newly appointed and departing directors. I drop the observations if lag or forward observations are missing and I cannot identify whether they are newly appointed or departing directors. I successfully identify 11,114 newly appointed director observations and 10,853 departing director observations. The results in Table V show that the newly appointed independent director age is positively correlated with the age of nominating committee members and the positive correlation increases with the increase in the average age of the nominating committee. In addition, I find that senior-age CEOs are generally more likely to appoint senior directors, which is consistent with hypophysis 1.2. However, I find no significant influence from the nominating committee on newly appointed executive director age. This might indicate that the nominating committee has little control over the appointment of executive directors.

In Column IV, I show that the age of departing independent directors is positively associated with the age of nominating committee members. However, similar to the result for newly appointed directors, the nominating committee has little control over the executive directors. One reason is that most executives have a mandatory retirement age and nominating committee members have no control over that. To mitigate the effect from M&As and other unrelated director departures that are beyond the nominating committee's control, I exclude the director turnover event caused by M&As.[22] The results are the same. In addition, this result holds for the forced turnover sample.

2.4.1.3 Directors Selecting Firm or Firm Selecting Directors?

<Insert Table V here.>

To differentiate the effect of firms from the effect of directors, I control firm fixed effects and director fixed effects separately to reveal the choice of firms and directors. The director fixed effect is used to determine the preference of directors when leaving the firm. Then, I further compare this result with the regression result, only controlling firm fixed effect, which represents firm choices in director departures. I find that directors are more likely to leave firms with a high independent ratio, larger board size, and higher stock return volatility and less likely to leave firms with more committee commitment, more connections on the board, and more previous employment experience. However, firms are more likely to terminate older directors (mandatory

[22] Since 2004, the SEC has required firms to file the 8-K Current Report to record the reason for the departure of board of directors in item 5.02. A brief summary of reasons from Audit Analytics are listed in the appendix.

retirement age policy) and those with bad attendance records but less likely to fire directors with active social activities, more committee commitment, and better connections with the CEO.

2.4.2 Board Governance Activities

2.4.2.1 Attendance Problems

In this section, I examine whether attendance at board meetings varies among directors within different age groups. Board meeting attendance can be a good indicator for examining the attitude of independent directors toward monitoring and advising duties. The SEC and major stock exchanges require firms to report whether individual directors on their boards attend less than 75% of meetings. Although some research has shown that the busyness or attendance problem will not hurt firm value and may create value for certain firms (Ferris, Jagannathan, and Pritchard, 2003; Field, Lowry, and Mkrtchyan, 2013), busy directors and poor attendance have been widely criticized as counterproductive (Fich and Shivdasani, 2006). Consequently, the attendance rate can be a good way to measure directors' behaviors, at least their attitude toward director responsibilities. In the sample of all independent directors in S&P1500 firms, the mean *attendance problem indicator* [23] is only 1.6%, which shows that missing 75% or more meetings is rare.

<Insert Table VI here.>

Table VI presents the regression results of the independent director attendance problem on director age. On average, the attendance problems of independent directors drop significantly with an increase in age. The relationship is not uniform among different age groups. The coefficients of monomial and quadratic terms in Column III indicate that, on average, independent directors around age 75 have the lowest attendance problems. The piecewise regression results show the attendance problems decrease the most among 62 to 67 year-old directors but get slightly better

[23] The attendance problem indicator equals one if the director has not attended 75% of the meeting and zero otherwise.

as age increases among retirement-age directors (director older than 67 year-old). Potential health issues might drive this increase of attendance problems among retirement-age directors (see Column IX). The Tobit regression in Column V provides similar results as the OLS estimators. Generally speaking, senior-age directors are less likely to miss board meeting than younger directors.

For robustness, I further control the *board-meeting fee* because the *director-meeting fee* can be another incentive for directors to attend more board or committee meetings (Adam and Ferreira, 2008). However, due to the lack of board meeting fee and number of board meetings data from 2007 onward in RiskMetrics, I restrict the sample to 1996-2006 as a robustness test and the result is similar. Also, after 2006, most of the firms adopt a fixed amount of annual cash retainer rather than a one-off meeting fee payment structure. Therefore, the board meeting fee incentive may be less relevant. Today, firms give directors more incentive payment (e.g., stock options) than cash payments or director meeting fees to motivate directors in both their monitoring and their supervisory roles. I will further discuss director compensation in part V: the cost of hiring senior-age directors.

2.4.2.2 Committee Membership

<Insert Table VII here.>

Board committees are delegated to important monitoring and advisory role in looking after the best interests of shareholders and committee decisions have become more and more important to firms (Adams, Ragunathan, and Tumarkin, 2015). Most committees are fully independent and less influenced by executives after SOX. Therefore, the commitments and actions of independent directors are the keys to the success of board committee functions, including auditing financial reports, nominating executives and directors, creating vision and strategies, and formulating compensation packages. However, many firms do not pay additional fees for committee meetings (e.g., Yermack, 2004). Consequently, better committee engagement can be a good sign of extra commitment to company governance.

Table VII illustrates the preference of retired independent directors on committee memberships. The senior age directors are more willing to sit on nominating committees and compensation committees, but are less like to stay on audit committees,[24] as shown in Column I through Column III. This finding may be driven by the hard work needed for auditing and the members of the auditing committee needing timely updates on changes in accounting or auditing rules. Today's audit committee imposes a huge workload burden. Also, after SOX and Dodd Frank, the audit task has become more demanding, requiring more knowledge and imposing more responsibility. Senior-age directors may prefer a relatively lower work burden but higher power and responsibility (e.g., nominating committee and compensation committee). In general, the likelihood of sitting on board committees increases with independent director age (Column IV). Overall, high committee participation rates among senior-age directors may result from these directors being more responsive and having more available time than independent directors with full-time executive jobs.

2.4.2.3 Forced CEO Turnover

<Insert Table VIII here.>

In Table VIII, I report the effects of an aging board on the likelihood of a firm having a forced CEO turnover event. Independent directors play an important role in the board's monitoring functions and one key decision of a board is the selection, monitoring, and retention (dismissal) of the CEO (Hermalin, 2005). Thanks to the independent nominating committee listing requirement, the

[24] The committee data in RiskMetrics have issues with committee data in 1996-1997, so I have conducted the test with and without these two-year data.

independent directors in nominating committees bear the responsibility for monitoring and selecting firm leadership. In this section, we examine how the age of independent directors, especially those who sit on the nominating committee, influences CEO forced turnover. I find a positive association between age of nominating committee members and the likelihood of having a forced CEO turnover. This result is robust in different measures of the aging board.

2.4.2.4 Risk Controls

<Insert Table IX here.>

Finally, I investigate the risk control behaviors of aging independent directors. I use annualized standard deviations of monthly stock return as the measure of firm risk. I find that firm risk decreases, ceteris paribus, with an increase in independent director age. The result is consistent with different measures of independent director age. Moreover, senior-age directors are generally better at controlling firm risk of fraud, especially financial risk, and they are more experienced in dealing with different types of emergency events (e.g., CEO illness or deaths), tested in other papers. In addition, I find that firms operated by older CEOs also perform with lower volatility. Among all the controls, I find a negative relationship between firm size and firm risk, which is consistent with prior studies. Moreover, firm risk is negatively associated with board size, return on assets, and firm age. In sum, the useful life experience of senior-age independent directors can be beneficial in preventing unforeseen market fluctuation as part of the board function.

2.4.3 Director Age and Firm Value

2.4.3.1 An Event Study

I first conduct an event study to show shareholders' reaction to a change in the mandatory retirement age in the boardroom. Investors, on average, react positively surrounding the effective date and filing date when a firm increases its mandatory retirement age or eliminates the mandatory retirement policy, especially to keep their talented and important directors on board (Figure III). Moreover, the accumulated abnormal returns are, on average, negative and not significant for a decrease in the mandatory retirement age or establishment of a mandatory retirement policy. Nevertheless, the abnormal returns after relaxing the mandatory retirement rule are significantly higher than after tightening the mandatory retirement rule.

<Insert Figure III here.>

2.4.3.2 Multi-variant Regression

<Insert Table X here.>

After the pilot study, I further examine the effect of the aging phenomenon in the boardroom on firm performance in a more general setup in corporate governance research. Based on the multi-variant regression in Table X, independent directors aging has a negative impact on firm value and the results are robust among different measures of age and different empirical designs. Appointing a new retired age director is even more detrimental to firm value. This negative impact seems contradictory to the implications from the previous event study. Therefore, I conduct a more detailed investigation of independent director age on firm performance, as shown in Table XI. I find that this is the result of the non-linear relationship between independent director age and firm value. The nonlinear regressions show that the negative result is driven by about-retirement-age directors: directors aged between 62 and 67 (see Column II and Column IV, respectively). Outside this age boundary, I observe a positive relationship between director age and firm value, especially retirement-age directors. Column V shows that the retired independent directors can benefit firm performance. Moreover, due to the high co-linearity of tenure and age, I control the tenure effect and divide the sample into a long tenure or short tenure subsample and the result is still significant at the 5% significant level. For the short-tenure board, the older director can result in damage to the firm value. Last, but not least, consistent with the result of independent directors, I find that increasing age of the CEO also has a negative impact on firm performance but the negative effect is driven by CEOs aged 70-80. The negative effect may be the result of CEO entrenchment or CEO health issues (see Appendix).

<Insert Table XI here.>

Finally, the empirical result also illustrates that firms with older CEOs or independent directors tend to invest less, spend less on research and development (R&D), hold less cash, pay more dividends, and have a smaller debt ratio (results not reported).

2.4.3.3 Instrumental Measures and LATE

<Insert Table IV here.>

To address potential endogeneity issues resulting from a firm choosing its own independent directors as well as controlling the independent director age, I conduct an IV regression. I use the age of the independent director candidate pool as an instrument variable for independent director age. The IV regression results also confirm my main findings. As discussed in the Empirical Design Section, this IV only captures the exogenous effects of age increase before age 67. In addition, the negative relationship between independent director age and firm performance is driven by about-to-retirement-age directors (aged 62-67). Consequently, we observe more negative effects of an age increase on firm performance economically and statistically.

2.4.3.4 Director Sudden Death Sample

Director sudden death is well documented and broadly accepted as an exogenous shock to the board structure. By adopting this natural experiment (director sudden death event), I exploit the shareholder reactions to director sudden deaths among different age groups. Through an extensive search of more than 1.2 million documents in Form 8-K current reports and Form 10-K annual reports, I identify 1,576 director death events. This is the most comprehensive death sample to my best knowledge. Table XIII reports summary statistics of the death sample. I find a smaller proportion of female directors in the deaths of retirement-age directors, which is consistent with the smaller proportion of female directors among senior-age directors. Most retirement-age directors who pass away are on the boards of large firms and high-value firms (measured by Tobin's Q). However, contrary to intuition, the summary shows that more retirement-age directors are deceased on the boards of firms with high R&D expenses. The CARs are negative for the deaths of retirement-age directors and positive for the deaths of about-to-retirement-age directors.

I further investigate the age impacts on firm value with the death sample by multi-variant regressions. Shareholders react negatively with increased age of independent directors, which means that the senior-age directors on average create value for the firm, ceteris paribus. The regression result in Column III with the non-linear regression setup confirms that the negative impact of an age increase on firm value is from about-retirement age directors. In the subsample of independent directors, I find a negative stock reaction, with the growth of age driven by the subsample of directors older than 67 (Column VI). The sudden death sample of independent directors shows a similar result as the all death sample because if a director stands for election in an annual meeting, the shareholders have faith that this director can serve the company for the full term. The death event will surprise the executives in that firm, as well as other directors on the board and shareholders. In addition, shareholders react more negatively following the death of an older and important independent director, controlling other factors. My findings provide evidence against establishing mandatory retirement age rules for independent directors.

<Insert Table XIII here.>

<Insert Table XIV here.>

2.4.4 Compensation Plan for Individual Directors

Finally, I study the cost of having senior-age directors on the board through the effects of board member aging on director compensation. One of the most important reasons for independent directors willingness to stay on the board is the abundant director compensation. I have discussed the benefit of keeping senior-age directors on the board, but the increase in independent director payment can increase the cost of hiring senior-age directors. I follow the research design of Yermack (2004). After going through a large amount of DEF14A filings, I find that compensation plans for directors are evolving from a meeting-based one-off payment to a comprehensive executive-like payment package that includes stock options and deferred compensation like retirement benefits.[25] Furthermore, according to the 10K filings, the non-employee directors of Apple are expected to own shares of Apple that have a value equal to five times their annual cash retainer to serve as a director.

<Insert Table XV here.>

The empirical evidence in Table XV shows that companies pay more to senior-age independent directors, controlling for all observable factors. In addition, CEOs with senior-age directors on their compensation committee generally receive more in total compensation (result is shown in the Appendix). Table XV shows that most variation in director payment comes from cross-firm variation rather than within firm variation. By controlling the director fixed effect, I conclude that director total pay increases with directors' career development. Independent directors choose to stay with high-payment boards. Total director compensation increases $14,686 per year of age increase. Moreover, the increase in compensation is accelerating, as illustrated by the piecewise regression results shown in Column IV. The compensation increase rate among young directors is $12,796 per year of age increase, which is lower than $17,234 compensation increase rate of retirement-age independent directors. Therefore, on average, it costs more to retain senior-age

[25] An example of Apple is given in the appendix.

directors, ceteris paribus. However, we find that senior-age directors are actively involved in the board monitoring and advisory function. This is consistent with Adams and Ferreira (2008), who suggested that well-compensated directors are more likely to be actively involved in board monitoring activities as evidenced by attending meetings. In general, the independent director payment has increased significantly during the past decades, but it is still significantly lower than executive pay. As the executives do not receive any extra payment for the board job, it might be wise for firms to pay more to independent directors to attract more talented people to perform the board's function. Consequently, the cost of appointing senior-age director is higher but the higher cost of paying senior-age directors can benefit firms.

In addition, the results show that firms usually pay additional fees for the chairman role of the board: on average, $200,000 per year. However, firms usually pay no extra fees for their committee commitment, which is consistent with my observations and assumptions in section 2. Independent directors are better compensated in prestigious firms (Masulis and Mobbs, 2014), as measured by firm size, Tobin's Q, and return on assets. Middle-age directors are more likely to stay on the board of a distinguished firm for career benefit, which is consistent with the results in Table V. Finally, the total director compensation increases with director age, but the increase is at a decreasing rate, which is revealed by the negative sign for the quadratic term.

2.5 Other Robustness Tests and Alternative Explanations

In this section, I discuss robustness tests and propose alternative explanations.

2.5.1 Subsample Results

I exclude firms with total assets less than $20 million (Knyazeva, Knyazeva, and Masulis, 2013). In addition, I exclude the regulated financial and utility firms (SIC codes 6000–6999 and 4900–4999), following previous literature. The results are similar. Since different firms may have different needs for advisory jobs or monitoring jobs, I further control for advisory need density and information transparency, following Duchin, Matsusaka, and Ozbas (2010). I find that senior-age independent directors are more important to the firms with more information asymmetry because they have more experience as a director and more unique information in the same firms or a similar industry.

2.5.2 Evidence from Financial Crisis

Fahlenbrach, Low, and Stulz (2010) find that independent directors have incentives to resign to protect their reputation or avoid an increase in their workload. This dark side of directorship will lead them to leave a firm with potentially poor performance or adverse news disclosure. However, I observe a positive impact of senior-age independent directors on firms during crisis. This result suggests that retirement-age directors are more likely to stay on the board and help the firm overcome hard times since senior-age directors have less career incentive and no other executive job.

Financial distress can be an important reason to appoint more independent directors and to demonstrate good corporate governance. However, the joint leadership structure of executives and boards of directors provides a unified focus and shows strong leadership to external investors. I use the Global Financial Crisis to gauge the effect of senior-age directors on financially constrained firms. The Global Financial Crisis is an exogenous shock to firm financing condition since it is beyond firms' control. The crisis might create increased workload for independent directors of firms that happen to have a lot of long-term debt at the maturity date. It provides a great opportunity to observe the behavior of independent directors ahead of trouble. I examine firms with a large proportion of long-term debt maturing during the crisis as the treatment group and otherwise similar firms whose debt is scheduled to mature in other than the crisis period. By using the DiD matching estimator, I find that the age effect and the resource provision function of the board can lead to a less significant drop in debt level and help the firm achieve its investment target.[26] I find that senior-age people and young people are more willing to help the firm. Detailed discussions are presented in another paper.

2.5.3 Professional Directors

After SOX, the burden of independent director has increased considerably. Appointing retired executives as independent directors offers a temporary solution. The increased committee meetings (Adams, Ragunathan, and Tumarkin, 2015) and higher required responsibility distract the independent directors from their full-time executive jobs. Therefore, the existence of professional director companies as in the hedge fund industry offers a better solution to enhance the monitoring role of independent boards (Clifford, Ellis, and Gerken, 2016).

2.5.4 Shock to the Director in Different Age Cohort

Many studies have shown that the people in the same cohort may behavioral similarly due to their early life experience (e.g., education). Reform of the education system (e.g., landmark Supreme Court case, Brown v. Board of Education and the Elementary and Secondary Education Act) as well as pension plans (e.g., 401k) can exert significant influence on the personal knowledge, characteristics, and behavior of CEO, executives, and directors. I confirm these finding via their different performance in the boardroom.

2.5.5 International Evidence: Future Improvements

I find that many countries have passed employment equality-related acts to abort the mandatory retirement age. These legal changes provide a great opportunity to study the effect of age of employees on firm performance. Due to data limitations, I leave the discussion for future work.

2.6 Conclusion

---

[26] I follow the methodology provided by Almeida at el. (2010) to create the exogenous shock.

This paper analyzes the aging phenomenon in the boardroom. I discover that the aging trend among independent directors is driven by SOX and aging nominating committees. Then, I investigate the performance incentive and board behavior for senior-age independent directors in a sample of S&P 1500 firms. Last, I illustrate the costs and benefits associated with the aging phenomenon inside the boardroom. My findings provide evidence against establishing mandatory retirement age rules for independent directors. The empirical evidence suggests that developing a pool of professional directors can provide a solution to the extensive demand for independent directors.

With the empirical design, I find that independent directors who have retired from their primary job attend more board meetings and are more likely to join committees, but not the audit committee. Accordingly, they have more spare time and can concentrate more on monitoring the firm. The nominating committees with higher ratios of retirement-age directors are more willing to appoint older directors and older CEOs. In addition, senior-age CEOs and independent directors are good at controlling firm risk. On average, an increase in both CEO and independent director age has negative impacts on firm performance and hiring a new retirement-age CEO in the executive suite or hiring a new retirement-age independent director can be more determinant to a firm. However, I observe an inverse effect: The impact becomes positive when the independent directors pass the retirement age, namely, 67 years old and stay on board. This positive effect is confirmed by an event study of changing the mandatory retirement age policy and director sudden death. Nevertheless, for R&D-intensive firms, it is better to hire more young and creative directors to advise the firm executives. Finally, yet importantly, I document the higher cost of hiring senior-age independent directors relative to younger directors.

To sum up, the average age of directors has increased substantially over time, rising 8% from 2002 to 2014. The increase in CEO and independent director age is detrimental to firms, on average, but the effects are not uniform. Using 8-K filings of all listed firms from 1994-2014, I show that shareholders welcome amendments to corporate charters that increase the independent director mandatory retirement age. To address potential endogeneity issues, I exploit director sudden death events. My results suggest that age has both costs and benefits. Mandatory retirement policies may preclude firms from retaining talented individuals.

2.7 References

Abadie, A. and Imbens, G., 2007. Bias Corrected Matching Estimators for Average.

Adams, R.B. and Ferreira, D., 2007. A theory of friendly boards. *The Journal of Finance*, *62*(1), pp.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), pp.291-309.

Adams, R.B. and Ferreira, D., 2008. Do directors perform for pay?. *Journal of Accounting and Economics*, *46*(1), pp.154-171.

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), pp.58-107.

Adams, R.B., Ragunathan, V. and Tumarkin, R., 2015. *The changing nature of corporate board activity*. Working paper, University of New South Wales.

Almeida, H., Campello, M., Laranjeira, B. and Weisbenner, S., 2009.*Corporate debt maturity and the real effects of the 2007 credit crisis* (No. w14990). National Bureau of Economic Research.

Boumosleh, A.S., Cline, B.N. and Yore, A.S., 2012. Should the Outsiders be Left Out? Director Stock Options, Expectations and Earnings Management.*Director Stock Options, Expectations and Earnings Management (June 30, 2012)*.

Bebchuk, L., Cohen, A. and Ferrell, A., 2009. What matters in corporate governance?. *Review of Financial studies*, *22*(2), pp.783-827.

Baker, M. and Gompers, P.A., 2003. The determinants of board structure at the initial public offering. *Journal of Law and Economics*, *46*(2), pp.569-598.

Byoun, S., Chang, K. and Kim, Y.S., 2016. Does corporate board diversity affect corporate payout policy?. *Asia-Pacific Journal of Financial Studies*,*45*(1), pp.48-101.

Güner, A.B., Malmendier, U. and Tate, G., 2008. Financial expertise of directors. *Journal of Financial Economics*, *88*(2), pp.323-354.

Byrne, D. and Nelson, D., 1965. Attraction as a linear function of proportion of positive reinforcements. *Journal of personality and social psychology*,*1*(6), p.659.

Carleton, W.T., Nelson, J.M. and Weisbach, M.S., 1998. The influence of institutions on corporate governance through private negotiations: Evidence from TIAA-CREF. *The Journal of Finance*, *53*(4), pp.1335-1362.

Field, L., Lowry, M. and Mkrtchyan, A., 2013. Are busy boards detrimental?.*Journal of Financial Economics*, *109*(1), pp.63-82.

Finkelstein, S. and Hambrick, D.C., 1988. Chief executive compensation: A synthesis and reconciliation. *Strategic Management Journal*, *9*(6), pp.543-558.

Clifford, C.P., Ellis, J.A. and Gerken, W.C., 2016. Hedge Fund Boards and the Market for Independent Directors. *Available at SSRN 2537253*.

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

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

Corporate Board Member and PricewaterhouseCoopers, 2009. What Directors Think: Annual Board of Directors Survey. Available at: http://www.boardmember.com/WorkArea/DownloadAsset.aspx?id=4481.

Craver, R., 2013. As transition looms, BB&T raises mandatory retirement age for directors. Winston-Salem Journal.

Duchin, R., Matsusaka, J.G. and Ozbas, O., 2010. When are outside directors 55ffecttive?. *Journal of financial economics*, *96*(2), pp.195-214.

Fahlenbrach, R., Low, A. and Stulz, R.M., 2010. *The dark side of outside directors: Do they quit when they are most needed?* (No. w15917). National Bureau of Economic Research.

Fahlenbrach, R., Low, A. and Stulz, R.M., 2010. The dark side of outside directors: Do they quit ahead of trouble. *Dice Center WP*, *7*.

Falato, A., Kadyrzhanova, D. and Lel, U., 2014. Distracted directors: Does board busyness hurt shareholder value?. *Journal of Financial Economics*,*113*(3), pp.404-426.

Fama, E.F. and Jensen, M.C., 1983. Separation of ownership and control.*The Journal of Law & Economics*, *26*(2), pp.301-325.

Ferris, S.P., Jagannathan, M. and Pritchard, A.C., 2003. Too busy to mind the business? Monitoring by directors with multiple board appointments. *The Journal of finance*, *58*(3), pp.1087-1111.

Fich, E.M. and Shivdasani, A., 2006. Are busy boards effective monitors?.*The Journal of finance*, *61*(2), pp.689-724.

Finkelstein, S. and D'aveni, R.A., 1994. CEO duality as a double-edged sword: How boards of directors balance entrenchment avoidance and unity of command. *Academy of Management journal*, *37*(5), pp.1079-1108.

Forbes, D.P. and Milliken, F.J., 1999. Cognition and corporate governance: Understanding boards of directors as strategic decision-making groups. *Academy of management review*, *24*(3), pp.489-505.

Fracassi, C. and Tate, G., 2012. External networking and internal firm governance. *The Journal of Finance*, *67*(1), pp.153-194.

Goldman, E., Rocholl, J. and So, J., 2009. Do politically connected boards affect firm value?. *Review of Financial Studies*, *22*(6), pp.2331-2360.

Gompers, P.A., Ishii, J.L. and Metrick, A., 2001. *Corporate governance and equity prices* (No. w8449). National bureau of economic research.

González, T.A., Schmid, M. and Yermack, D., 2013. *Smokescreen: How managers behave when they have something to hide* (No. w18886). National Bureau of Economic Research.

Güner, A.B., Malmendier, U. and Tate, G., 2008. Financial expertise of directors. *Journal of Financial Economics*, *88*(2), pp.323-354.

Guo, L. and Masulis, R.W., 2015. Board structure and monitoring: New evidence from CEO turnovers. *Review of Financial Studies*, *28*(10), pp.2770-2811.

Hymowitz, C. and Green, J., 2013. Corporate directors get older, hold their seats longer, Bloomberg Businessweek, May 23.

Hwang, B.H. and Kim, S., 2009. It pays to have friends. *Journal of financial economics*, *93*(1), pp.138-158.

Imbens, G.W. and Angrist, J.D., 1994. Identification and estimation of local average treatment effects. *Econometrica*, *62*(2), pp.467-475.

Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, *3*(4), pp.305-360.

Kang , Jun-Koo and Kim, Jungmin and Low, Angie, Rookie Directors (June 2016). *Available at SSRN*: http://ssrn.com/abstract=2800853 or http://dx.doi.org/10.2139/ssrn.2800853

Kaplan, S.N., Klebanov, M.M. and Sorensen, M., 2012. Which CEO characteristics and abilities matter?. *The Journal of Finance*, *67*(3), pp.973-1007.

Kim, E.H. and Lu, Y., 2012. Governance in executive suites. *Available at SSRN 2119716*.

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

Larcker, D.F. and Tayan, B., 2011. Seven myths of corporate governance. *Rock Center for Corporate Governance at Stanford University Closer Look Series: Topics, Issues and Controversies in Corporate Governance No. CGRP-16*.

Li, X., Low, A. and Makhija, A.K., 2014. Career concerns and the busy life of the young CEO. *Charles A. Dice Center Working Paper*, (2011-4).

Linck, J.S., Netter, J.M. and Yang, T., 2009. The effects and unintended consequences of the Sarbanes-Oxley Act on the supply and demand for directors. *Review of Financial Studies*, *22*(8), pp.3287-3328.

Mace, M.L., 1971. Directors: Myth and reality.

Mallette, P. and Fowler, K.L., 1992. Effects of board composition and stock ownership on the adoption of "poison pills". *Academy of Management journal*,*35*(5), pp.1010-1035.

Malmendier, U. and Nagel, S., 2009. *Depression babies: Do macroeconomic experiences affect risk-taking?* (No. w14813). National Bureau of Economic Research.

Malmendier, U. and Tate, G., 2005. CEO overconfidence and corporate investment. *The journal of finance*, *60*(6), pp.2661-2700.

Malmendier, U., Tate, G. and Yan, J., 2011. Overconfidence and early-life experiences: the effect of managerial traits on corporate financial policies. *The Journal of finance*, *66*(5), pp.1687-1733.

Masulis, R.W. and Mobbs, S., 2014. Independent director incentives: Where do talented directors spend their limited time and energy?. *Journal of Financial Economics*, *111*(2), pp.406-429.

Masulis, R.W., Ruzzier, C., Xiao, S. and Zhao, S., 2012, March. Do independent directors matter. In *Paper presented by at the Corporate Governance Symposium a t University of Delaware on November* (Vol. 9, p. 2012).

Masulis, R.W., Wang, C. and Xie, F., 2012. Globalizing the boardroom—The effects of foreign directors on corporate governance and firm performance. *Journal of Accounting and Economics*, *53*(3), pp.527-554.

Miller, T. and del Carmen Triana, M., 2009. Demographic diversity in the boardroom: Mediators of the board diversity–firm performance relationship. *Journal of Management studies*, *46*(5), pp.755-786.

Nguyen, B.D. and Nielsen, K.M., 2010. The value of independent directors: Evidence from sudden deaths. *Journal of Financial Economics*, *98*(3), pp.550-567.

Parrino, R., 1997. CEO turnover and outside succession a cross-sectional analysis. Journal of Financial Economics, 46(2), pp.165-197.

Piliavin, J.A. and Chang, H.W., 1990. Altruism: A review of recent theory and research. Annual review of sociology, pp.27-65.

Rhode, D.L. and Packel, A.K., 2014. Diversity on corporate boards: How much difference does difference make. *Del. J. Corp. L.*, *39*, p.377.

Salas, J.M., 2010. Entrenchment, governance, and the stock price reaction to sudden executive deaths. Journal of banking & finance, 34(3), pp.656-666.

Serfling, M.A., 2014. CEO age and the riskiness of corporate policies. *Journal of Corporate Finance*, *25*, pp.251-273.

Shivdasani, A. and Yermack, D., 1999. CEO involvement in the selection of new board members: An empirical analysis. *The Journal of Finance*, *54*(5), pp.1829-1853.

Shue, K., 2013. Executive networks and firm policies: Evidence from the random assignment of MBA peers. *Review of Financial Studies*, *26*(6), pp.1401-1442.

Westphal, J.D., 1999. Collaboration in the boardroom: Behavioral and performance consequences of CEO-board social ties. *Academy of Management Journal*, *42*(1), pp.7-24.

Westphal, J.D. and Zajac, E.J., 1995. Who shall govern? CEO/board power, demographic similarity, and new director selection. *Administrative science quarterly*, pp.60-83.

Yermack, D., 2004. Remuneration, retention, and reputation incentives for outside directors. *The Journal of Finance*, *59*(5), pp.2281-2308.

Yermack, D., 2014. Tailspotting: Identifying and profiting from CEO vacation trips. Journal of Financial Economics, 113(2), pp.252-269.

Yim, S., 2013. The acquisitiveness of youth: CEO age and acquisition behavior. *Journal of financial economics*, *108*(1), pp.250-273.

Figure I

Time Trends of Director Age among Different Directors inside Boardrooms

This figure shows the time trends of average age among independent directors, executive directors and CEOs. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). *Director Age* is the director's age, measured in years.

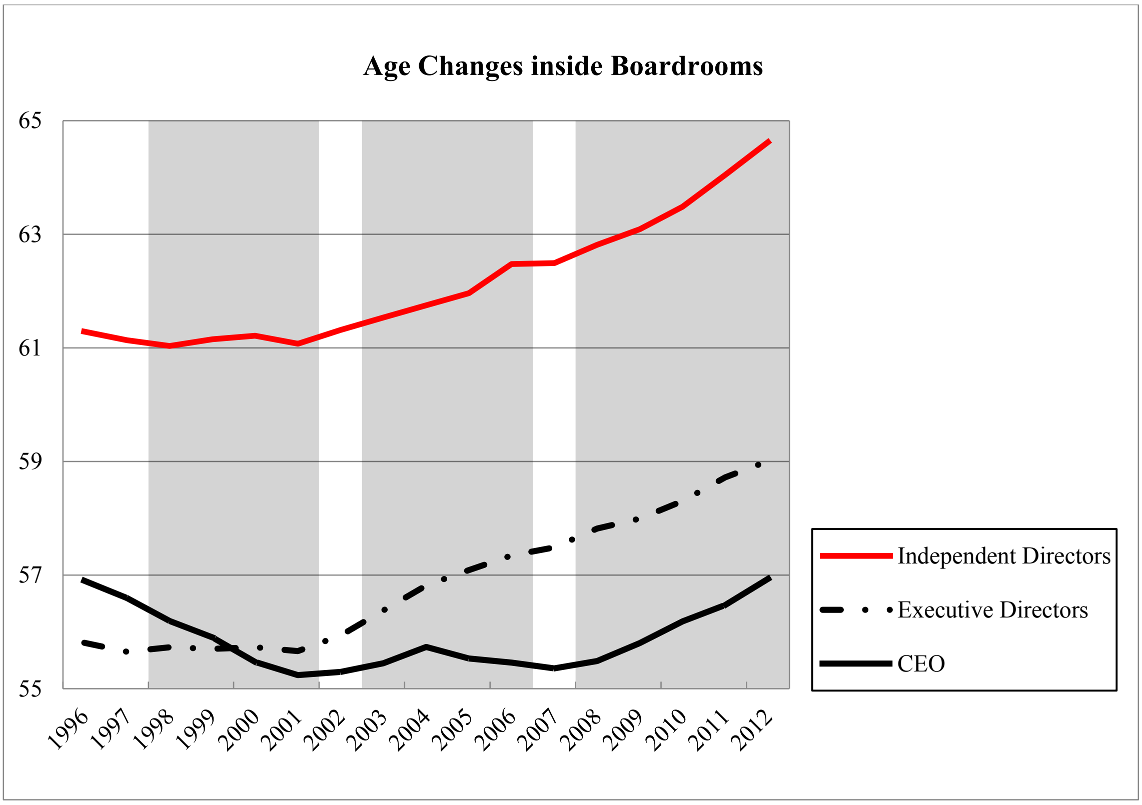


Figure II

Time Trends of Retired Age Ratio among Different Directors inside Boardrooms

This figure shows the time trends of retired ratio among independent directors, executive directors and CEOs. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). *Retired-Age* is an indicator variable which equals to one if the director is over 67 years old.

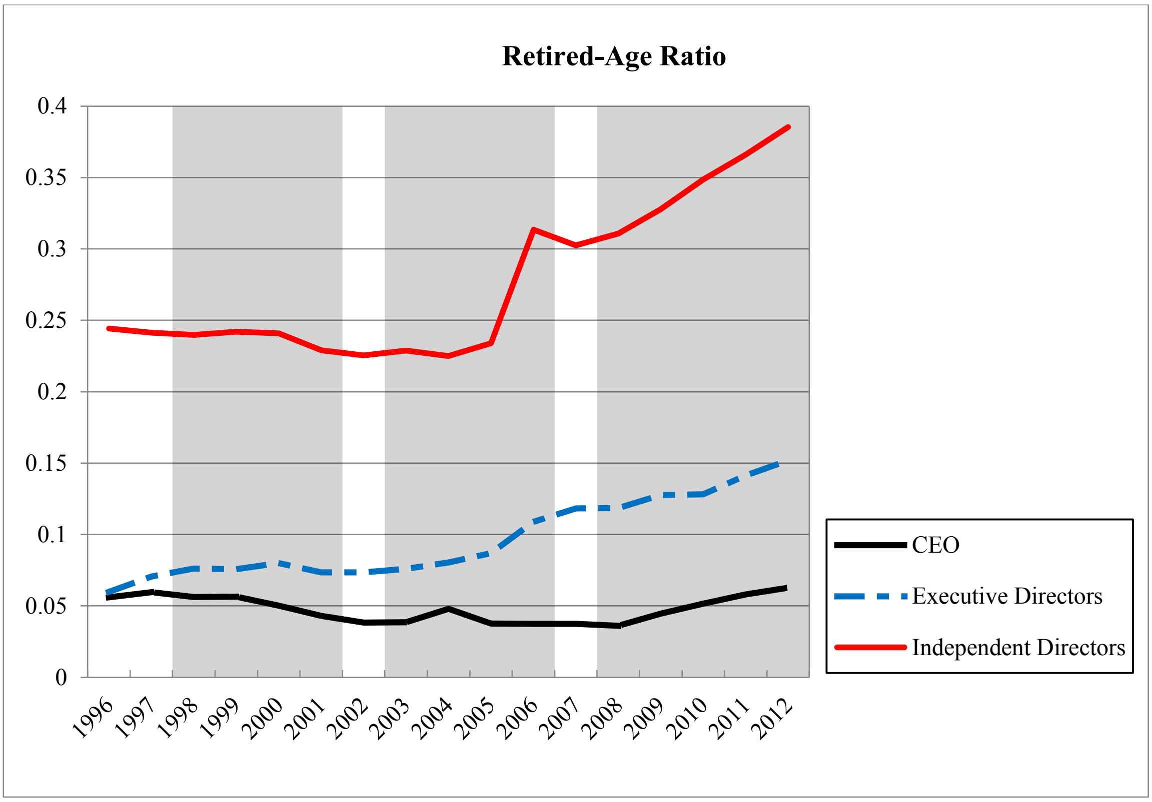
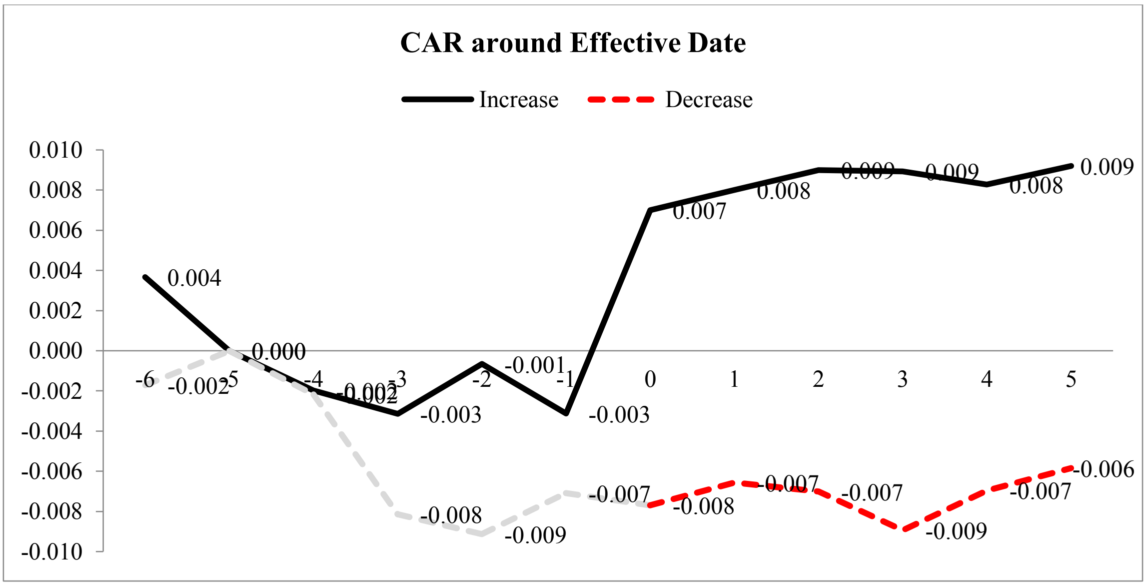


Figure III

Event Study of Mandatory Retirement Policy Changes

This figure shows the stock reactions toward the amendments of mandatory retirement policy on effective dates and filing dates. I use amendments of mandatory retirement age mentioned in 8-K current reports for all listed firms during the period of 1994-2014. All 8-K filings retrieved from Edgar database.



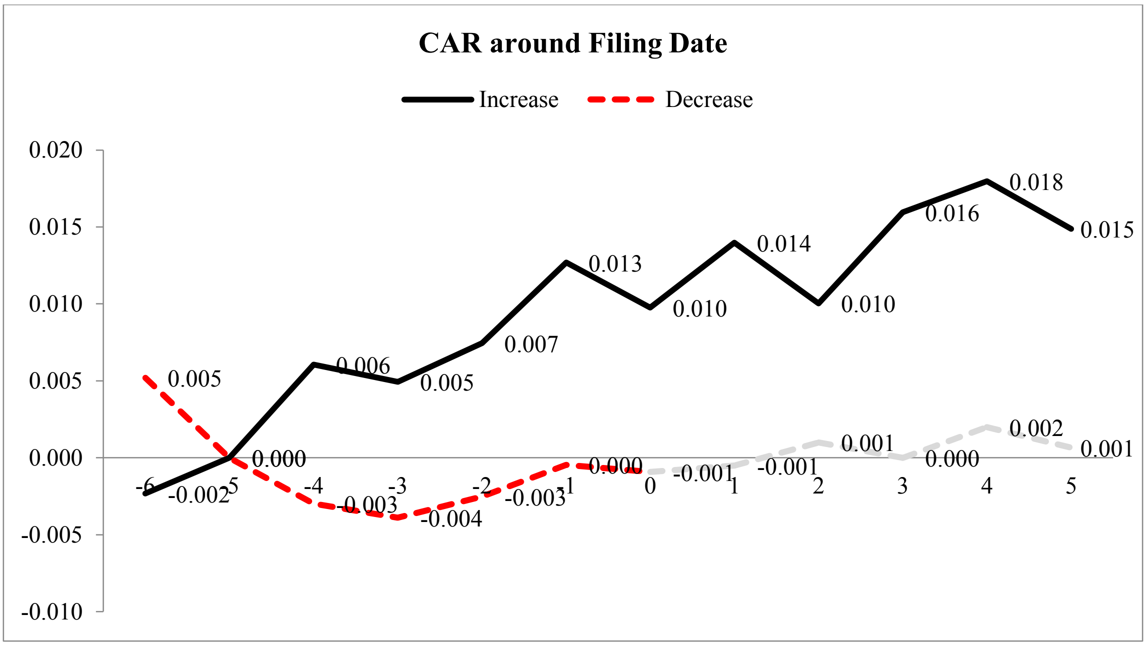


Figure VI
A Joke on Waiving Requirement of Retirement Age

Source: http://www.businessweek.com/articles/2013-05-23/corporate-directors-get-older-hold-their-seats-longer

Table I

Summary Statistics

This table reports the summary statistics for age related variables, other director characteristics, and firm fundamentals across the sample period of 1996–2012. The main sample of firms is from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors for the sample, and exclude all directors in a given fiscal year who are appointed that year. This table presents the summary statistics for this main sample. Panel A presents the summary statistics of the data at director level. Panel B presents the summary statistics at firm level. *Director Age* is the director's age, measured in years. *Initial Age on Board* is the age of this director when firstly appointed to the boards measured by years. *Retired-Age* is an indicator variable which equals to one if the director is over 67 years old. *Tobin's Q* is measured as the ratio of market value of assets to book value of assets. Market value of assets is defined as book value of total assets (at) plus market equity minus book equity. Market equity is defined as common shares outstanding (csho) times fiscal year closing price (prcc_f). Book equity is calculated as stockholders' equity (seq) minus preferred stock liquidating value (pstkl) plus balance sheet deferred taxes (txdb). Book value of assets is total assets (at). *ROA* is net income divided by the lag of total assets. *Cash Flow* is net income plus depreciation divided by the numerator of beginning-of-year total assets. *Market Leverage* is total debt divided by the numerator of market equity. *Director Independence* is an indicator variable equal to one if the director is independent. *Firm Size* is the natural logarithm of total assets. *ROA, Q*, and *Firm Size* are measured at the beginning of the fiscal year. *Entrenchment Index (E-Index)* measures anti-shareholder charter provisions and is defined and constructed by Bebchuk et al. (2004). All other variables are defined in the Appendix Table AI. All other variables are defined in the Appendix Table AI.

Panel A: Directorship Level

Variable Name	*N*	Mean	SD	25%	Median	75%
Director Age (Years)	*166,906*	60.468	8.705	55	61	67
Initial Age on Board (Years)	*163,224*	50.978	9.264	45.337	51.411	57.411
Retired Age	*166,906*	0.245	0.430	0	0	0
Female Dummy	*158,293*	0.105	0.307	0	0	0
Tenure on Board	*163,224*	9.475	8.215	3.627	7.337	12.595
Log(Tenure)	*163,224*	1.871	0.939	1.289	1.993	2.533
Ownership	*158,163*	0.000	0.003	0	0.000	0.000
Ownership (less 1%)	*129,050*	0.778	0.416	1	1	1
# of Outside Directorships	*148,827*	0.936	1.235	0	1	2
Attend Less than 75%	*166,905*	0.016	0.124	0	0	0
Audit Committee Member	*166,906*	0.367	0.482	0	0	1
Nomination Committee Member	*166,906*	0.269	0.443	0	0	1
Compensation Committee Member	*166,906*	0.354	0.478	0	0	1
No Committees	*166,906*	0.347	0.476	0	0	1
# of Connections with CEO	*111,649*	5.647	5.417	2	4	8

(Table I continued)

CEO Age is the age of CEO acquired from Execucomp. *CEO Initial Age* is the age of CEO when firstly appointed as CEO. All other variables are defined in the Appendix Table AI.

Panel B: Firm Level

Variable Name	*N*	Mean	SD	25%	Median	75%
Age Related Variables						
CEO Age	*18,608*	55.215	7.471	50	55	60
Independent Directors Age	*18,600*	61.328	4.598	58.625	61.500	64.250
Executive Directors Age	*18,560*	55.973	6.440	52	56	60
Directors Age	*18,635*	60.271	4.169	57.800	60.533	63.000
Average Age of Nominating Committee	*14,955*	62.218	5.363	59	62.400	65.600
Average Age of Compensation Committee	*17,231*	61.892	5.686	58.500	62.250	65.500
Average Age of Audit Committee	*17,563*	61.319	5.548	58	61.500	65
CEO Initial Age	*20,683*	46.673	8.968	41.000	47.000	53.000
Initial Age of Executive Directors	*22,178*	47.039	7.774	42.000	47.500	52.500
Initial Age of Independent Directors	*22,207*	54.427	4.996	51.200	54.333	57.714

(Table I continued)

Panel B: Firm Level

Variable Name	*N*	Mean	SD	25%	Me-dian	75%
Other CEO and Board Characteristics						
Outside CEO	*18,635*	0.152	0.359	0	0	0
CEO Ownership	*18,418*	0.026	0.061	0.001	0.005	0.018
CEO on Board	*18,635*	0.975	0.157	1	1	1
Female CEO	*18,635*	0.024	0.152	0	0	0
Female Ratio of Independent Directors	*17,720*	0.119	0.123	0	0.125	0.200
Female Ratio of Executive Directors	*17,675*	0.031	0.146	0	0	0
CEO-Chairman	*18,635*	0.586	0.493	0	1	1
Independence Ratio	*18,635*	0.693	0.171	0.583	0.714	0.833
Board Size	*18,635*	9.051	2.331	7	9	11
# of Audit Committee Members	*18,635*	3.313	1.367	3	3	4
# of Compensation Committee Members	*18,635*	3.201	1.444	3	3	4
# of Nominating Committee Members	*18,635*	2.895	1.933	2	3	4
Independent Directors Coopted-Ratio	*18,635*	0.449	0.371	0.091	0.400	0.800
Executive Directors Coopted-Ratio	*18,635*	0.107	0.219	0	0	0
Audit Committee Coopted-Ratio	*17,526*	0.438	0.397	0	0.333	0.800
Compensation Committee Coopted-Ratio	*17,192*	0.411	0.399	0	0.333	0.750
Nominating Committee Coopted-Ratio	*14,955*	0.371	0.386	0	0.250	0.667
CEO Tenure	*18,610*	7.609	7.470	2.466	5.248	10.085
Audit Committee Tenure on Board	*17,430*	8.757	4.752	5.589	7.847	10.905
Compensation Committee Tenure on Board	*17,130*	9.279	4.889	5.940	8.389	11.508
Nominating Committee Tenure on Board	*14,841*	9.815	5.264	6.300	8.867	12.094
# of New Directors	*18,635*	0.776	0.968	0	1	1
# of Leaving Directors	*18,635*	0.454	0.836	0	0	1
Firm Characteristics						
Q	*18,632*	2.032	1.641	1.226	1.600	2.275
ROA	*17,480*	0.055	0.149	0.038	0.069	0.102
Leverage	*18,568*	0.218	0.180	0.060	0.206	0.328
Cash Ratio	*18,627*	0.146	0.165	0.025	0.081	0.213
Tangibility	*18,611*	0.280	0.218	0.112	0.217	0.392
Cash Flow Ratio	*18,631*	0.106	0.093	0.063	0.104	0.152
Cash Flow	*18,391*	0.703	3.753	0.209	0.439	0.903
Cash Ratio	*18,627*	0.146	0.165	0.025	0.081	0.213
Dividends	*18,635*	0.012	0.041	0	0.003	0.016
Cash Holding	*18,404*	0.234	0.215	0.115	0.186	0.325
Total Asset ($ mil)	*18,635*	6929.080	27695.390	585.595	1458.449	4319.490
R&D Expense	*11,987*	0.565	1.555	0.014	0.126	0.563
Investment Ratio	*18,509*	4.199	1.764	3.013	4.110	5.298
E-Index	*18,371*	2.072	1.303	1	2	3
Interest Coverage Ratio	*18,277*	132.818	2024.649	4.384	8.862	20.854

Table II

Summary Statistics by Age Groups

This table reports the mean statistics of director and firm attributes. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors in the sample, and exclude all directors in a given fiscal year who are appointed that year. This table presents the summary statistics by age group. The young directors refer to the directors below age of 50; the middle-age directors refer to the directors at age of 50-62; the about-retirement directors refer to the directors at age of 62-67; and the retirement-age directors refer to the director above the age of 67. All other variables are defined in the Appendix Table AI.

	Age Stage				
	Young	Middle Age	About Re-tirement	Retirement Age	Total
Attend less than 75%	0.019	0.016	0.014	0.015	0.016
Is Female	0.169	0.141	0.077	0.044	0.105
Mortality Rate	0.004	0.009	0.017	0.033	0.016
# of Connections with CEO	4.363	4.819	5.869	7.180	5.647
# of Industry Expertise	1.374	1.944	2.495	2.585	2.165
Director Tenure	5.568	7.424	9.739	14.370	9.475
Director Ownership	0.000	0.000	0.000	0.000	0.000
Firm Performance Measures					
ROA	0.044	0.055	0.056	0.057	0.054
Cash Flow	0.106	0.109	0.107	0.106	0.107
Q	2.215	2.020	1.945	1.898	1.994
Annual Stock Return	0.147	0.135	0.126	0.131	0.133
Corporate Policies					
Investment Ratio	4.049	4.427	4.568	4.485	4.431
Dividends	0.009	0.013	0.014	0.014	0.013
Leverage	0.223	0.227	0.230	0.228	0.227
Cash Holding	0.238	0.225	0.217	0.219	0.223
Cash Ratio	0.158	0.134	0.126	0.127	0.133
R&D	0.643	0.494	0.440	0.436	0.484
R&D Missing	0.369	0.354	0.352	0.387	0.363
No Segments	7.888	10.495	11.897	11.341	10.731
Post SOX Indicator	0.482	0.568	0.619	0.646	0.590
Corporate Governance and Firm Risk					
Monthly Stock Return Volatility	0.129	0.114	0.109	0.108	0.113
E Index	1.852	2.078	2.164	2.167	2.095
CEO Tenure	7.215	7.231	7.258	8.117	7.459
CEO Ownership	0.031	0.022	0.020	0.025	0.023
CEO Power (Pay Slice)	0.676	0.705	0.711	0.697	0.701
Log (Total Asset)	7.234	7.640	7.813	7.745	7.660

Table III-A

Difference in Difference Estimation

This table present the DiD analysis of the average treatment effect of SOX. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors from the sample. The variable of interest is the number of retired-age directors on board. The treated group are firms which are non-compliant with majority independent board before SOX. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Independent board	Panel A: # of Independent Directors at Retired Age		
in Year 2001	Pre SOX I	Post SOX (D)	Post-Pre SOX Difference (D)-I
0 (A)	0.921	1.524	0.604***
T-Statistics	35.076	36.719	12.92
N	[1502]	[988]	
1 (B)	1.560	1.815	0.255***
T-Statistics	68.325	67.571	7.28
N	[3977]	[3262]	
Difference (A)-(B)	-1.385***	-0.290***	0.395***
T-Statistics	-15.780	-5.390	6.41

Table III-B

Retired Age Ratio DiD Estimation

This table present the DiD analysis of the average treatment effect of SOX. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors from the sample. The variable of interest is the number of retired-age directors on board. The treated group are firms which are non-compliant with majority independent board before SOX. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Independent board	Panel B: Retired Age Ratio of Independent Directors		
in Year 2001	Pre SOX (C)	Post SOX (D)	Post-Pre SOX Difference (D)-(C)
0 (A)	0.227	0.260	0.033***
T-Statistics	59.668	63.467	5.8237
1 (A)	0.247	0.251	0.003
T-Statistics	50.423	48.755	0.4301
Difference (A)-(B)	0.020***	0.009*	0.030***
T-Statistics	3.270	1.406	3.240

Table III-C

The Newly Appointed Directors Age DiD Estimation

This table present the DiD analysis of the average treatment effect of SOX. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors from the sample. The variable of interest is the number of retired-age directors on board. The treated group are firms which are non-compliant with majority independent board before SOX. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Independent board in Year 2001	Panel E: Age of New Independent Directors		
	Pre SOX (C)	Post SOX (D)	Post-Pre SOX Difference (D)-(C)
0 (A)	55.923	57.277	1.354***
T-Statistics	312.552	262.230	6.951
1 (A)	56.381	56.752	0.371
T-Statistics	360.029	345.885	0.837
Difference (A)-(B)	0.525	-0.457	0.030**
T-Statistics	1.5	-1/57	2.17

Table III-D

The Effect of SOX on New Independent Director Age

This table presents the effect of SOX on new independent director age. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors from the sample, and exclude all directors in a given fiscal year who are appointed that year. The dependent variable is average age of newly appointed independent directors. Treat I is an indicator which equals to one if the firm is non-compliant with majority independent board before SOX, and equals zero otherwise. Treat II is an indicator which equals to one if the firm is non-compliant with the independent nomination committee. Treat III is indicator which equals to one if the firm is non-compliant with no CEO seating on the independent nomination committee. Post SOX is SOX is an indicator which equals to one if the fiscal year is greater than 2004. Industry and year fixed effects are included. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Independent Director Age					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Independent Ratio (Treat I)	-1.7381***					
in Boardroom	(-3.118)					
Treat I * Post SOX		1.0216**				
		(2.083)				
Independent Ratio (Treat II)			-0.5363			
in Nominating Committee			(-1.432)			
Treat II * Post SOX				0.7626***		
				(2.983)		
CEO (Treat III)					0.5656**	
in Nominating Committee					(2.529)	
Treat III * Post SOX						0.5003
						(1.505)
Post SOX Dummy	1.3751***	1.1285***	1.5093***	1.7977***	1.2297***	0.5981
	(3.155)	(2.697)	(2.782)	(3.944)	(2.962)	(1.140)
Director Age	0.2904***	0.2913***	0.2923***	0.2882***	0.2961***	0.2933***
in Nominating Committee	(18.361)	(18.396)	(18.511)	(15.517)	(18.696)	(18.563)
Co-opted Ratio of	-2.7154***	-2.7614***	-2.7752***	-2.5575***	-2.7687***	-2.7789***
Independent Directors	(-10.268)	(-10.565)	(-10.535)	(-8.911)	(-10.470)	(-10.549)
Log(Board Size)	-0.7060**	-0.6286*	-0.6705**	-0.4837	-0.6284*	-0.6598*
	(-2.100)	(-1.872)	(-1.987)	(-1.222)	(-1.872)	(-1.954)
Board Expertise	0.8599***	0.7879***	0.7995***	0.8139***	0.7850***	0.7752***
	(4.384)	(4.100)	(4.117)	(3.445)	(4.061)	(4.007)
BOSS	0.1663*	0.1457	0.1403	0.1748	0.1336	0.1451
	(1.676)	(1.487)	(1.422)	(1.638)	(1.364)	(1.477)
E-Index	0.0265	0.0272	0.0251	0.0240	0.0265	0.0261
	(0.451)	(0.462)	(0.426)	(0.349)	(0.450)	(0.445)
Log(CEO Age)	1.3349**	1.3006**	1.3412**	1.1736*	1.3051**	1.3192**
	(2.302)	(2.259)	(2.311)	(1.782)	(2.239)	(2.280)
Outside CEO	0.2786	0.2607	0.2590	0.3133	0.2362	0.2611
	(1.285)	(1.182)	(1.179)	(1.239)	(1.095)	(1.209)
Log(CEO Tenure)	0.5002***	0.5065***	0.5051***	0.4508***	0.4988***	0.5038***
	(8.619)	(8.809)	(8.701)	(7.171)	(8.601)	(8.657)
Firm Age	0.2963	0.2835	0.2808	0.4341	0.2741	0.2940
	(0.722)	(0.684)	(0.681)	(0.962)	(0.654)	(0.703)
Constant	39.1753***	38.1827***	38.1784***	38.2644***	37.8331***	38.1399***
	(13.895)	(13.989)	(13.876)	(12.017)	(13.761)	(13.859)
Other Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year
R-squared	0.800	0.800	0.799	0.775	0.799	0.799
N	8,561	8,561	8,561	8,561	8,561	8,561

Table IV

The Determination of New and Left Director Age

This table presents the regression analysis of the determinants of new and left director age. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The sample is restricted to newly appointed or left independent directors (one observation per director turnover event). The dependent variable for Column I and II are the age of new directors and the dependent variable for column III and IV is the age of left director. Turnover due to M&As, spin-off or other de-listing of the firm is excluded.

	New Director Age		Left Director Age	
	Executive Directors	Independent Directors	Executive Directors	Independent Directors
	(II)	(II)	(III)	(IV)
Age of Nominating	-0.0404	0.1399***	0.0669	0.6987***
Committee	(-0.329)	(4.188)	(0.613)	(13.626)
Age Square of	0.2064	0.2573***	-0.0644	0.2250***
Nominating Committee	(1.355)	(6.713)	(-0.398)	(3.501)
Ownership	171.5114	78.4567	-994.0762**	737.9731*
	(0.390)	(0.614)	(-2.133)	(1.856)
Ownership	-2.07e+04	-800.3514	7.77e+04	-4.34e+03**
Square	(-0.762)	(-1.152)	(1.578)	(-2.308)
Busy Director	-1.0427	0.2305	-0.5095	0.0574
	(-0.416)	(0.780)	(-0.409)	(0.144)
Foreign	3.3707	1.1336**	3.2920	-1.5939**
Director	(0.688)	(2.458)	(1.105)	(-2.014)
Former	-1.7557	-1.3261	9.5554***	2.4112
Employee	(-0.297)	(-0.582)	(2.632)	(1.221)
# of	0.6728	0.1200	0.5810	-0.8153***
Directorships	(0.642)	(1.099)	(0.944)	(-5.434)
Director	1.0723	1.0737***	1.0571***	0.9162***
Expertise	(1.616)	(16.341)	(4.120)	(13.147)
Independent Directors	-0.1370	-1.5298***	0.1588	0.1459
Age Volatility	(-0.729)	(-21.906)	(0.666)	(1.327)
Independent	2.4707	0.6779	3.0557	-4.1148***
Ratio	(0.671)	(0.618)	(0.873)	(-2.587)
Log(Board Size)	-0.7860	1.4860*	1.8224	1.4691
	(-0.296)	(1.922)	(0.738)	(1.375)
BOSS	1.8606	0.2041	-2.0252	1.5446
	(0.790)	(0.222)	(-1.024)	(1.322)
E-Index	0.2412	-0.0678	0.3666	-0.0605
	(0.436)	(-0.482)	(0.570)	(-0.285)
Log(CEO Age)	25.6863***	2.2425*	-3.2159	-0.9740
	(6.013)	(1.725)	(-0.783)	(-0.558)
Outside CEO	0.6429	0.4549	0.8898	1.0971
	(0.605)	(1.005)	(0.555)	(1.511)
Log(CEO Tenure)	-0.9182**	-0.1332	0.2704	0.1793
	(-2.007)	(-1.220)	(1.052)	(1.171)
Board Expertise	-0.0286	0.0105	-0.0709	0.0518
	(-0.252)	(0.348)	(-0.682)	(1.250)
Constant	-54.6303**	42.6153***	56.6068***	13.2358
	(-2.536)	(7.239)	(2.816)	(1.569)
Other Firm Controls	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year	Firm+Year	Firm+Year	Firm+Year
R-squared	0.244	0.274	0.289	0.261
N	1,819	9,295	2,290	8,563

Table V

Determinant of Choice of Director Departure and Promotion

This table presents the regression analysis of the determinants of director departures and appointments. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The sample is restricted to newly appointed or left independent directors (one observation per director turnover event). The dependent variable for Column I and II are the age of new directors and the dependent variable for column III and IV is the age of left director. Turnover due to M&As, spin-off or other de-listing of the firm is excluded. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	The Likelihood to Leave the Board			New Position
	(I)	(II)	(III)	(IV)
Log(Director Age)	1.4761***	1.3028***	11.9861***	-0.1018***
	(25.801)	(21.537)	(5.785)	(-6.251)
Log(Director Tenure)	0.0326***	0.0279***	0.0327***	
	(6.777)	(4.875)	(4.455)	
Ownership	1.8933	-6.3263	-9.7416	-21.2997***
	(0.289)	(-0.829)	(-1.270)	(-10.024)
Ownership	-68.8842	716.2422	1505.8570	2586.2918***
Square	(-0.065)	(0.745)	(1.101)	(9.309)
Delta of All	-0.0001***	-0.0001***		0.0000***
Connections	(-4.449)	(-3.841)		(3.816)
Is Retired	0.0178***	0.0184***		-0.0028
	(3.027)	(2.786)		(-1.602)
Attend less 75 Percent	0.0778***	0.0746**		
	(2.924)	(2.522)		
Is female	0.0113	-0.0025		-0.0093***
	(1.001)	(-0.211)		(-3.235)
Is Chairman	0.0068	0.0364	-0.0160	
	(0.208)	(1.075)	(-0.456)	
Is Nominating	-0.0169***	-0.0161***	-0.0218***	
Committee Number	(-3.394)	(-2.862)	(-3.141)	
Is Audit	-0.0137***	-0.0146***	-0.0254***	
Committee Number	(-2.636)	(-2.600)	(-3.069)	
Is Compensation	-0.0128**	-0.0174***	-0.0169**	
Committee Number	(-2.482)	(-3.142)	(-2.171)	
Is Co-opted	0.0028	0.0108	-0.0198*	
Director	(0.333)	(1.098)	(-1.677)	
Log(Industry Expertise)	0.0135***	0.0121**		-0.0016
	(2.658)	(2.160)		(-1.070)
Busy Director	-0.0387***	-0.0242**		-0.0044
	(-4.261)	(-2.249)		(-1.145)
Foreign Director	-0.0110	0.0131		-0.0065
	(-0.719)	(0.749)		(-1.320)
Former Employee	0.0006	0.0099	-0.1187**	-0.0031
	(0.019)	(0.315)	(-2.522)	(-1.212)
# of Outside Boards	-0.0037	-0.0061	0.0212***	0.0033**
	(-0.995)	(-1.398)	(4.522)	(2.012)
All Known People	0.0000	0.0000	-0.0002***	
	(0.675)	(1.406)	(-4.828)	
Connections with CEO	-0.0023***	-0.0016*	0.0000	-0.0027***
	(-3.126)	(-1.931)	(0.031)	(-10.328)
Standard Error	0.0031**		-0.0053***	0.0009**
independent director age	(2.046)		(-3.660)	(2.304)
independent Ratio	0.1184***		0.1112***	0.0069
	(3.510)		(3.448)	(0.899)
Log(Board Size)	0.2062***		0.0939***	-0.0021
	(8.492)		(4.283)	(-0.387)
BOSS	-0.0128		-0.0054	-0.0085
	(-0.524)		(-0.240)	(-1.103)
E-Index	0.0035		-0.0053*	-0.0003
	(1.044)		(-1.671)	(-0.422)
CEO Connections	0.0006***		0.0000	0.0001***
with All Board Members	(4.059)		(0.021)	(2.898)
Log(CEO Age)	-0.0065		-0.0485	0.0024

	(-0.168)		(-1.436)	(0.287)
Outside CEO	-0.0229		-0.0019	-0.0004
	(-1.355)		(-0.138)	(-0.134)
Log(CEO tenure)	-0.0067*		-0.0059	-0.0022**
	(-1.821)		(-1.627)	(-2.425)
Tobin's Q	0.0053		0.0012	-0.0003
	(1.177)		(0.340)	(-0.259)
Firm Size	0.0085		-0.0008	-0.0019**
	(0.871)		(-0.217)	(-2.377)
ROA	-0.0645*		-0.0387	0.0073
	(-1.646)		(-1.128)	(0.631)
Stock Return	0.0018		0.0087	0.0035
	(0.293)		(1.551)	(1.201)
Daily Stock Return Volatility	0.6862**		0.6823**	0.2313**
	(2.087)		(2.219)	(2.187)
Leverage	-0.0002		-0.0002*	0.0000*
	(-1.490)		(-1.830)	(1.646)
# of Segments	-0.0027**		-0.0013*	-0.0001
	(-2.431)		(-1.780)	(-0.529)
Constant	-6.6634***	-5.4604***	-50.3149***	0.4734***
	(-20.722)	(-21.369)	(-5.859)	(6.240)
Fixed Effect	Firm+Year	Firm*Year	Director+Year	Year
R-squared	0.108	0.205	0.179	0.019
N	22,584	25,904	24,622	26,289

Table VI

Director Age and Attendance Problems

This table presents the regression analysis of poor board meeting attendance. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors from the sample, and exclude all directors in a given fiscal year who are appointed that year. The dependent variable is a dummy variable that is equal to one if the director is named in the proxy as having attended less than 75% of meetings during the previous fiscal year. All other variables are defined in the Appendix Table AI. Firm and year fixed effects are included. Industries are the Fama-French (1997) 48 industry groups. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Attendance Problem								
	OLS		Nonlinear Regression						Retirement Age Directors
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Director Age/10	-0.004***	-0.004***	-0.030***	-0.019*	-0.0580***				
	(-7.762)	(-4.610)	(-4.473)	(-2.507)	(-4.189)				
Director Age Square/100			0.002***	0.001*	0.0004***				
			(3.878)	(2.075)	(3.567)				
Retirement Age Dummy						-0.005***			
						(-5.986)			
Retirement Title							-0.003**		
							(-2.834)		
Qx (Fatality Rate according to Gender and Age)									0.1981***
									(4.377)
Marginal <50								-0.000	
								(-0.290)	
Marginal 50 < Age < 62								-0.002*	
								(-2.541)	
Marginal 62 < Age < 67								0.001	
								(1.586)	
Marginal Age > 67								-0.000	
								(-0.288)	
Log(Director Tenure)		0.002**		0.002**	0.0532***		0.001	0.004***	-0.0020*
		(2.803)		(2.663)	(3.146)		(1.855)	(3.939)	(-1.901)
Ownership		-1.387**		-1.396**	-102.1996***		-0.556	-0.863	-1.5004*
		(-3.054)		(-3.072)	(-3.806)		(-1.221)	(-1.478)	(-1.921)
Ownership Square		7.596**		7.543**	485.2590***		2.994	5.846	9.2501
		(2.777)		(2.748)	(3.690)		(1.153)	(1.415)	(1.408)
Female		-0.004***		-0.004***	-0.1381***		-0.003*		-0.0059*
		(-3.624)		(-3.667)	(-4.094)		(-2.300)		(-1.759)
Nominating Committee		-0.003***		-0.003***	-0.1098***		-0.002**	0.001	-0.0027*
		(-3.502)		(-3.467)	(-4.581)		(-2.590)	(0.903)	(-1.906)
Audit Committee		-0.006***		-0.006***	-0.1611***		-0.006***	0.003**	-0.0068***
		(-6.276)		(-6.201)	(-6.705)		(-6.335)	(2.731)	(-4.606)

Compensation		-0.004***		0.007	-0.0845***		0.007	0.001	-0.0056***
Committee		(-3.771)		(1.456)	(-3.437)		(1.473)	(0.963)	(-3.804)
Chairman		0.007		-0.004***	0.1345		-0.004***	0.005	-0.0029
		(1.416)		(-3.693)	(1.458)		(-4.068)	(0.889)	(-0.320)
Co-opt Director		0.001		0.001	0.0414		0.001	-0.000	0.0027
		(0.696)		(0.686)	(1.448)		(0.880)	(-0.251)	(1.610)
Busy Director		0.000		0.000	0.0156		0.000	0.003	0.0019
		(0.040)		(0.063)	(0.391)		(0.080)	(1.332)	(0.679)
Foreign		0.015***		0.016***	0.3098***		0.016***	-0.008	0.0064
Director		(4.231)		(4.255)	(5.631)		(4.493)	(-1.209)	(1.352)
Former		-0.003		-0.003	-0.1529		-0.002	-0.004	0.0027
Employee		(-0.443)		(-0.447)	(-0.715)		(-0.398)	(-0.665)	(0.265)
# of		0.002		0.002	0.0452***		0.001	0.000	0.0002
Directorships		(1.710)		(1.797)	(2.645)		(1.282)	(0.169)	(0.175)
Board Expertise		-0.000		-0.000	-0.0007		-0.000	-0.000*	-0.0000
		(-1.608)		(-1.600)	(-0.358)		(-0.634)	(-2.404)	(-0.050)
Independent		-0.017**		-0.017**	-0.676***		0.011*	0.009	-0.0245***
Ratio		(-3.069)		(-3.060)	(-7.359)		(2.012)	(1.853)	(-4.559)
Log(Board Size)		0.023***		0.023***	0.351***		0.017***	0.018***	0.0058
		(5.169)		(5.118)	(4.659)		(4.450)	(5.280)	(1.632)
BOSS		0.003*		0.000	0.069**		0.000	0.000	0.0019
		(2.408)		(0.014)	(2.648)		(0.388)	(0.247)	(0.404)
Ln(Independent		-0.001		0.003*	-0.575**		0.020	0.017	-0.0219*
Director Age)		(-0.047)		(2.405)	(-2.695)		(1.601)	(1.543)	(-1.734)
Constant	0.045***	0.107*	0.121***	0.149**	2.4387**	0.018***	-0.056	-0.037	0.1069**
	(12.129)	(1.977)	(5.859)	(2.587)	(2.528)	(29.683)	(-1.062)	(-0.663)	(1.970)
Other Firm Controls	No	Yes	No	Yes	Yes		Yes	Yes	Yes
Fixed Effect	No	Firm+Year	No	Firm+Year	No	No	Firm+Year	Director+Year	No
R-squared	0.001	0.045	0.001	0.005		0.005	0.028	0.128	0.004
N	160,214	117,958	160,214	117,958	160,214	160,214	117,958	117,959	37,451

Table VII

Director Age and Committee Memberships Preference

This table presents the regression analysis of director age and committee membership preference. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). I only include independent directors from the sample, and exclude all directors in a given fiscal year who are appointed that year. For each committee type I also restrict the sample to firms that have a committee of that type. The dependent variables in Column I, II, and III are dummy variables indicating whether a director is a member or chair of the nominating committee (including corporate governance committee), compensation committee, or audit committee in a given year. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Committee Memberships			
	Nominating Committee	Compensation Committee	Audit Committee	# of Committees
	(I)	(II)	(III)	(IV)
Retired Age	0.0182***	0.0196***	-0.0157**	0.0155**
	(4.652)	(2.650)	(-2.059)	(2.326)
Log(Director Tenure)	-0.0163***	0.0504***	-0.0128**	0.0909***
	(-6.204)	(11.076)	(-2.572)	(19.001)
Ownership	1.6748	-2.9801	-0.9891	4.9864*
	(1.025)	(-0.951)	(-0.321)	(1.660)
Ownership	-40.6487***	50.3017**	11.5733	-26.7194
Square	(-3.067)	(2.095)	(0.426)	(-1.164)
Female	0.0323***	-0.0456***	-0.0267**	0.0088
	(6.158)	(-4.312)	(-2.400)	(0.902)
Log(# of Committees)	0.8704***	0.2072***	-0.0512***	
	(300.625)	(21.999)	(-5.291)	
Chairman	-0.0161	0.0726***	-0.0483*	-0.0221
	(-1.226)	(2.966)	(-1.929)	(-1.056)
Co-opted Directors	-0.0044	0.0095	0.0013	-0.0155**
	(-0.932)	(1.225)	(0.157)	(-1.975)
Busy Directors	-0.0035	0.0038	0.0024	-0.0064
	(-0.633)	(0.346)	(0.221)	(-0.672)
Foreign Directors	0.0515***	0.0028	-0.0943***	-0.0289
	(5.089)	(0.130)	(-4.601)	(-1.624)
Former Employee	0.0665***	-0.1606***	0.0243	-0.0647
	(3.035)	(-3.559)	(0.511)	(-1.535)
# of Directorships	0.0001	-0.0088*	0.0084*	0.0116***
	(0.051)	(-1.947)	(1.851)	(2.820)
# of Industry Expertise	-0.0012	0.0229***	-0.0208***	0.0116***
	(-0.964)	(8.520)	(-7.683)	(4.946)
All Connections Outside	0.0000***	-0.0000***	-0.0000	-0.0000
	(3.251)	(-3.463)	(-0.009)	(-1.058)
Connections with CEO	0.0018***	0.0001	-0.0032***	0.0012
	(3.739)	(0.167)	(-3.860)	(1.532)
Constant	-0.0459	0.4207***	0.7242***	0.5124***
	(-1.618)	(13.571)	(6.630)	(10.840)
R-squared	0.072	0.109	0.061	0.223
N	98,869	98,869	98,869	98,869

Table VIII

The Age Effects on Forced CEO Turnover Ratio

The table presents the regression analysis of independent director age on the likelihood of forced CEO turnovers. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The dependent variables are dummies, which equal to one if the firm has a CEO turnover event in year t, 0 otherwise. I measure the Forced Turnover according different sources (detailed discussions please see Section Data and Empirical Design). Age is the director's age, measured in years. Independence is an indicator variable equal to one if the director is independent. Firm Size is the natural logarithm of total assets. ROA, Q, and Firm Size are measured at the beginning of the fiscal year. Entrenchment Index measures anti-shareholder charter provisions and is defined and constructed by Bebchuk et al. (2004). All other variables are defined in the Appendix Table AI. Industry and year fixed effects are included. Industries are the Fama-French (1997) 48 industry groups. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Turnover Ratio							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Nomination	0.0015***		0.0039***	-0.0209***				0.0064***
Committee Age	(4.351)		(8.924)	(-2.829)				(9.643)
Independent		-0.0077***	-0.0088***					
Directors Age		(-18.149)	(-14.231)					
Nomination				0.0002***				
Committee Age Square				(3.706)				
Marginal					0.0010			
<50					(0.408)			
Marginal					-0.0002			
50 < Age < 62					(-0.128)			
Marginal					0.0009*			
62 < Age < 67					(1.660)			
Marginal					0.0058***			
Age > 67					(5.481)			
NC Retired Age						0.0099**		
Ratio						(1.967)		
Lag NC							0.0402***	
Retired Title							(6.434)	
NC Directors								0.0272***
Entrenched Ratio								(4.038)
NC Directors								0.0000
Age Volatility								(0.006)
Independent			0.0001	0.0019***	0.0013*	0.0021***	0.0016**	0.0004
Age Volatility			(0.126)	(2.975)	(1.905)	(3.188)	(2.399)	(0.812)
NC Attendance			0.0167	0.0097	0.0141	0.0148	0.0146	0.0153
Problems			(0.885)	(0.603)	(0.848)	(0.896)	(0.893)	(0.839)
Co-opted Ratio of			0.1028***	0.1449***	0.1358***	0.1337***	0.1352***	0.1407***
Independent Directors			(12.535)	(17.476)	(16.662)	(16.533)	(16.690)	(16.519)
Independent			0.0090	0.0523***	0.0315**	0.0269*	0.0298*	0.0461***

Ratio			(0.588)	(3.417)	(2.058)	(1.762)	(1.957)	(2.837)
Log(Board Size)			0.1663***	0.1749***	0.1705***	0.1704***	0.1709***	0.1778***
			(14.181)	(14.845)	(14.357)	(14.333)	(14.334)	(14.472)
Board Expertise			-0.0108**	-0.0216***	-0.0185***	-0.0178***	-0.0179***	-0.0222***
			(-2.288)	(-4.510)	(-3.927)	(-3.868)	(-3.860)	(-4.302)
BOSS			-0.0171***	-0.0179***	-0.0189***	-0.0190***	-0.0195***	-0.0182***
			(-5.162)	(-5.355)	(-5.694)	(-5.722)	(-5.876)	(-5.317)
E-Index			0.0009	0.0011	0.0004	0.0008	0.0006	0.0005
			(0.550)	(0.650)	(0.246)	(0.501)	(0.368)	(0.313)
Log (CEO Age)			-0.0538***	-0.0779***	-0.0696***	-0.0648***	-0.0674***	-0.0831***
			(-3.169)	(-4.511)	(-4.014)	(-3.803)	(-3.935)	(-4.392)
Outside CEO			-0.0055	-0.0066	-0.0095	-0.0084	-0.0097	-0.0112*
			(-0.880)	(-1.095)	(-1.475)	(-1.316)	(-1.524)	(-1.700)
Log (CEO Tenure)			-0.0266***	-0.0350***	-0.0327***	-0.0325***	-0.0324***	-0.0333***
			(-12.616)	(-15.614)	(-14.855)	(-14.824)	(-14.799)	(-14.777)
Female CEO			0.0115	0.0186*	0.0156	0.0157	0.0155	0.0149
			(1.044)	(1.728)	(1.522)	(1.536)	(1.507)	(1.343)
Firm Age			-0.0204*	-0.0272**	-0.0151	-0.0081	-0.0134	-0.0322**
			(-1.708)	(-2.219)	(-1.261)	(-0.670)	(-1.109)	(-2.529)
Constant	-0.0082	0.5756***	0.3611***	0.5794**	0.0199	0.0350	0.0587	-0.0197
	(-0.383)	(22.076)	(4.138)	(2.466)	(0.142)	(0.419)	(0.703)	(-1.614)
Other Firm Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year
R-squared	0.038	0.095	0.165	0.164	0.140	0.134	0.139	0.140
N	12,897	18,710	11,071	12,118	11,353	11,353	11,353	11,095

Table IX

The Age Effects on Rick Control

The table presents the analysis of independent director age on the corporate risk control. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The dependent variable is daily stock volatility. Daily stock volatility is measured by fiscal year. ROA is net income divided by the lag of total assets. Cash Flow is net income plus depreciation divided by the numerator of beginning-of-year total assets. Market Leverage is total debt divided by the numerator of market equity. Age is the director's age, measured in years. Independence is an indicator variable equal to one if the director is independent. Firm Size is the natural logarithm of total assets. ROA, Q, and Firm Size are measured at the beginning of the fiscal year. Entrenchment Index measures anti-shareholder charter provisions and is defined and constructed by Bebchuk et al. (2004). GIM is the Gompers, Ishii, and Metrick (2003) governance index. All other variables are defined in the Appendix Table AI. Industry and year fixed effects are included. Industries are the Fama-French (1997) 48 industry groups. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Firm Risks					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Independent	-0.0007***	-0.0005***	-0.0004**	-0.0005*		
Directors Age	(-2.944)	(-3.200)	(-2.562)	(-1.712)		
Log(Independent					-0.0287*	
Directors Age)					(-1.650)	
Lag Independent						-0.0005**
Directors Age						(-2.079)
Independent Directors		0.0000	-0.0000	-0.0002	-0.0002	-0.0002
Age Volatility		(0.063)	(-0.133)	(-0.452)	(-0.435)	(-0.803)
Attendance		0.0082	-0.0008	0.0031	0.0032	-0.0040
Problems		(0.808)	(-0.090)	(0.345)	(0.346)	(-0.410)
Co-opted Ratio of		-0.0057*	-0.0030	-0.0062*	-0.0062*	-0.0058*
Independent Directors		(-1.860)	(-1.051)	(-1.773)	(-1.757)	(-1.693)
Independent		0.0026	-0.0027	-0.0013	-0.0012	-0.0026
Ratio		(0.540)	(-0.570)	(-0.209)	(-0.196)	(-0.416)
Log(Board Size)		-0.0222***	-0.0155***	-0.0137***	-0.0137***	-0.0125**
		(-5.105)	(-3.616)	(-2.626)	(-2.625)	(-2.366)
Board Expertise		-0.0013	0.0008	0.0016	0.0017	0.0013
		(-1.160)	(0.723)	(0.814)	(0.825)	(0.620)
BOSS		-0.0004	0.0001	-0.0003	-0.0003	0.0006
		(-0.326)	(0.108)	(-0.203)	(-0.207)	(0.375)
E-Index		-0.0013**	-0.0007	0.0005	0.0005	0.0002
		(-2.149)	(-1.315)	(0.664)	(0.667)	(0.265)
Log(CEO Age)		-0.0196***	-0.0150**	-0.0112	-0.0113	-0.0096
		(-2.956)	(-2.328)	(-1.534)	(-1.533)	(-1.243)
Outside CEO		0.0071***	0.0073***	0.0013	0.0013	0.0030
		(3.394)	(3.743)	(0.429)	(0.432)	(0.929)
Log(CEO Tenure)		0.0010	0.0002	0.0011	0.0011	0.0009
		(1.012)	(0.276)	(1.244)	(1.235)	(0.984)
Female CEO		-0.0015	-0.0004	-0.0007	-0.0006	-0.0005
		(-0.308)	(-0.091)	(-0.093)	(-0.091)	(-0.061)
Firm Age		-0.0077***	-0.0058***	-0.0270***	-0.0269***	-0.0303***
		(-6.242)	(-4.884)	(-4.616)	(-4.591)	(-4.605)
Constant	0.1433***	0.3453***	0.3078***	0.3544***	0.4429***	0.3798***
	(9.668)	(10.904)	(10.174)	(9.141)	(6.046)	(8.644)
Other Firm Controls	No	Yes	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year	Year	Industry+Year	Firm+Year	Firm+Year	Firm+Year
R-squared	0.483	0.338	0.386	0.502	0.502	0.545
N	17,890	16,218	16,218	16,218	16,218	14,237

Table X

Performance Regression

This table presents the regression analysis of director age and firm performance. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The dependent variable is Tobin's Q. Tobin's Q is measured as the ratio of market value of assets to book value of assets. Market value of assets is defined as book value of total assets (at) plus market equity minus book equity. Market equity is defined as common shares outstanding (csho) times fiscal year closing price (prcc f). Book equity is calculated as stockholders' equity (seq) minus preferred stock liquidating value (pstkl) plus balance sheet deferred taxes (txdb). Book value of assets is total assets (at). ROA is net income divided by the lag of total assets. Cash Flow is net income plus depreciation divided by the numerator of beginning-of-year total assets. Market Leverage is total debt divided by the numerator of market equity. Age is the director's age, measured in years. Entrenchment Index measures anti-shareholder charter provisions and is defined and constructed by Bebchuk et al. (2004). All other variables are defined in the Appendix Table AI. Industry and year fixed effects are included. Industries are the Fama-French (1997) 48 industry groups. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Independent Directors Age	-0.0225***	-0.0078*	-0.0137***			-0.0115**
	(-3.854)	(-1.818)	(-2.617)			(-2.020)
Log (Independent Directors Age)				-0.8740***		
				(-2.715)		
Lag Independent Directors Age					-0.0125**	
					(-2.399)	
Independent Directors Age Volatility		-0.0007	-0.0042	-0.0041	-0.0035	-0.0014
		(-0.120)	(-0.690)	(-0.677)	(-0.534)	(-0.219)
Attendance Problems		-0.2886	-0.2878*	-0.2872*	-0.2102	-0.1342
		(-1.502)	(-1.909)	(-1.906)	(-1.179)	(-1.095)
Co-opted Ratio of Independent Directors		-0.0964	-0.1076	-0.1099	-0.0695	0.0351
		(-1.284)	(-1.290)	(-1.318)	(-0.811)	(0.342)
Independent Ratio		-0.2701**	-0.1184	-0.1178	-0.1987	-0.1888*
		(-2.388)	(-0.963)	(-0.962)	(-1.540)	(-1.707)
Log (Board Size)		-0.1248	-0.2288**	-0.2288**	-0.2407**	-0.0513
		(-1.387)	(-2.313)	(-2.314)	(-2.334)	(-0.652)
Board Expertise		0.0697***	-0.0149	-0.0136	-0.0053	0.0718*
		(2.637)	(-0.405)	(-0.371)	(-0.152)	(1.899)
BOSS		-0.0002	0.0111	0.0111	0.0002	0.0222
		(-0.006)	(0.349)	(0.347)	(0.007)	(0.871)
E-Index		-0.0576***	0.0220	0.0221	0.0286	-0.0186
		(-4.128)	(1.049)	(1.053)	(1.250)	(-1.438)
Log (CEO Age)		-0.3606***	-0.0652	-0.0627	-0.0587	-0.0794
		(-2.638)	(-0.352)	(-0.339)	(-0.292)	(-0.395)
Outside CEO		-0.0160	0.0246	0.0254	0.0063	-0.0114
		(-0.302)	(0.417)	(0.430)	(0.101)	(-0.219)
Log (CEO Tenure)		0.0696***	0.0561***	0.0565***	0.0484**	0.0053
		(3.577)	(2.851)	(2.876)	(2.352)	(0.337)
Female CEO		-0.1640	0.1171	0.1173	0.0809	0.2104*
		(-1.532)	(1.159)	(1.162)	(0.805)	(1.721)
Firm Age		-0.1084***	-0.4950***	-0.4914***	-0.3836**	-0.4900***
		(-3.886)	(-3.249)	(-3.249)	(-2.123)	(-3.127)
Constant	3.6997***	4.1165***	7.6637***	10.3963***	7.4001***	2.6211***
	(10.333)	(6.615)	(7.233)	(6.097)	(6.365)	(3.738)
Other Firm Controls	No	Yes	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year	Industry+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year
R-squared	0.464	0.460	0.656	0.656	0.669	0.678
N	18,707	16,218	16,218	16,218	14,237	3,561

Table XI

Nonlinear Effect of Age of Independent Directors on Firm Performance

This table presents nonlinear effect of independent director age on firm performance. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The dependent variable is Tobin's Q. Tobin's Q is measured as the ratio of market value of assets to book value of assets. All other variables are defined in the Appendix Table AI. Industry and year fixed effects are included. Industries are the Fama-French (1997) 48 industry groups. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q				
	(I)	(II)	(III)	(IV)	(V)
Independent	-4.2573*				-0.0167***
Directors Age	(-1.944)				(-2.940)
Independent	0.0005				
Directors Age Square	(1.609)				
Marginal		-0.0227			
<50		(-0.630)			
Marginal		0.0374*			
50 < Age < 62		(2.064)			
Marginal		-0.0226**			
62 < Age < 67		(-2.286)			
Marginal		0.0138			
Age > 67		(0.786)			
Retired Age			-0.0433		
Ratio			(-0.613)		
About Retirement				-0.1400**	
Age				(-1.973)	
Retired Title					0.1253**
Ratio					(1.992)
Independent Directors	-0.0026	-0.0118	-0.0015	-0.0048	-0.0057
Age Volatility	(-0.421)	(-1.378)	(-0.246)	(-0.773)	(-0.925)
Attendance	-0.2841*	-0.2883*	-0.2906*	-0.2892*	-0.2846*
Problems	(-1.888)	(-1.916)	(-1.924)	(-1.917)	(-1.889)
Co-opted Ratio of	-0.1047	-0.1088	-0.0623	-0.0570	-0.1065
Independent Directors	(-1.258)	(-1.307)	(-0.779)	(-0.737)	(-1.278)
Independent	-0.1001	-0.1108	-0.0920	-0.0899	-0.1161
Ratio	(-0.796)	(-0.900)	(-0.750)	(-0.736)	(-0.944)
Log(Board Size)	-0.2279**	-0.2359**	-0.2272**	-0.2335**	-0.2314**
	(-2.308)	(-2.375)	(-2.299)	(-2.349)	(-2.341)
Board Expertise	-0.0090	-0.0075	-0.0256	-0.0217	-0.0127
	(-0.246)	(-0.203)	(-0.714)	(-0.604)	(-0.347)
BOSS	0.0097	0.0098	0.0097	0.0084	0.0097
	(0.304)	(0.307)	(0.303)	(0.262)	(0.306)
E-Index	0.0227	0.0225	0.0220	0.0222	0.0224
	(1.083)	(1.074)	(1.048)	(1.054)	(1.065)
Log(CEO Age)	-0.0630	-0.0635	-0.1036	-0.1053	-0.0562
	(-0.341)	(-0.344)	(-0.558)	(-0.567)	(-0.305)
Outside CEO	0.0277	0.0261	0.0176	0.0180	0.0250
	(0.471)	(0.446)	(0.299)	(0.305)	(0.425)
Log(CEO Tenure)	0.0556***	0.0561***	0.0477**	0.0467**	0.0554***
	(2.832)	(2.846)	(2.488)	(2.487)	(2.820)
Female CEO	0.1195	0.1142	0.1180	0.1174	0.1172
	(1.191)	(1.140)	(1.171)	(1.169)	(1.163)
Firm Age	-0.4730***	-0.4808***	-0.5157***	-0.5105***	-0.4916***
	(-3.152)	(-3.197)	(-3.353)	(-3.326)	(-3.235)
Constant	22.5041***	8.1908***	7.0505***	7.0974***	7.7770***
	(2.783)	(4.158)	(7.045)	(7.069)	(7.234)
Other Firm Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year	Firm+Year	Firm+Year	Firm+Year	Firm+Year
R-squared	0.657	0.657	0.656	0.656	0.657
N	16,218	16,218	16,218	16,218	16,217

Table XII

Instrument Variable Performance Regression

This table presents the instrument variable regression analysis of director age and firm performance. I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms). The dependent variable is Tobin's Q. The instrument is the average age of local director labor market: the average age of the executives of SP1500 firms in 20 miles' radius. Industry and year fixed effects are included. This instrument variable captures more exogenous variation between within the same industry rather than the time-series variation within each firm since firms are less likely to change directors frequently. Consequently, I use industry fixed effect rather than firm fixed effect. Industries are the Fama-French (1997) 48 industry groups. All other variables are defined in the Appendix Table AI. All standard errors are clustered at the firm level. All regressions include a constant. Industries are the Fama-French (1997) 48 industry groups. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	IV Regression	
	Stage I	Stage II
	(I)	(II)
Lag Executive Director	0.1617***	
Pool Age	(3.367)	
Independent		-0.1758***
Directors Age		(-3.102)
Independent Directors	-0.0640**	-0.0090
Age Volatility	(-2.176)	(-1.059)
Coopted Ratio	-3.0062***	-0.4681**
	(-10.002)	(-2.481)
Independent Ratio	-0.7807	-0.7286***
	(-1.455)	(-4.719)
Log(Board Size)	-0.2501	-0.0690
	(-0.574)	(-0.577)
Board Expertise	0.1575	0.1744***
	(1.102)	(4.535)
BOSS	-0.3868	0.0251
	(-1.079)	(0.269)
E-Index	0.2617***	-0.0328
	(4.727)	(-1.581)
Log(CEO Age)	7.0393***	0.7872*
	(10.556)	(1.878)
Outside CEO	-0.0689	-0.0287
	(-0.289)	(-0.408)
Log(CEO Tenure)	0.8319***	0.1582***
	(10.028)	(2.907)
Female CEO	-0.2546	-0.1212
	(-0.753)	(-1.115)
Firm Age	0.5360***	0.0093
	(3.732)	(0.168)
Constant	24.6071***	9.2019***
	(7.020)	(4.444)
Other Firm Controls	Yes	Yes
Fixed Effect	Industry+Year	Industry+Year
R-squared	0.133	0.171
N	15,022	15,022

Table XIII

Summary Statistics by Age Group: Director Deaths Sample

This table presents the summary statistics for the death sample. The sample includes 1576 CEO death events with available information in BoardEx/RiskMetrics/Execucomp, Compustat and CRSP. I retrieve the death information from the 8-K filing covering 1994–2013. Additional information regarding death are retrieve by different resources (e.g. BoardEx, Factiva, CapitalIQ Key Development). For detail information regarding to death sample, please refer to the Appendix.

	Age Stage				
	Young	Middle	About to Retire	Retired Age	Total
CAR[-1, +2]	-0.003	-0.004	0.002	-0.001	-0.002
CAR[-1, +1]	-0.002	-0.003	0.001	-0.001	-0.001
CAR[-1, 0]	0.002	0.002	0.001	0.001	0.001
Female	0.072	0.094	0.063	0.028	0.044
Director Tenure	4.830	6.978	8.520	16.534	13.170
Audit Committee Member	0.301	0.338	0.423	0.373	0.373
Compensation Committee Member	0.329	0.338	0.457	0.401	0.398
Nomination Committee Member	0.205	0.274	0.364	0.332	0.324
Total Assets	6546.427	25320.740	19749.740	28753.090	26356.060
Cash Flow	0.054	-0.001	0.035	0.009	0.012
ROA	0.072	0.001	0.050	0.011	0.017
Tobin's Q	1.874	1.869	1.774	2.052	1.983
Investment Ratio	0.110	0.114	0.074	0.271	0.217
R&D	0.862	1.061	1.215	1.771	1.569
R&D Missing	0.574	0.534	0.513	0.536	0.534

Table XIV

Age Effect on Death Announcement CAR

The table presents the result estimated using all director deaths. The sample includes 1576 CEO death events with available information in BoardEx/RiskMetrics/Execucomp, Compustat and CRSP. I retrieve the death information from the 8-K filing covering 1994–2013. Additional information regarding death are retrieve by different resources (e.g. BoardEx, Factiva, CapitalIQ Key Development). For detail information regarding to death sample, please refer to the Appendix. The dependent variables are the cumulative abnormal returns (CAR) for (-1, +2). Column I, II, III and IV capture the CARs around the death events in the window from (-1, +5). Column V, VI and VII capture the CARs around the death events in the window from (-1, +3), (-1, +4) and (-1, +5), respectively. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	All Deaths			Independent Directors Deaths				Executive Directors Deaths
	All	All	All	All	All	Over 67 Years Old	Sudden Death	All
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Director Age	-0.0006**	-0.0007**		-0.0012**		-0.0010*	-0.0035**	0.0005
	(-1.980)	(-2.335)		(-2.488)		(-1.739)	(-2.068)	-0.329
Log(Director Age)					-0.0818**			
					(-2.503)			
Age Increase among			-0.0095***					
Young Director			(-3.087)					
Age Increase among			-0.0173*					
Mid-age Directors			-2.016					
Age Increase among			0.0095***					
About-Retirement-Age Directors			-2.784					
Age Increase among			-0.0007*					
Retired-age Directors			(-1.769)					
Female Dummy	-0.0147	-0.0153	-0.0142	-0.016	-0.0164	0.0113	-0.0518	0.0272
	(-1.208)	(-1.246)	(-1.174)	(-1.149)	(-1.176)	-0.609	(-1.169)	-0.488
Director Tenure	0.0007***	0.0009***	0.0007***	0.0009**	0.0009**	0.0007*	0.0014	0.0005
	-2.797	-3.494	-2.714	-1.968	-1.968	-1.714	-1.241	-0.613
CEO Dummy	0.012	0.0144	0.0155					
	-0.84	-1.005	-1.083					
Executive Dummy	0.0191*	0.0098	0.0177					
	-1.696	-0.852	-1.578					
Independent Director Dummy	0.0133*	0.0069	0.0140*					
	-1.823	-0.845	-1.914					
Director Busyness	0.0013	0.0026	0.0016	0.0055*	0.0055*	0.0094**	0.0205**	-0.003
	-0.548	-1.048	-0.691	-1.739	-1.747	-2.333	-2.198	(-0.318)
Audit Committee	0.0026	0.0058	0.0029	0.0062	0.0063	0.0069	0.0361	
Member	-0.428	-0.95	-0.471	-0.841	-0.86	-0.8	-1.562	
Compensation Committee	0.003	0.0068	0.0027	0.0068	0.007	0.0106	0.0023	

Member	-0.502	-1.13	-0.462	-1.025	-1.046	-1.364	-0.12	
Nominating Committee	-0.0047	-0.0057	-0.0042	-0.0076	-0.0075	-0.0094	-0.0023	
Member	(-0.774)	(-0.925)	(-0.685)	(-1.097)	(-1.076)	(-1.205)	(-0.112)	
Board Size	0.0009	0.0005	0.001	-0.0016	-0.0016	-0.0019	-0.0007	0.0103**
	-0.827	-0.391	-0.915	(-1.019)	(-1.021)	(-1.052)	(-0.102)	-2.003
Independent Ratio	-0.0028	0.0007	-0.0004	0.0105	0.0111	0.0252	-0.0147	-0.1336
	(-0.148)	-0.034	(-0.022)	-0.37	-0.392	-0.738	(-0.147)	(-1.287)
ROA	-0.0064	-0.0064	-0.0067	0.0386	0.0386	0.029	-0.0292	0.029
	(-0.916)	(-0.896)	(-0.959)	-1.364	-1.365	-1.247	(-0.499)	-0.338
Log(Total Asset)	0.0023	0.0016	0.0023	0.0007	0.0007	-0.0007	0.0064	0.0025
	-1.48	-0.956	-1.452	-0.311	-0.329	(-0.221)	-0.714	-0.486
Constant	-0.0045	0.0241	0.4259***	0.0676	0.3293**	0.0466	0.5569***	0.0609
	(-0.163)	-0.762	-2.839	-1.514	-2.336	-0.707	-4.061	-0.486
Fixed Effect	No	Industry+Year		Industry+Year				Industry+Year
R-squared	0.017	0.109	0.26	0.095	0.096	0.161	0.512	0.459
N	1,576	1,576	1,576	988	988	623	147	217

Table XV

Independent Director Age and Director Compensation

I use the 1996–2012 sample of firms from ISS RiskMetrics database with available information in Execucomp and Compustat/CRSP database (S&P 1500 firms).

	Total Compensation			
	S&P 500 Sample			
Director Age	0.9760***		14.6860***	
	(3.893)		(10.913)	
Marginal		-0.1096		12.7956***
<50		(-0.073)		(4.858)
Marginal		1.1256***		14.1226***
50 < Age < 62		(2.854)		(10.199)
Marginal		0.7967		16.2495***
62 < Age < 67		(0.845)		(6.400)
Marginal		0.6327		17.2365***
Age > 67		(0.734)		(4.670)
Firm Size	102.3027***	102.3296***	28.5731***	28.6576***
	(6.587)	(6.583)	(5.343)	(5.385)
Tobin's Q	36.2853***	36.2870***	32.0387***	32.0302***
	(3.593)	(3.597)	(3.725)	(3.734)
ROA	229.2553**	229.1952**	165.5324**	165.2705**
	(2.367)	(2.366)	(2.008)	(2.007)
Ownership	98.2718***	101.1780***	151.6962***	155.2220***
	(3.370)	(3.261)	(4.168)	(4.204)
Ownership	-55.4176***	-56.8897***	-65.9073***	-66.0872***
Square	(-3.124)	(-3.063)	(-3.392)	(-3.348)
Log(Director Tenure)	3.6503	3.6754	5.5406	5.5556
	(0.536)	(0.539)	(0.898)	(0.897)
Female	-2.5164	-2.3760		
	(-0.777)	(-0.723)		
Foreign	-2.0368	-2.0495		
Director	(-0.301)	(-0.303)		
Nominating	1.6380	1.6405	-4.2803	-4.4820
Committee	(0.269)	(0.269)	(-0.496)	(-0.513)
Audit	4.8780	4.9088	4.1435	3.9746
Committee	(0.654)	(0.656)	(0.405)	(0.386)
Compensation	1.6708	1.7291	-5.3993	-5.1733
Committee	(0.192)	(0.198)	(-0.339)	(-0.327)
Chairman	174.2260***	174.1157***	204.7506***	204.5388***
	(6.475)	(6.470)	(5.812)	(5.808)
BOSS	-5.5734	-5.5807	8.8947	8.9154
	(-0.460)	(-0.461)	(1.018)	(1.022)
# of	1.0052*	0.9980	2.0043	2.8368
Directorships	(1.664)	(1.634)	(0.544)	(0.736)
Log(Board Size)	-40.7196	-40.6316	-35.2980	-36.2605
	(-1.163)	(-1.157)	(-1.237)	(-1.261)
Independent	167.5227***	167.7179***	9.8347	9.4095
Ratio	(4.207)	(4.203)	(0.253)	(0.240)
Constant	-971.1042***		-1.01e+03***	
	(-5.862)		(-9.340)	
Other Firm Controls	Yes	Yes	Yes	Yes
Fixed Effect	Firm+Year		Director+Year	
R-squared	0.127	0.127	0.142	0.142
N	31,897	31,897	31,897	31,897

2.8 Appendix

2.8-A1 Sample Formation and Variable Definition

First, I cross reference on different sources of director databases to figure out a proper way to investigate on director pool. I use RiskMetrics as a benchmark because the coverage is consistent since 1996. However, certain variables (e.g. committee memberships) are not reliable in 1996-1997. Consequently, I use the sample from 1996-2012, but I also use the whole sample 1998-2012 as a robustness test and most of results pass it. Then, I focus on the 2004-2013 sample, as both the Audit Analytics and BoardEx have better coverage during this time period. In addition, I use the observations after 2006 for death sample due to the availability of the death information in 8K filings is not complete before 2006.[27]

[27] After 2006, SEC requires all listed firms to file the change of director and officer in item 5.02 in their 8K current report.

Table 2.8-A1-1
Variable Definition and Data Source

Variables	Definitions	Source
Age Related Variables		
Director Age	The age of director	RiskMetrics/BoardEx/ Capital IQ/Edgar
Retired Age Directors	Indicator that equals 1 if the director is aged sixty-seven or over, and equals 0 otherwise.	RiskMetrics/BoardEx/ Capital IQ/Edgar
About Retirement Age Directors	Indicator that equals 1 if the director is aged sixty-two or over but less than sixty-seven, and equals 0 otherwise.	RiskMetrics/BoardEx/ Capital IQ/Edgar
Young Age Directors	Indicator that equals 1 if the director is aged less than fifty, and equals 0 otherwise.	RiskMetrics/BoardEx/ Capital IQ/Edgar
Retired Title	Indicator that equals 1 if the director does NOT holding any other jobs than the directorship, and equals 0 otherwise.	
CODA	Indicator that equals 1 if the director is the Children of Depression (CODA), born 1924-1930, and equals 0 otherwise.	
HRS	Indicator that equals 1 if the director is HRS, born 1931-1941, and equals 0 otherwise.	
War Babies	Indicator that equals 1 if the director is War Babies (WB), born 1942-1947, and equals 0 otherwise.	
Early Baby Boomers	Indicator that equals 1 if the director is Early Baby Boomers (EBB), born 1948-1953, and equals 0 otherwise.	
Mid Baby Boomer (MBB)	Indicator that equals 1 if the director is Mid Baby Boomer (MBB), born 1954-1959, and equals 0 otherwise.	
The retired age ratio of Independent Directors	The percent of independent director who are over the age of 72.	
Independent Directors' Age	The average age of independent directors	
Other Director Characteristics		
Female	Indicator that equals 1 if the director is female, and equals 0 otherwise.	
Founder	Indicator that equals 1 if the director is the founder, co-founder or founding partner of the firm, and equals 0 otherwise.	BoardEx
Independent dir. block. Ownership	Indicator that equals 1 if the firm has an independent director with a 5% or larger stake and equals 0 otherwise..	RiskMetrics
Attendance Problem	Indicator that equals 1 if the director and equals 0 otherwise..	
Nominating Committee Membership		
Co-opted director	Indicator that equals 1 if the director who joined the board after the CEO assumed office and equals 0 otherwise, following Coles, Daniel and Naveen (2014)	
Connections with the CEO	The number of all type of social connections the director	
Average Director Tenure	Average tenure of all directors on board	
Number of Directorships	Number of additional public firm directorships identified by RiskMetrics or BoardEx data set.	RiskMetrics
Committee	Indicator that equals 1 if the director sits on the any committees of the firm, and equals 0 otherwise.	
Audit Committee Member	Indicator that equals 1 if the director sits on the audit committees of the firm, and equals 0 otherwise.	

Compensation Committee Member	Indicator that equals 1 if the director sits on the compensation committees of the firm, and equals 0 otherwise.	
Nominating Committee Member	Indicator that equals 1 if the director sits on the nominating committees of the firm, and equals 0 otherwise.	
CEO Characteristics		
CEO Age	CEO age	Execucomp
CEO Retired	Indicator that equals 1 if the CEO is aged sixty-seven or over and equals 0 otherwise.	Execucomp
CEO Tenure	One plus the total number of years a CEO has been the CEO in certain Firm and calculated fiscal year end date minus date became CEO	Execucomp
CEO Ownership	Percent ownership of the CEO in the firm.	RiskMetrics
Log (CEO Tenure)	Natural logarithm of CEO tenure.	Execucomp
Log (CEO Tenure on Board)	Natural logarithm of the number of years the CEO has served on the board.	RiskMetrics
BOSS	Indicator that equals one if the CEO is also the chairperson of the board and equals 0 otherwise.	RiskMetrics
Total CEO pay	Total CEO compensation (including value of option grants), in million, divided by total assets.	Execucomp
CEO turnover	Indicator that equals 1 if a change in the CEO has occurred compared to the previous year, and equals 0 otherwise.	Execucomp
CEO Pay-Performance Sensitivity (Delta)	Expected dollar change in CEO wealth for a 1% change in stock price (using entire portfolio of stocks and options) computed, following Core and Guay (2002)	
Founder CEO	Indicator that equals 1 if the CEO is the founder, co-founder or founding partner of the firm, and equals 0 otherwise.	
Board Characteristics		
Executive Expertise (%)	Percent of outside directors with executive expertise on the board. Executive expertise is defined as CEO, CFO, CIO, COO, President, VP, Executive VP, Senior VP, Partner, Managing Director, or Treasurer title, or insider status on another board. Where specified, independent directors are used.	RiskMetrics/ BoardEx/Execucomp
Academic Expertise (%)	Percent of directors with specialized expertise on the board. Academic Expertise is defined as being a professor, faculty member, lecturer, instructor, researcher, fellow, dean or provost.	RiskMetrics/BoardEx
Legal Expertise (%)	Legal Expertise is defined as having an attorney, counsel, or similar law-related title or holding a law degree.	RiskMetrics/BoardEx
Financial Expertise (%)	Financial Expertise is defined as having a CFO, Treasurer, banking, finance, investment or accounting position.	RiskMetrics/BoardEx
R&D Experience (%)	Percent of outside directors with corporate experience at firms with positive R&D, firms with High-tech indicator of 1, and firms in the same quartile of growth opportunities (market-to-book), respectively, among outside directors with identifiable corporate jobs (officer on another board, where RiskMetrics identifies the firm).	
Retired Executives (%)	Percent of outside directors who are retired executives (directors over sixty who are executives in the past but not in the current or two subsequent years).	RiskMetrics
Majority Independent	Indicator variable that equals 1 if the percent independent outside directors is greater than 50% and equals 0 otherwise.	RiskMetrics
Independent Ratio	Percent of independent directors on the board.	RiskMetrics
Gray Directors (%)	Percent of gray directors on the board. Gray directors are professional service providers, customers, suppliers, former employees, directors designated under an agreement with a group or by a significant shareholder, majority holders, relatives of executives, recipients of gifts, certain interlocking directors (a director and executive of my firm sits on another board that has an executive and director who also sit on my board), and others, as identified in proxies and disclosures.	RiskMetrics.

Inside Directors (%)	Percent of inside directors on the board.	
Board Size	Log of the number of directors on the board.	RiskMetrics
Busy Board	Indicator variable that equals 1 if a majority of the independent outside directors each hold 3 or more additional directorships and equals 0 otherwise.	RiskMetrics
Firm Characteristics		
Log of sales	Natural logarithm of annual sales.	Compustat
Sales growth	Annual change in net sales divided by the previous year's net sales.	Compustat
Profitability	Net operating cash flow plus depreciation and amortization.	Compustat
Advertising Expense	Advertising expenditures scaled by total assets and set to zero if unreported.	Compustat
Cash Flow		Compustat
Market-to-book ratio	Ratio of market value (book value of assets minus book value of equity plus year-end price times common shares outstanding) to book value of assets.	Compustat
Tangibility	Ratio of property, plants, and equipment to total assets.	Compustat
Dividend yield	Cash dividends per share divided by price at year-end.	Compustat
Leverage	Year-ending Long-term Debt plus Debt in Current Liabilities divided by year-end Total Assets	Compustat
Return	Annual average of monthly excess stock return.	CRSP
Stock Performance Standard Deviation	Standard deviation of monthly excess returns in a given fiscal year.	CRSP
Tobin's Q	The market value of common equity plus the book value of total liabilities divided by the book value of total assets.	Compustat
R&D	The ratio of research and development (R&D) expenditures to total asset. Missing observations are set to zero.	
R&D Missing	Indicator that equals 1 if the ratio of research and development (R&D) expenditures is missing, and equals 0 otherwise.	
Investment Ratio (Capex)	The ratio of capital expenditure to total assets.	Compustat
Assets	Year-end assets	Compustat
Firm Size	Log of total assets.	Compustat
ROA	Ratio of net income to total assets. ROA (%) is ROA expressed as a percent of total assets.	Compustat
Firm age	Natural logarithm of one plus the number of years from the firm's IPO or log of one plus the number of years since its first appearance in CRSP.	CRSP/CIQ/ SDC and etc.
R&D intensity	R&D intensity indicator equals one if R&D Intensity is positive and is zero otherwise.	Compustat
E-index	Calculated using staggered board, poison pill, limits to amend bylaws, limits to amend charter, supermajority and golden parachutes based on Bebchuk, Cohen and Ferrell (2009).	RiskMetrics
Post-SOX	Indicator that equals 1 if the observations occurs in fiscal year 2003-2005 and equals 0 in fiscal year 1999-2001.	
Herfindahl Index	Calculated using all available firms for each of the SIC 2-digit industry definitions as sum(sales/industy sales)^2, where i is the number of firms in the industry.	Compustat
Stock Volatility	Standard deviation of monthly stock returns	CRSP
Firm Risk	Standard deviation of daily excess returns expressed in percent in a given year, following Knyazeva, Knyazeva and Masulis (2013).	CRSP
Family Firm		
Institutional Ownership	Total percentage institutional ownership. Institutional block equals 1 if the firm has a 5% institutional blockholder.	Thomson Reuters.
High-tech indicator	Indicator that equals 1 if the high-tech firms are identified by SIC codes 2833-2836, 3570-3577, 3600-3674, 7371-7379 or 8731-8734, following Baginski et al. (2004), and equals 0 otherwise.	Compustat

Business segments	Natural logarithm of the number of business segments.	Compustat
Death Related		
Sudden deaths	Indicator that equals one if death of directors or officer is unexpected, and equals 0 otherwise. Sudden death is defined as “an unexpected death that occurs instantaneously or within 24 hours of an abrupt change in the person’s previous clinical state” (Nguyen and Nielsen (2010)). To include deaths that are sudden and not expected by the stock market, Nguyen and Nielsen (2010) exclude deaths attributed to cancer, complications from illness, past strokes, and surgery.	
Employee Treatment Index	Index is computed by summing up the six strength indicators for the employee relations dimension (i.e., employee involvement, health and safety strength, retirement benefit strength, cash profit sharing, union relations, and other strengths) and the four concern indicators for the employee relations dimension (i.e., health and safety concern, retirement benefits concern, union relations, and other concerns).	KLD database

Figure 2.8-A1-1
Average Director Age among Different Director Pool

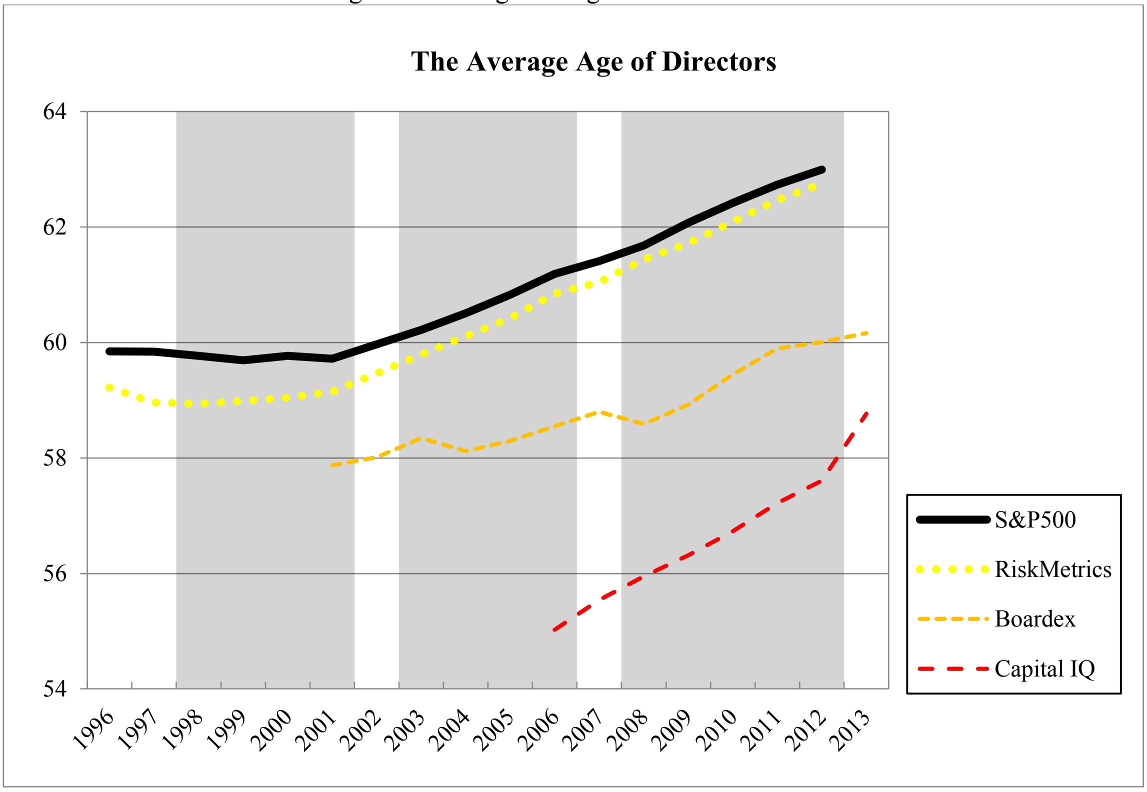
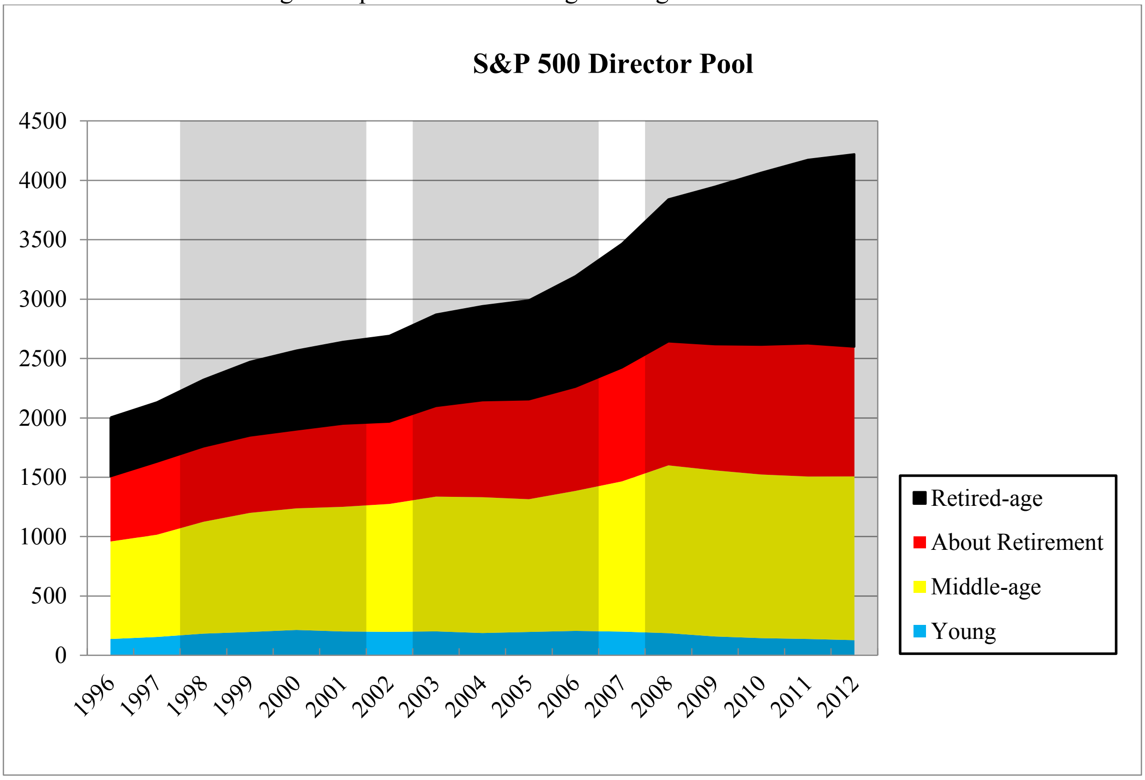


Figure 2.8-A1-2
Average Independent Director Age among Different Director Pool



2.8-A2 Summary of Director Turnover Events and Analytic Analysis Database

Table 2.8-A2-1

Reasons for Director Turnover (Analytic Analysis Database)

I use the 2006–2012 sample of Analytic Analysis Database firms with available information in RiskMetrics, Execucomp and Compustat/CRSP database (S&P 1500 firms).

SP1500 Sample (2006-2012)		
Reasons	Frequency	Percent
Merger / Acquisition	825	29.69
Mandatory Retirement Policy	384	13.82
Retired	325	11.69
Too Many Commitments	267	9.61
Personal / Health Reasons	235	8.46
Other Opportunity	175	6.3
Other	122	4.39
Pursue Other Interests	77	2.77
Expiration of Employment Agreement	62	2.23
Change in Control	59	2.12
Position Change within Company	48	1.73
Conflict of Interest	42	1.51
Disagreement w/ management or policies	36	1.3
Sale of Assets/Spin-Off	34	1.22
Sale of Assets	24	0.86
Personal Reasons	16	0.58
Establish or Maintain Independence of..	14	0.5
Investigation (Internal or Other)	9	0.32
Bankruptcy/Dissolution	7	0.25
Corporate Restructuring	7	0.25
Dismissed for Cause	5	0.18
Assuming additional Position(s)	2	0.07
Returning to Prior Position	2	0.07
Suspected or Determined Wrongdoing	2	0.07
Total	2,779	100

2.8-A3 Extended Tests on the Impacts of SOX

Table 2.8-A3-1

The Effect of SOX on Board Structure

Independent board in Year 2001	Panel B: # of Independent Directors		
	Pre SOX (C)	Post SOX (D)	Post-Pre SOX Difference (D)-(C)
0 (A)	3.515	5.287	1.772***
T-Statistics	77.865	90.233	24.212
N	[1,502]	[998]	
1 (B)	6.780	7.34	0.560***
T-Statistics	162.702	186.176	5.8237
N	[3,977]	[3,262]	
Difference (A)-(B)	-2.053***	3.265*	1.212***
T-Statistics	26.126	44.559	11.090

Independent board in Year 2001	Panel C: Board Size		
	Pre SOX (C)	Post SOX (D)	Post-Pre SOX Difference (D)-(C)
0 (A)	8.952	9.156	0.2038065**
T-Statistics	115.360	117.017	1.7751
N	[1,502]	[988]	
1 (B)	9.757	9.738	-0.0192125
T-Statistics	194.338	223.304	-0.2823
N	[3,977]	[3,262]	
Difference (A)-(B)	-0.805***	-0.582***	0.223*
T-Statistics	8.510	6.454	1.650

Independent board in Year 2001	Panel D: # of Executive Directors		
	Pre SOX (C)	Post SOX (D)	Post-Pre SOX Difference (D)-(C)
0 (A)	2.822	2.102	-0.720***
T-Statistics	67.395	58.937	12.1652
N	[1,502]	[998]	
1 (B)	1.808	1.466	-0.342***
T-Statistics	117.681	116.063	16.7173
N	[3,977]	[3,262]	
Difference (A)-(B)	-1.014	-0.636***	-0.378***
T-Statistics	-28.256	-21.056	-7.650

Independent Nominating Committee in Year 2001	Panel F: Co-opt Directors Ratio in Nominating Committee		
	Pre SOX (C)	Post SOX (D)	Post-Pre SOX Difference (D)-(C)
0 (A)	0.212	0.340	0.128***
T-Statistics	30.349	38.995	11.6109
N	[1,851]	[1,570]	
1 (B)	0.296	0.382	0.085***
T-Statistics	32.101	50.208	7.0305
N	[1,475]	[2,483]	
Difference (A)-(B)	-0.041***	-0.843***	0.043***
T-Statistics	-3.512	-7.418	2.58

2.8-A4 Extended Tests on Attendance Problems

Table 2.8-A4-1

Attendance Problems: Executive Director Sample

	Executive Directors		All Directors	
	(I)	(II)	(III)	(IV)
Director Age	-0.0012**	-0.0015	-0.0021***	-0.0019***
	(-2.123)	(-1.194)	(-3.676)	(-2.599)
Director Age	0.0000**	0.0000	0.0000***	0.0000**
Square	(2.354)	(1.359)	(3.435)	(2.430)
Log(Director Tenure)		0.0024		0.0009
		(1.325)		(1.510)
Ownership		-0.1859		-0.7621***
		(-0.826)		(-3.499)
Ownership		1.1253		3.8121***
Square		(0.921)		(2.970)
Female		-0.0042		-0.0018*
		(-0.488)		(-1.663)
Nominating		0.0021		-0.0017**
Committee		(0.470)		(-2.192)
Audit		-0.0057		-0.0037***
Committee		(-1.478)		(-4.601)
Compensation		-0.0034		-0.0015*
Committee		(-0.408)		(-1.776)
Chairman		-0.0043		-0.0064***
		(-1.252)		(-2.835)
Co-opt Director		0.0005		0.0011
		(0.096)		(0.909)
Busy Director		0.0078		-0.0017
		(1.502)		(-0.925)
Foreign		0.0714		0.0261***
Director		(1.562)		(6.660)
Former		0.0015		-0.0060***
Employee		(0.301)		(-3.280)
# of		-0.0057**		0.0025***
Directorships		(-2.269)		(2.853)
Director		0.0019		0.0006*
Expertise		(1.271)		(1.653)
Tobin's Q		0.0016**		-0.0005
		(1.992)		(-1.114)
ROA		0.0040		0.0005
		(0.687)		(0.149)
Stock Return		-0.0000		-0.0008
Annual		(-0.008)		(-0.891)
Daily Return		0.0875		0.0548
Volatility		(1.114)		(1.106)
Leverage		-0.0000		0.0000**
		(-0.673)		(2.208)
Board Expertise		0.0001		-0.0000
		(0.256)		(-0.311)
Independent		-0.0056		0.0040
Ratio		(-0.627)		(0.726)
Log(Board Size)		0.0125		0.0124***
		(1.490)		(2.988)
BOSS		0.0085		0.0041
		(1.636)		(1.177)
Ln(Independent		0.0398**		0.0164
Director Age)		(1.981)		(1.395)
Constant	0.0352**	-0.1624*	0.0821***	-0.0169
	(2.067)	(-1.898)	(4.804)	(-0.297)
Fixed Effect	No	Firm+Year	No	Firm+Year
R-squared	0.001	0.081	0.000	0.029
N	41,707	12,619	227,913	153,507

Table 2.8-A4-2

Cohort Effect - Attendance of Independent Directors

	Attendance Problems			
	(I)	(II)	(III)	(IV)
Children of Depression	-0.0048*			
	(-1.681)			
War Babies		-0.0048*		
		(-1.681)		
Early Baby Boomers			0.0020*	
			(1.659)	
Mid Baby Boomer				0.0057***
				(3.636)
Log(Director	0.0012*	0.0012*	0.0011	0.0013*
Tenure)	(1.666)	(1.666)	(1.544)	(1.765)
Ownership	0.0639	0.0639	0.0673	0.0561
	(0.113)	(0.113)	(0.119)	(0.099)
Ownership	-0.4469	-0.4469	-0.4584	-0.4014
Square	(-0.140)	(-0.140)	(-0.143)	(-0.126)
Female	-0.0029***	-0.0029***	-0.0030***	-0.0034***
	(-2.679)	(-2.679)	(-2.785)	(-3.137)
Nominating	-0.0026***	-0.0026***	-0.0026***	-0.0026***
Committee	(-2.984)	(-2.984)	(-2.975)	(-2.955)
Audit	-0.0071***	-0.0071***	-0.0071***	-0.0072***
Committee	(-7.036)	(-7.036)	(-7.032)	(-7.057)
Chairman	0.0078	0.0078	0.0078	0.0077
	(1.526)	(1.526)	(1.516)	(1.511)
Compensation	-0.0041***	-0.0041***	-0.0041***	-0.0041***
Committee	(-4.007)	(-4.007)	(-4.023)	(-4.008)
Co-opt Director	0.0022	0.0022	0.0021	0.0021
	(1.390)	(1.390)	(1.354)	(1.328)
Busy Director	0.0009	0.0009	0.0009	0.0010
	(0.436)	(0.436)	(0.436)	(0.522)
Foreign	0.0177***	0.0177***	0.0177***	0.0177***
Director	(4.639)	(4.639)	(4.643)	(4.643)
Former	-0.0068	-0.0068	-0.0066	-0.0067
Employee	(-1.131)	(-1.131)	(-1.104)	(-1.116)
# of	0.0010	0.0010	0.0010	0.0010
Directorships	(1.065)	(1.065)	(1.090)	(1.066)
Director	0.0003	0.0003	0.0003	0.0004
Expertise	(0.956)	(0.956)	(0.982)	(1.159)
Constant	0.0174***	0.0174***	0.0169***	0.0164***
	(8.835)	(8.835)	(8.366)	(8.169)
Fixed Effect	Firm*Year	Firm*Year	Firm*Year	Firm*Year
R-squared	0.040	0.040	0.040	0.040
N	140,441	140,441	140,441	140,441

2.8-A5 Extended Tests on Firm Performance

Table 2.8-A5
CEO Age and Firm Performance

I use the 1996–2011 sample of Compustat/CRSP firms with available RiskMetrics corporate governance, and Execucomp data. The dependent variable is Tobin's Q. Tobin's Q is measured as the ratio of market value of assets to book value of assets. Market value of assets is defined as book value of total assets (at) plus market equity minus book equity. Market equity is defined as common shares outstanding (csho) times fiscal year closing price (prcc f). Book equity is calculated as stockholders' equity (seq) minus preferred stock liquidating value (pstkl) plus balance sheet deferred taxes (txdb). Book value of assets is total assets (at). ROA is net income divided by the lag of total assets. Cash Flow is net income plus depreciation divided by the numerator of beginning-of-year total assets. Market Leverage is total debt divided by the numerator of market equity. Age is the director's age, measured in years. Independence is an indicator variable equal to one if the director is independent. CEO Age is the age of the annual CEO. CEO Age can also be measured with age cohorts defined as CEO Age < 30, CEO Age 30-39, CEO Age 40-49, CEO Age 60-69, CEO Age 70-79, CEO Age 80-89, and CEO Age >= 90. Cash Flow is net income plus depreciation divided by the numerator of beginning-of-year total assets. Market Leverage is total debt divided by the numerator of market equity. Age is the director's age, measured in years. Independence is an indicator variable equal to one if the director is independent. Firm Size is the natural logarithm of total assets. ROA, Q, and Firm Size are measured at the beginning of the fiscal year. Entrenchment Index measures anti-shareholder charter provisions and is defined and constructed by Bebchuk et al. (2004). All other variables are defined in the Appendix Table AI. Industry and year fixed effects are included. Industries are the Fama-French (1997) 48 industry groups. All standard errors are clustered at the firm level. All regressions include a constant. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	OLS				Piecewise Regression	
	I	II	III	IV	V	VI
Retired Age	-0.172***	-0.184***				
CEO	(-2.804)	(-3.065)				
Young CEO			0.050			
			(1.148)			
CEO Age				-0.077		
30-40				(-0.867)		
CEO Age				-0.026		
40-50				(-1.619)		
CEO Age				0.003		
50-60				(0.432)		
CEO Age				-0.007		
60-70				(-0.881)		
CEO Age				-0.043**		
70-80				(-2.559)		
CEO Age				0.021		
80-90				(0.813)		
CEO Age				-0.042		
90+				(-0.666)		
CEO Age Group I					-0.035*	
					(-1.905)	
CEO Age Group II					-0.001	
					(-0.250)	
CEO Age Group III					-0.043***	
					(-3.698)	
CEO Age Group II						-0.075
Dummy						(-1.234)
CEO Age Group III						-0.381***
Dummy						(-3.673)
Constant	1.891***	2.336***	2.255***	3.453***	3.981***	2.443***
	(75.272)	(6.093)	(5.745)	(3.710)	(4.193)	(6.644)
Other Controls	N	Y	Y	Y	Y	Y
Industry Fixed Effect	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y
Adjusted R-squared	0.001	0.300	0.299	0.302	0.302	0.301
# of Observations	19,667	12,189	12,189	12,189	12,189	12,189

2.8-A6 Sudden Death Sample

2.8-A6.1 Data

To isolate the value of firm directors and executives I use death as a quasi-experiment. Death as an identification strategy is documented in a number of existing studies; Table A5-1 is a summary of published work using this empirical method. Table A5-1 illustrates that death is an established identification strategy, but also that there is substantial variation in the samples that have been used[28]. Publication dates and variation in the specific research question can partial explain the variation. A contributing factor to the heterogeneity of existing samples is the need for death data to be hand collected. Deaths are disclosed by firms through a variety of mediums and in no standard way. My initial sample contains over 1.2 million documents (observations), making manual examination challenging. To provide scalability to the search process I use a textual analysis approach. I do like a number of existing papers use keyword searches; however, I extend on this and use natural language processing techniques. This result is the development of the largest death sample, 1909 unique death (Table A5-3), spanning the longest sample period, 1900-2014 (Table A5-3), to the best of my knowledge.

2.8-A6.2 Data Sources

I identify death events from three sources: 8-K filings (1993-2014)[29], BoardEx (1999-2013), Capital IQ Key Developments (2003-2013) and the Notable Names Database (1900-2015). *8-K* filings are the primary source examined, this data sources is selected as it is a comprehensive source for firm disclosures required by the SEC for major events, including director and executive changes. I examine all electronically available 8-Ks via the Edgar database[30], as it is ideally structured for the use of computational searches, such as web scrapping and text matching techniques. A potential concern is that firms did not disclose director and executive deaths prior to 2006 because of no formal requirement to report director and executive departures. SEC requires via *Item 5.02, Departure of Directors or Principal Officers; Election of Directors; Appointment of Principal Officers*. However, despite this "Item 5.02(b) of Form 8-K does not require a registrant

[28] Table A5-1 only includes published work using US director and executive deaths. Notable work examining political deaths, for example Faccio & Parsley (2009) and non-US samples, for example, Bennedsen, Perez-Gonzales, & Wolfenzon (2012) are not included.
[29] 2014 1st Quarter
[30] The Edgar database captures all 8-K forms filed after May 6th, 1996. This represents over 1.2 million 8-K forms filed by public companies.

to report the death of a director or listed officer (April 2, 2008)"[31] Therefore, I supplement my examination with the other data sets to ensure a comprehensive search. BoardEx is used as it captures changes in board structure, including hiring and departures as well as the reason for the changes. Capital IQ Key Developments is a news analysis and filtering service which aggregates information from over 20,000 news sources including SEC filings, transcripts, investor presentations and company website. Capital IQ was selected as it is tracks director and executive changes in item 16, 101 and 102. To further extend the search I use Notable Names Database (NNDB)[32], which is a data source on people of influence, it is included as it captures information on deaths of individuals who are in positions of influence but do not receive public attention. This source is included to overcome concerns about capturing only directors and executives that receive media coverage (for example, large firms and powerful executives and directors).

To supplement and verify information on the deceased directors and officers I use a number of sources including; Marquis Who's Who, Wikipedia, Factiva, Lexis Nexis, Business Week, Bloomberg, Legacy.com, search.ancensry.com, and company websites. These sources are primarily used to verify date and cause of death.

2.8-A6.3 Identification

The initial sample of potential death events is identified by performing keyword searches across all data sources. The only requirement is that a document contains a word related to death[33] (for example, "die", "pass away" and "suicide"). This stage of the sample development is as general as possible to maximize the number of potentially relevant observations. For example, I do not include keywords related to common director and executive positions (for example, CEO of chairman) or type of death (e.g. sudden, unexpected).

Our general keyword approach results in the identification of 173,539 filings containing death related key words. By ensuring that the search process is as general as possible, results in a large number of matches, however, it is likely that many of these are not actual director and executive death events. A few examples

[31] *http://www.sec.gov/divisions/corpfin/guidance/8-kinterp.htm* (May 16, 2013 update) provides guidance of the SEC's interpretation of 8-K reporting requirements. See Section 217.04.
[32] *http://www.nndb.com/about/*. NNDB includes the deaths of "holders of certain public offices, civic, or business positions. In some cases, people of importance may have escaped public notice yet may hold a position of substantial power. Thus, I may select a member of the board of directors of a specific company for listing."
[33] The dictionary developed contains 27 words commonly associated with death.

are included to illustrate the challenge associated with using a keyword search approach in isolation. Exhibit 1: Panel A is a disclosure from an 8-K filing which does include the word “death” but is clearly not referring to an actual death of director or executive. The use of keyword searches in isolation does not consider the context of the words.

To improve identification of director and executive deaths I use two techniques, which are necessitated in the absence of uniform disclosure standards. Firstly, I use natural language techniques which allow us to consider the context of death keywords without imposing any constraints on the structure or location of death related disclosures. Secondly, I keep the filings in which the death related keywords are in 8-K *Item 5.02* and *Item 8.01*. *Item 5.02* reports director and officer departures and therefore a likely location for director or executive deaths. *Item 8.01* reports Other Events and is also found to be a common place for relevant death disclosures. When this approach is used the only requirement is that a death related keyword is contained under *Item 5.02 or 8.01*. The two search approaches complement each other, increasing the likelihood of identifying director and executive deaths. I next outline the search approaches in greater detail.

The specific natural language process techniques used are tokenization contained in the Tactful Tokenizer package (Beliankou, 2011) and named entity recognition (NER) contained in Treat package[34]. The use of these advanced natural language process techniques substantially enhances the keyword-only analysis. I now explain how each of these tools functions and interacts to improve the identification of death events. Tactful Tokenizer is a linguistic tool that splits texts into segments based on naturally occurring boundaries, such as words, sentence or paragraphs. First, using the Tokenizer *I* segment matched documents that contain a death related keyword into sentences. Second, I use NER which tags words which are the name of things, for example a person, company or title. Third, I combine these tools to measure the proximity of key words and names to identify a likely match. I require that the death related keywords are contained in a segment that also has content related to people, for example names or titles.

<Insert Exhibit A5.1>

[34] Treat and Tactful Tokenizer are Ruby Gems. The treat gem can be downloaded from https://github.com/louismullie/treat. The Tactful Tokenizer gem can be downloaded from https://github.com/zencephalon/Tactful_Tokenizer.

I begin by showing how a keyword approach functions relative to an approach that uses natural language process techniques. Exhibit 1 (A.1 and A.2) demonstrates death related keywords, in isolation, may refer to many situations observed in a firm, such as "the law *passed*", or "until their earlier *death*, resignation or removal" etc. When I combine the natural language process techniques discussed above, I are able to provide context to the death related keywords. In Exhibit 1 (B.1 and B.2) demonstrate the word "*died"* is referring individuals that have unfortunately passed. In both cases these would be identified by the NER requiring individuals' names or employee titles, for example chief executive officer or board of director. This approach identified 6,660 potential death events. Next, I manually confirm each death event by reviewing the matched document to confirm whether an actual director or executive death occurred.

The second approach considers the structure of the document and imposes a requirement that a keyword is located in a specific section, 8-K Item 5.02 and Item 8.01. Although this approach is likely to capture many of the death events identified by the natural language approach (For example B.2), I adopted the more conservative and thorough search approach. I use this approach for robustness to ensure the highest likelihood of detecting director and executive deaths. This approach identified 1,927. Again, I manually review the identified observation to confirm the death event.

I also identify directors and executives death from the BoardEx database. Death events are identified by two methods: the director's profile database and corporate news database. BoardEx is used to identify director candidates for corporations, it contains all information about the potential candidates for independent directors. If the candidates died for certain reasons, BoardEx will record this in this sub database. BoardEx also records the corporate news announcement regarding to the change of directors including the reasons (e.g. death) and this sub database provide us a good supplementary data source for death events. To the best of my knowledge, I are the first study to use BoardEx for the identification of director and executive deaths. A limitation of BoardEx, and the likely reason it is not commonly used by existing death related studies (See table 1), is that it does not provide any information relating to the cause of death. I overcome this by performing my own extensive search using Google, Factiva, Lexis Nexis, Business Week, Bloomberg, Legacy.com, search.ancensry.com and company websites to manually check the death and identify a cause death.

This final sample developed identifies 2,548 (Table) firms and 1,909 unique director deaths (Table) over the sample period 1900-2014. The majority of these deaths occur after 1998 which will form the start of the sample period for this study.

2.8-A6.4 Firm level Information

After collecting all the death related information, I collect the firm fundamental data from Compustat and stock return data from CRSP. Firm deaths not contained in Compustat are excluded from the final sample. The final sample contains 2,548 director death firm pairs.

2.8-A6.5 Director or Executive Information

Information on deceased directors and executives as well as the board and corporate governance are obtained from BoardEx, RiskMetrics, CapitalIQ (Professional) and AuditAnalytics. I match across the different databases using a name matching algorithm which is then manual checked. Table A5-3 reports the number of boards that can be matched with the Compustat sample. I use name match techniques (TFIDF and SoundEx) to match the director or executive in Risk Metrics, BoardEx, Capital IQ Professional, Capital IQ compensation and Execucomp. I collect the individual information for each director-firm pair (e.g. age, gender, tenure, committee membership, title, and outside position). I have 2,548 director-firm pair observation been identify in either Risk Metrics, BoardEx, Capital IQ Professional, Capital IQ compensation or Execucomp The final sample contains 1917 unique director and executive deaths. Table A5-3 reports the sources that these are obtained from. The number of firms is 2,559, this is greater than the number of director and executive deaths, due to multiple positions. The final sample period is 1998 to 2014[35]. Year 1998 is the first year that I can develop comprehensive information on the underlying boards.

Exhibit 2.8-A6-1

An example of text matching on company filings

The initial sample is examined for keywords related for death, for example, died, passed away and succumbed as well as words related to health conditions associated with death, for example, cancer, heart attack, life threatening. A keyword dictionary of 78 words was developed. All documents 8-K filings and the entire BoardEx database are examined for observations containing these key words. Exhibit 1(A) is an example of text matching using only keywords. Exhibit 1(B) is an example of a match identified when the text matching incorporate keyword searches, tokenization of the document and Natural Entity Recognition (NER).

Panel A: Keyword text matching

Example A5-1.A1

SEC FILE NUMBER: 030-32311

[35] 2014 Quarter 1.

SECTION APPENDIX

The law was *passed* to overturn the ruling earlier this year by the Michigan Federal District Court that the Taubman family had violated the statute by not obtaining shareholder approval for their voting shares.

Example A5-1.A2

SEC FILE NUMBER: 000-03274

SECTION 1.05 Directors and Officers.

The directors of Acquiror Sub immediately prior to the Effective Time shall be the initial directors of the Surviving Corporation, each to hold office in accordance with the Amended Articles and Amended By-Laws, and the officers of the Company immediately prior to the Effective Time shall be the initial officers of the Surviving Corporation, in each case until their respective successors are duly elected or appointed and qualified, or until their earlier *death*, resignation or removal.

Panel B: Keyword text matching, Tokenization & Named Entity Recognition

Example A5-1.B1

SEC FILE NUMBER: 001-04434

Item 1 Changes in Control of Registrant.

On November 22, 1995, **Israel Cohen**, **the Chief Executive Officer** and the **Chairman of the Board of Directors** of Registrant, *died* of complications associated with Non-Hodgkin's Lymphoma.

Example A5-1B.B2

SEC FILE NUMBER: 039-42654

Item 5.02 Departure of **Directors** or **Principal Officers**; Election of **Directors**; Appointment of **Principal Officers**. (b) **John P. Mulroney**, 68, a dedicated member of the **Board of Directors** of Alcoa Inc. since 1987, *died* suddenly on Friday, September 24, 2004.

The company is deeply saddened by **his** untimely *death* and extends its condolences to **his family** and **many friends**.

Table 2.8-A6-1

Previous using death events (Firm Level)

Reference	Sample Period	Sample Size	Data Sources
(Borokhovich, Brunarski, Donahue, & Harman, 2006)	1978-2000	161 CEO deaths	Wall Street Journal Standard and Poor's Register of Corporations, Directors and Executives SEC Disclosure Database LexisNexis
(Etebari, 1987)	1972 – 1982	110 CEO's initially identified Final sample 48 CEO sudden deaths	Wall Street Journal Index
(Falato, Kadyrzhanova, & Lel, 2013)	1988 – 2007	633 independent directors 189 CEO deaths	Factiva Lexis Nexis Edgar Online
(Fee, Hadlock, & Pierce, 2013)	1990-2007	208 CEO health and death events	Factiva
(Fracassi & Tate, 2012)	2000-2007		
(Hayes & Schaefer, 1999)	1979-1994	29 sudden CEO deaths	Lexis Nexis
(Johnson, Magee Nagarajan and Newman, 1985)	1971-1982	210 deaths of senior executives 53 sudden deaths	Wall Street Journal Index Wall Street Journal
(Nguyen & Nielsen, 2010)	1994 – 2007	772 deceased directors 229 sudden director deaths Holding 279 U.S directorships 108 independent directors	Factiva Lexis Nexis Edgar Online
(Nguyen & Nielsen, 2014)	1991-1998	520 deceased top executives Final sample 149 sudden deaths of top executives deaths	Factiva Lexis Nexis Edgar Online
(Salas, 2010)	1972-2008	195 sudden senior executive deaths 55 from Etebari et al (1987) 112 from Wall Street Journal Index 154 from Lexis Nexis	Wall Street Journal Index Etebari, 1987 Lexis Nexis
(Worrell & Davidson, 1986)	1967-1981	220 deaths initially identified 127 Key executives meeting sample criteria 61 Chairman 23 CEO's 43 CEO and Chairman	Wall Street Journal

Table 2.8-A6-2
Director Death Sample Formation

Source	Change	Sample Size
All 8-K Filings		1,203,060
Exclude the largest 3 observations	(3)	1,203,057
Identify the filings containing death related key words	(1,029,518)	173,539
Use Ruby to analyses filings containing the death key words and output a log of analysis result	(164,952)	8,587
Manually select the ones with director and executive deaths and scan the documents to extract all related information from the filings and remove duplicates death identified by two processing methods	(7,154)	1,433
Add in BoardEx Director with Death Date	12,763	14,196
Add in BoardEx news announcement table of Director and Executive deaths	472	14,668
Drop the duplicates death event and drop the death after resignation	(10,238)	4,430
Extra Deaths Observations from CIQ Key Development	352	4,782
Match CUSIP and company names from 8-K filings with CRSP and COMPUSTAT		2,550
No data in CRSP database including the observation during market close****	(328)	
Final Sample Size		2,222

Table 2.8-A6-3

Source of Director and Executive Deaths

This table reports the source distribution of unique director level director and executive deaths. If a death is detected by multiple sources, then only one source will be counted.

Source	Frequency	Percent (%)	Cum (%)
8-K	725	37.98	37.98
BoardEx	998	52.28	90.26
NNDB and Other Sources	186	9.74	100
Total	1,909	100	

Table 2.8-A6-4

Death Distribution by Years

Panel A: Independent Director Deaths

Year	Frequency	Percent	Cum
Before 1998	89	4.64	4.64
1998	16	0.83	5.48
1999	14	0.73	6.21
2000	31	1.62	7.82
2001	61	3.18	11.01
2002	77	4.02	15.02
2003	86	4.49	19.51
2004	125	6.52	26.03
2005	146	7.62	33.65
2006	149	7.77	41.42
2007	167	8.71	50.13
2008	174	9.08	59.21
2009	158	8.24	67.45
2010	143	7.46	74.91
2011	140	7.3	82.21
2012	124	6.47	88.68
2013	145	7.56	96.24
2014	72	3.76	100
Total	1,917	100	

Panel B: Director Deaths

Year	Frequency	Percent	Cum
Before 1998	101	4	3.95
1998	16	0.63	4.57
1999	14	0.55	5.12
2000	34	1.33	6.45
2001	65	2.54	8.99
2002	85	3.32	12.31
2003	108	4.22	16.53
2004	160	6.25	22.78
2005	240	9.38	32.16
2006	203	7.93	40.09
2007	229	8.95	49.04
2008	225	8.79	57.84
2009	204	7.97	65.81
2010	223	8.71	74.52
2011	191	7.46	81.99
2012	163	6.37	88.35
2013	200	7.82	96.17
2014	98	3.83	100
Total	2,559	100	

Table 2.8-A6-5

Firm Level Information

Panel A: Corporate Governance Variables

Variables	N	Mean	SD	25 percentile	Median	75 percentile
Average Age of the Board (Y ears)	*2,079*	61.47	4.56	58.67	61.40	64.25
Board Female	*2,142*	0.10	0.10	0	0.09	0.15
Average Board Tenure	*2,078*	8.94	4.60	5.62	8.31	11.50
CEO-Chairman Duality	*2,148*	0.61	0.49	0	1	1
Board Size	*2,148*	9.03	3.07	7	9	11
Independence Ratio	*2,148*	0.73	0.16	0.636	0.750	0.857
Average Number of Outside Positions	*2,079*	4.43	6.83	0	0.56	7.50

Panel B: Corporate Fundamental Variables

Variables	N	Mean	SD	25 percentile	Median	75 percentile
Total Assets ($ mil)	*2,192*	26346.78	171774.60	206.24	1154.16	4816.65
Market Capitalization ($ mil)	*2,170*	8473.93	29694.54	114.90	686.35	3202.30
Tobin's Q	*2,170*	1.98	3.98	1.06	1.30	1.89
ROA	*2,133*	0.02	0.68	0.02	0.09	0.16
Sale	*2,192*	6687.68	24590.22	82.45	535.19	3010.99
Cash Flow	*2,135*	0.01	0.50	0.01	0.06	0.12
Earnings Volatility	*2,133*	0.02	0.68	0.02	0.09	0.16
Research and Development	*2,192*	143.32	781.51	0.00	0.00	5.67
Capital Expenditure	*2,114*	0.22	2.83	0.01	0.03	0.06
Long-Term Leverage	*2,188*	0.18	0.23	0.01	0.12	0.28
Leverage	*2,187*	0.26	0.67	0.04	0.18	0.34

Table 2.8-A6-6
Director Level Information

Variables	N	Mean	SD	25 Percentile	Median	75 Percentile
Director Age (Years)	*1,900*	69.27	10.11	63	69	76
Director Time to Retirement (Years)	*1,854*	-0.44	10.09	-7.2	-0.2	5.8
Director Female (%)	*2,045*	0.05	0.21	0	0	0
Director Tenure (Years)	*1,897*	13.17	11.83	4.5	9.9	18.1
Director-CEO	*2,075*	0.06	0.24	0	0	0
Director-Executive	*2,075*	0.14	0.34	0	0	0
Director-Independent	*2,075*	0.62	0.49	0	1	1
Director Network Size	*2,005*	12.52	135.26	0	0	0
Insider Promotion to Board	*2,045*	0.07	0.26	0	0	0
# Outside Positions Per Director	*2,075*	2.48	2.33	1	2	3
# Directorships Per Director	*2,075*	1.54	1.30	1	1	2
Director Audit Committee	*2,075*	0.38	0.49	0	0	1
Director Compensation Committee	*2,075*	0.41	0.49	0	0	1
Director Nomination Committee	*2,075*	0.33	0.47	0	0	1

Table 2.8-A6-7
Outside Positions

Positions Held	Frequency	Percent	Cum.
1	1,574	82.11	82.11
2	210	10.95	93.06
3	63	3.29	96.35
4	31	1.62	97.97
5	24	1.25	99.22
More than 5	15	0.78	100
Total	1,917	100	

Table 2.8-A6-8
Causes of Death

Reason	Freq.	Percent	Cum.
Accident	50	3.69	3.69
Brain tumor	8	0.59	4.28
Cancer	364	26.84	31.12
Complications from medical condition	48	3.54	34.66
Dementia	12	0.88	35.55
Heart failure	151	11.14	46.68
Murder	2	0.15	46.83
Natural causes	43	3.17	50
Pneumonia	25	1.84	51.84
Prescription overdose	1	0.07	51.92
Respiratory related	25	1.84	53.76
Stroke	13	0.96	54.72
Suicide	14	1.03	55.75
Surgery related complications	17	1.25	57.01
Undisclosed	583	42.99	100
Total	1,356	100	

2.8-A7 Change of Corporate Bylaw or Charter regarding Mandatory Retirement Rule

First, I use PosgreSQL to sort out the 8-K filings with the key works “mandatory retirement age”, “director” and “board”.

Second, I further pick up the filings with change of mandatory retirement rule manually. Than I have a sample of 161 firm-year observations which change mandatory retirement rule of firm. I divide the sample into two categories: the ones increasing the mandatory retirement age or relaxing the mandatory retirement rule and the ones decreasing the mandatory retirement age or adding the mandatory retirement rule.

Table 2.8-A7-1

Sample of 8-K Filings with Increasing the Mandatory Retirement Age

8-K Filings	**Change**	**Sample Size**
All 8-K Filings		1,203,060
Exclude the largest 3 observations	(3)	1,203,057
Contains Key Words: "mandatory retirement age", "director" and "board"	(1,202,276)	781
Change of mandatory retirement rule	(620)	161
Matching CUSIP and company names from 8-K filings with CRSP	(21)	140
Increasing the mandatory retirement age or relaxing the mandatory retirement rule	(5)	87
No data in CRSP database	(3)	82
Exclude the observation during market close	(3)	79
Final Sample Size		79

Table 2.8-A7-2

Sample of 8-K Filings with Decreasing the Mandatory Retirement Age

8-K Filings	Change	Sample Size
All 8-K Filings		1,203,060
Exclude the largest 3 observations	(3)	1,203,057
Contains Key Words: "mandatory retirement age", "director" and "board"	(1,202,276)	781
Change of mandatory retirement rule	(620)	161
Matching CUSIP and company names from 8-K filings with CRSP	(21)	140
Decreasing the mandatory retirement age or adding the mandatory retirement rule	(87)	53
No data in CRSP database	(2)	52
Exclude the observation during market close	(1)	50
Final Sample Size		49

Chapter 3

The Value of CEO Succession Plans: Learning about CEO Candidates and Stock Return Volatility

Abstract[36]

This chapter investigates the value of CEO succession planning. I explore the effects of CEO succession plans on firm performance. I find firms with succession plans have lower volatility around CEO turnover events, are able to appoint successors in a timelier manner with exogenous CEO departures, and have better performance following turnover events. The CEO succession planning creates more value in firms where CEO talent is a key risk factor. To isolate the effects of CEO succession planning, I use CEO death events as a natural experiment to randomly force firms to reveal their succession plans and to address the endogeneity problems. Overall, these results provide direct evidence that CEO succession planning is an important part of a board's monitoring function and highlights the importance of corporate governance mechanism in creating value.

[36] I would like to thank Renée Adams, Ronald Masulis, Warwick Schneller, Robert Tumarkin and Jin Yu for helpful comments and suggestions.

3.1 Introduction

What is the value of a CEO succession plan? Firms today operate in a business environment in which CEO tenure has declined nearly 40 percent since 1992. Directors face more frequent CEO turnover events and the challenges of how to navigate the transition from one firm leader to another. The Securities and Exchange Commission (SEC) asserts that, "One of the board's key functions is to provide succession planning so that the company is not adversely affected due to a vacancy in leadership" (SEC 2009). However, on average, boards dedicate only one hour per year to CEO succession planning (Larcker and Saslow, 2014).

Missing CEO succession planning can have significant economic ramifications for firm performance. For example, the CEO of Twitter, Dick Costolo announced his resignation on June 11, 2015 without a successor announcement until October 5, 2015. During this period, the stock price of Twitters declined 21 percent. "We are stunned that we have now passed over 100 days since the announcement of the former CEO's resignation," wrote technology analyst Robert Peck, "Feedback we hear from investors is that the process has taken too long." (Forbes Magazine, September 21, 2015). Not surprisingly, the announcement of a CEO successor leads to a 7% rise of the stock price. Moreover, succession plans can also have positive implications for firm performance. McDonalds had two CEOs who died within nine months. However, the capability of McDonalds to implement its succession plan gives "immediate reassurance to employees, franchisees and investors…" (Wall Street Journal, April 20, 2004).

If CEO succession planning is an important issue in corporate governance and the responsibility of the board (Vancil, 1987), then why do lapses occur? Variations in the incentives of the directors and the CEO, based on principle-agent theory (Jensen and Meckling, 1976; Fama, 1980), affect the likelihood of a firm having an implementable succession plan. For example, incumbent CEOs seeking to increase of their bargaining power have private incentives to dissuade the board from developing a succession plan. Under the Hermalin and Weisbach (1988) model, a succession plan is analogous to a board preparing a pool of potential replacements or candidates. CEOs seeking to increase their bargaining power have an incentive to discourage the board from examining internal and external labor markets for potential candidates.

The key research question of this paper is how firms with or without CEO succession plans are affected by CEO turnover events. CEO turnover research generally examines either the factors affecting the likelihood of CEO turnover (e.g. Eisfeldt and Kuhnen, 2013; Guo and Masulis, 2015; Jenter and Kanaan, 2015), or the impacts of CEO turnover on firm performance (e.g. Denis and Denis, 1995; Weisbach, 1995; Huson, Malatesta, and Parrino, 2004; Fee, Hadlock, and Pierce, 2013). The CEO turnover literature has implicitly assumed that the effects of succession planning on the firm are subsumed by either the incumbent CEO or the successor. I believe that I offer a more complete view of the turnover process and the value of CEO succession planning.[37]

Estimating the effects of CEO succession plans faces both identification and selection issues. Identification challenges occur because firms are not legally required to disclose succession plan details.[38] Firms that do disclose succession plan information may differ from firms that do not. Similarly, since most CEO turnover events are endogenous, examining all turnover events may induce self-selection and reverse causality problems, which can lead to biased results. In this paper, I use a natural experiment, namely CEO death that causes sudden and unexpected CEO departures and forces firms to reveal information about their succession plans. I hand-collect CEO sudden deaths sample. This empirical strategy to catch exogenous shock is originally employed by Johnson, Magee, Nagarajan, and Newman (1985) and become popular with more recently publications in the corporate governance literature (e.g. Fee, Hadlock, and Pierce, 2013; Pan, Wang, and Weisbach, 2015). An attractive feature of this identification strategy is that it rules out

[37] Naveen (2006) and (Mobbs and Raheja 2012) examine succession planning from an alternate perspective to this paper. Naveen (2006) examines how the complexity of the firm affects the likelihood of an internal successor. Mobbs and Raheja (2012) study the structure of the internal labor market.

[38] During 2008 – 2012, there were 32 shareholder sponsored proposals for information relating to firm succession plans. The management teams always recommend "Against" and all proposals failed to achieve sufficient support. Please see Appendix Table A1-2 for more detailed information. However, some of firms adopt CEO succession plans after successive shareholder proposals without the majority voting results.

reverse causality, that is, the succession plans leading to deaths. Notably, I extend on the current approaches by scraping all 8-K filings and collecting information on firms' succession processes, such as the transition period duration, interim successor, external or internal successor as well as whether the firms indicates ex-ante whether they have a succession plan. Consequently, I can confidently draw causal conclusions about the impact of succession plans. Furthermore, this identification approach is more robust than the methods used in the previous literature which infers the existence of succession plans or potential candidates by using proxies such as number of executive titles. The use of these proxies in isolation creates measurement error as one-third of the heirs apparent leave firms prior to CEO turnover events (Shen and Cannella, 2003) and also restricts succession planning to the internal labor market only.

I provide evidence that succession planning has positive firm value effects around CEO turnover events. The first channel that I examine is resolving uncertainty and reducing firm risk. Consistent with Pan, Wang, and Weisbach (2015), I observe an increase in idiosyncratic volatility around CEO turnover events. Dividing the sample into firms with and without succession plans, I find a statistically and economically significant difference in firm risk measured by idiosyncratic volatility, option-implied volatility and realized stock return volatility. Firms with evidence of succession plans exhitbit a 25% lower level of idiosyncratic volatility in the transition period surrounding the departure of the incumbent CEO. This finding is consistent with theories showing that it is optimal to resolve uncertainty sooner (Song Shin, 2003; Song Shin, 2006) and that succession planning reduces uncertainty around CEO turnover events. The empirical results indicate that firms with succession plans can signal their capability to smooth the impact of CEO turnover events on the firms. These findings are robust to deaths sample and alternate measures of volatility and CEO succession planning.

To verify the hypothesis that succession planning allows firms to smooth the turnover process, I examine the stock price reaction to the unexpected loss of CEOs. The underlying assumption is that the stock price reaction towards a CEO death should reflect not only the loss of CEO talent, but also expectations about the quality of the successor CEO and the search time to find a replacement CEO. Differing from earlier research regarding this aspect, I control the confounding factors relating to the succession. In the empirical analysis, with the exogenous CEO sudden death sample, I find a positive association between the abnormal returns surrounding the departure of CEOs and firms that exhibit evidence of succession plans across different measures. I provide evidence that firms with succession plans experience a more positive price impact following the exogenous loss of the CEO.

Furthermore, I examine whether succession planning has effects beyond the immediate turnover period. First, I analyze the long-term effects of succession planning to examine whether firms falsely signal that they have CEO succession plans. In the short run, investor may not be able to detect misreporting of CEO succession planning. However, as time progresses, this information asymmetry should diminish (Pan, Wang, and Weisbach, 2015) as investors learn about a firm's true state of succession planning and quality of successor CEOs. I observe that firms with succession plans exhibit superior firm performance on time horizons of up to 12 months. This provides evidence that on average, firms do not engage in false succession planning signals. Second, I investigate how the search time for a successor affects the firm value and find a negative relationship between firm performance and search time. Moreover, the size of the negative effect increases as the search time increases. This result is consistent with Bennedsen, Pérez-González, and Wolfenzon (2012) that the longer absence of the CEO will result in more negative impact on firm performance.

The combined results provide important evidence of the effects and value of CEO succession planning. To date, research directly examining CEO succession planning has been limited. The rest of the paper is organized as follows. Section 2 discusses the related literature and hypothesis development. Section 3 develops the empirical strategy and data collection methods. Section 4 discusses the results of the paper. Section 5 presents additional tests and robustness checks. Section 6 concludes.

3.2 Literature Review and Hypothesis Development

For CEO succession planning to be an important part of the boards monitoring function requires that CEO succession planning be of economic importance to the firm. The main research question that this paper is to examine how firms with or without CEO succession plans are affected by CEO turnover events. The following section reviews the previous literature and provides a link between the CEO succession plan and its effect on firm value.

A key function that is ascribed to the board is the selection, monitoring and retention (or dismissal) of the CEO (Weisbach, 1995; Adams, Hermalin, and Weisbach, 2010; Jenter and Kanaan, 2015). Vancil's (1987) seminal work highlights that CEO succession planning forms part of the board's monitoring function, allowing firms to prepare in advance for CEO turnover events. Existing studies examining CEO turnover events have investigated on either factors affecting the likelihood of a CEO turnover (Bushman, Dai, and Wang, 2010; Hazarika, Karpoff, and Nahata, 2012; Coles, Daniel, and Naveen, 2014; Guo and Masulis, 2015), or consequences of a turnover event on firms (Murphy and Zimmerman, 1993; Parrino, 1997; Huson, Malatesta, and Parrino, 2004; Pan, Wang, and Weisbach, 2015). However, earlier studies have neglected to consider how CEO succession plans affect firms around CEO turnover events. The CEO turnover literature has implicitly assumed that the effects of succession planning on firms are subsumed by either the incumbent CEOs or their successors.

A CEO succession plan is a set of guidelines for the board to manage a turnover event and to appoint a new CEO (Vancil, 1987). It is the process by which the board ensures that the firm has the optimal CEO overtime and a smooth transition from one leader to another. For the CEO selection process to function efficiently, the skills of available talents in the CEO labor market must match the demands of firms. Succession planning is a corporate governance mechanism to improve the efficiency of the matching process. CEO selection models pay varying degrees of attention to how a successor is selected. For example, in the Hermalin and Weisbach (1998) model, the board selects the replacement CEO from a pool of candidates. The model does not explicitly detail the mechanism for how this pool is developed; however, it is akin to the board preparing a succession plan.

More recent theoretical work by Goel and Thakor (2008) models the CEO selection process and includes a mechanism for the board to acquire information about potential successors. In an environment in where managers' ability is initially unknown and is learned overtime, the board replaces the incumbent CEO by following a "rational ability filtering process". The board learns about potential successors by observing them and then selects the manager with the "highest perceived ability". This filtering process by the board is the equivalent of CEO succession planning. The learning process by shareholders has been confirmed with the empirical evidence provided in Pan, Wang, and Weisbach (2015).

An implicit assumption of these CEO selection models is that the board is undertaking this ongoing monitoring and learning process which results in a succession plan. In the absence of a succession plan, the board of the firm will begin the learning and evaluation process for a CEO successor from the beginning. Based on this proposition, if a firm has a CEO succession plan, ceteris paribus, it will have the ability to improve the CEO selection process and make the transition to the CEO successor more efficient.

3.2.1 CEO Succession Plans and Stock Return Volatility

Next, I consider how succession plans affect firm volatility and firm value. I focus on the effects of succession plans around CEO turnover events because succession plans form part of the “board’s role in the oversight of a company’s management of risk” (SEC 2009). Because succession plans play an important role in the transition from one firm leader to his (or her) successor, I focus on how succession plans affect firms during CEO turnover events.

Earlier studies have documented a positive relationship between CEO turnover events and stock return volatility (e.g. Rosenberg, Clayton, and Hartzell, 2003; Taylor, 2013; Pan, Wang, and Weisbach, 2015). The channel that links CEO turnover events and stock volatility is uncertainty about the ability of the successors. Pan, Wang and Weisbach’s (2015) recent empirical and theoretical work demonstrates that under a learning model, volatility is the highest when uncertainty about the CEO’s ability is the greatest. Volatility declines as learning about the successor’s ability occurs. Therefore, if the board is monitoring and learning about the pool of potential CEO replacements consistently prior to turnover events, volatility during the turnover events should be lower during the turnover events, ceteris paribus. Under Hermalin and Weisback (1998) learning framework, firms that monitor the replacement pool consistently, will observe more precise signals regarding the abilities of CEO candidates than boards that do not, as it is an increasing function of the monitoring.

A lack of a succession plan means that a firm does not have a developed process to follow or a set of viable candidates to turn to and must start the evaluation process from scratch. In this case, the period of time taken to resolve the uncertainty regarding the appointing of the CEO successor can be longer. Song Shin (2003; 2006) links resolution of uncertainty and firm volatility theoretically and proves that firm volatility increases with time taken to resolve uncertainty. In the context of succession plans, the absence of a feasible successor creates uncertainty. A longer search process for CEO candidates leads to a greater impact on stock volatility. The first order impact is that the succession plans mitigate the firm risk directly, since the succession plan helps the firm smooth the turnover process. The second order impact is that a valid succession plan can help a firm find a new CEO more quickly; the appointment of the new CEO reduces the uncertainty for future firm performance. Firms with succession plans will have lower stock return volatility surrounding CEO turnovers and the stock volatility increases with the longer the succession process.

An important consideration is how shareholders learn about a board's succession planning effort. Shareholders learn about the board's succession plan activities via firm disclosures prior to CEO turnover events, as well as by observing firm behavior around the turnover event. For example, market participants can learn about firm succession plans from company filings (SEC 2009) and the gaps between a turnover announcement and a successor announcement. Moreover, this conjecture does not require the assumptions about the speed of learning by a board or the ability of the CEO successor (Pan, Wang, and Weisbach, 2015) .

An alternative explanation for the lower stock volatility for firms with succession plans around CEO turnover events than those without them is that succession plans act as insurance for shareholders.

This leads to the papers' first hypothesis:

H1.1 Firms with succession plans have lower volatility surrounding CEO turnover events.

3.2.2 CEO Succession Plans and Firm Value

Observing the skills of a potential CEO successor requires the board to process a noisy signal (Campbell, 2014; Eisfeldt and Papanikolaou, 2013). The board learns about candidates by observing imprecise measures of skills to infer their true abilities. Hermalin's (2005) CEO selection model views the choice of selecting a successor as an exchange traded option. Under this interpretation, the less that is known about the potential successor the more valuable the option becomes. For example, external candidates will have higher option values, due to the higher uncertainty about ability. A board that engages in succession planning consistently monitors a pool of potential CEO replacements. This monitoring effort helps reveal the true ability of potential replacements after observing the noisy signals. Succession planning is an ongoing monitoring process. As the duration of the planning process increases, the precision of the signals regarding candidates' abilities increases. This increases precision will result in better matching of labor market talents with the skill needs of firms' during CEO turnover events.

An important implication of the above proposition is that regardless of the reasons for the turnover event -- e.g. whether it is forced, voluntary or exogenously occurring -- firms that have succession plans have more precise signals of potential CEO abilities and therefore conduct improved CEO candidate selection.

In addition, prior research shows that firm performance is affected by the CEO's actions (e.g. Kim, 1996; Huson, Malatesta, and Parrino, 2004). Therefore, following a CEO turnover event and in the absence of a successor, the firm will not benefit from any CEO labor contribution. Using CEO hospitalization events, Bennedsen, Pérez-González, and Wolfenzon (2012) find that longer CEO absences lead to more negative impacts on firm performance, including on profitability, revenue and investments. Succession plans allow firms to prepare in advance for CEO turnover events, thereby shortening the search time and the length of the transition period. This finding provides a direct link between succession plans and firm value: succession planning helps prevent and mitigate the damage to firm value from the absence of CEO talent. An alternative explanation is that a succession plan creates value for the firm by reducing the uncertainty during the turnover period. Song Shin (2003; 2006) shows that when a firm faces uncertainty, an early resolution is optimal to reduce volatility. As the uncertainty remains unresolved, the firm volatility increases. And, this uncertainty about the future CEO is detrimental to firm value.

This leads to the second hypothesis:

H1.2 Firm performance is positively affected following a turnover event if a succession plan is present.

Given capital market efficiency, the price reaction following a turnover event should reflect the expectation about the quality of the successor and time needed to find a replacement CEO, in addition to the loss of human capital. A number of papers have examined stock price reactions following the loss of executives, including the CEO (Johnson, Magee, Nagarajan, and Newman, 1985; Salas, 2010; Nguyen and Nielsen, 2014). Shareholder wealth effects following the loss of a CEO will depend on confounding events, the loss of the incumbent CEO's talent and the perceived challenge in finding a replacement. Firms with succession plans are expected to have a better and larger skilled CEO candidate pool to choose from, ceteris paribus.

The value of a succession plan will be reflected in common stock price responses when a turnover event occurs. Firms with CEO succession plans are able to appoint a replacement better matching the skills demanded by firms than firms without CEO succession plans (Marcel, Cowen, and Ballinger, 2013). This positive effect will be reflected in the share price responses towards CEO turnover announcements.

This results in the third hypothesis:
H1.3 Shareholders react more positively to CEO turnover announcements in firms with succession plans.

3.3 Data and Empirical Design

I start this section by describing my sample construction and variable calculation methods, including different succession plan measures. Then, I describe the experimental design, matching estimator and fixed effects model.

3.3.1 Data Collection and Sample Formation

3.3.1.1 S&P 1500 CEO Turnover Sample

First, I collect CEO turnover events identified by ExecuComp from 1992 to 2014. Table I reports the summary statistics on CEOs, boards and firm attributes during CEO turnover events. Year 1998 is the first year for which I can achieve comprehensive information about the underlying boards due to the RiskMetrics Database coverage of the board information. The initial sample contains 4,728 unique CEO turnover events.

<Insert Table I here.>

3.3.1.2 CEO Sudden Deaths Sample

To isolate the effects of CEO succession plans, I use death events as a natural experiment to force firms to disclose more information about their succession plan. The use of death as an exogenous shock is documented in a number of existing corporate governance studies (Johnson, Magee, Nagarajan, and Newman, 1985; Nguyen and Nielsen, 2010; Falato, Kadyrzhanova, and Lel, 2014; Pan, Wang, and Weisbach, 2015). As the penal regression results presented so far cannot rule out the reverse causality and confounding factors. A firm may prepare a CEO succession plan in advance for CEO turnover. Therefore, the succession plan leads to the CEO turnover. Also, firms with CEO succession plans can be systematically different from the firm without secession plans. For example, the firms with succession plans are better at corporate long-term strategy management and may plan for the CEO turnover events for a long time. To address these concerns, I run the same model specification but on the sample of CEO turnover events that are induced by an exogenous shock, CEO deaths. Appendix A.3 explains in detail the development of the previous studies with death sample and the keyword matching and natural language processing tools used in this study. Through an extensive search of over 1.2 million documents of 8-K and 10-K filings I am able to identify 151 sudden CEO death events. Table II reports summary statistics on sudden CEO deaths.

<Insert Table II here.>

After collecting CEO death related information such as date and cause of death[39], I merge the death data with firm fundamental data from Compustat and stock return data from CRSP. The foundation information of firms incurring CEO deaths not contained in Compustat are excluded from the final sample. I follow Almeida, Campello, Laranjeira, and Weisbenner (2009) to clean the Compustat fundamental data, dropping firms with missing or negative values for total assets (at), capital expenditures (capx), property, plant and equipment (ppent), cash holdings (che), or sales (sale). I also drop the firms with cash holdings, capital expenditures or property, plant and equipment larger than total assets.

Information on the deceased CEOs, board of directors and corporate governance is obtained from ExecuComp, BoardEx, RiskMetrics, Capital IQ (Professional) and Audit Analytics. I match across the different databases using an advanced name matching-algorithm following a manual check[40]. I use name match techniques (TFIDF and SoundEx) to match the CEO in ExecuComp, RiskMetrics, BoardEx, Capital IQ Professional and Capital IQ compensation. I collect individual information for each CEO-firm pair (e.g. age, gender, tenure, committee membership, title, and outside position). For the missing values or potential error observations (outliers or different age records for the same CEO among different databases), I manually correct more than 38 observations. Approximately 10% of the CEO or executive observations in ExecuComp do not include age information. I have manually searched for these observations from different public sources.

3.3.1.3 Panel Data Structure Sample

The last sample that I use is the panel data of all S&P 1500 firms from 1996 to 2014. This data set includes all S&P 1500 firms with available information in RiskMetrics, Boardex, Compustat

[39] For a detailed explanation see Appendix A.3
[40] Special thanks to Dr. Robert Tumarkin for providing us the comprehensive code to process the name matching.

and CRSP. I follow a similar process as above and collect CEO, board and firm information from Execucomp, BoardEx, RiskMetrics, Capital IQ (Professional) and AuditAnalytics.

<Insert Table III here.>

3.3.2 Variable Construction and Summary of Statistics

3.3.2.1 Proxies for Succession Planning

Identifying whether or not a firm has a CEO succession plan is empirically challenging for three reasons. First, a legal requirement to disclose detailed information about CEO succession plans[41] is absence. Second, boards have an incentive not to reveal CEO succession plans. Revealing CEO succession plan information impacts on the incentives for firm members' efforts (Fama and Jensen, 1983), the likelihood of remaining in the firm and the willingness to acquire firm specific knowledge (Acharya, Myers, and Rajan, 2011). In addition, the CEO succession plans can have external effects including signaling high quality labor and prompting competitors to induce "successors" to move firms (Shen and Cannella, 2003).

Owing to these challengers in identifying CEO succession plans, one approach is to proxy for CEO succession plans by identifying an heir apparent by executive job titles, such as COO or president. This identification strategy has frequently been used in the management succession literature (e.g. Shen and Cannella, 2003; Zhang, 2006) and to some extent in finance (Naveen, 2006). A major weakness of this approach is that nearly one-third of heirs apparent leave firms prior to promotion to CEO (Shen and Cannella, 2003) . In addition, under tournament theory, multiple managers or COOs compete for promotion to CEO (Mobbs and Raheja, 2012), thus diminishing the validity of an heir apparent proxy based only on title.

[41] 100 percent (32) of shareholder proposals seeking succession planning disclosure information between 2008 – 2013 failed to pass. See Appendix Table A1-2

In this paper, I use five measures to identify CEO succession plans. The first measure of CEO succession planning is *Succession Planning Mentioned in Proxy Statement*, which is measured by whether or not the firm discusses succession planning in SEC proxy filings (DEF 14A). Figure I reports the number of firms that discuss succession planning in their proxy statements from 1994 to 2013. The use of ex-ante proxy statement disclosures identifies firms that disclose the presence of succession plans prior to turnover events. I observe that the proportion of firms that discuss succession planning in their proxy statements has increased significantly in last 10 years, between 1994 and 2013, from 5% to 39%. The proxy statement succession plan dummy is created by using computer code to scan for key words related to succession planning in SEC proxy filings.

<Insert Figure I here.>

The second measure of CEO succession planning is *Revealed Succession Planning in News Release*. This proxy is constructed by examining firm announcements relating to CEO turnovers. I identify the references, in firm filings and news articles, for succession planning related key words. For the CEO death sample, both the death announcements and successor announcements are examined.

The third measure of CEO succession planning is *CEO Appointments within 3 Days following a Death Event*. To proxy for whether a firm has a CEO succession plan, I examine the firm's ability of the firm to name a CEO successor following the death of the incumbent. Vancil (1987) observes that a succession plan identifies viable candidates in advance of CEO turnover. I argue that the capability of a board to appoint a CEO successor in a short time period following a death event is evidence of a succession plan existing ex-ante a CEO turnover event. A firm with a succession plan will be able to appoint a successor in a shorter amount of time than a firm without a succession plan, ceteris paribus. For empirical tests, I select a 3-day announcement window. Figure II shows that nearly 80 percent of CEO successor announcements are made within 3 days. In unreported results, different windows are examined including 1-day, 2-day and 6-day windows, and the results remain consistent. To create this dummy variable, I determine the time between the earliest record of death and when a firm appoints a CEO successor.

<Insert Figure II here.>

The fourth measure of CEO succession planning is *Directors with Succession Planning Experience*. A dummy variable equals to one if the director is on the nominating committees of the firm and there is a reference to their succession planning experience, and zero otherwise. I am currently collecting data for this proxy. The fifth measure of CEO succession planning is *Directors with CEO Turnover Experience*. The dummy variable equals to one if the director has CEO turnover experience outside the firm prior to their appointment, and zero otherwise.

3.3.2.2 Measures of Firm Risk

To proxy for the risk of the firm, I use four volatility measures: idiosyncratic volatility, stock return volatility, implied volatility and risk of delisting, following Pan, Wang, and Weisbach (2015). I calculate the volatility surround the announcements of CEO deaths and CEO successors in sudden death sample, as well as the announcements of the resignations of incumbent CEOs and the nominations of new CEOs in S&P 1500 full sample. The idiosyncratic volatility is estimated by the standard deviation of the daily stock return residual of the market model following Ang, Hodrick, Xing, and Zhang (2006)[42]. The realized stock return volatility is the volatility of the daily stock returns during the turnover or death events. To estimate short term option implied volatility, I use the volatility calculated based on the daily prices of options written on the firm's common stock. For the long-term option implied volatility, I form an implied volatility curve to calculate the implied vitalities over different time periods. The data of option prices is obtained

[42] I extend this estimation to use the Fama-French three-factor model, and the results are similar. The literature shows very similar results using these two specifications.

from OptionMetrics from 1996-2014. The risk of delisting is a dummy variable equals to one if the firm is delisted within one year after the departure of the incumbent CEO, and zero otherwise.

3.3.2.3 Measures of Firm Performance

I use return on asset (ROA) as the accounting measure of firm performance. For event study, I use short-term cumulative abnormal returns (CARs) and long-term buy-and-hold abnormal returns (BHARs)[43].

3.3.2.4 Controls

In the regression specification, the following explanatory controls are included. Firm size is measured by Total Assets. It has been observed that the size of the organization can affect the succession process (Parrino, 1997; Naveen, 2006). Board independence is captured by the Independent Director Ratio. Guo and Masulis (2015) document a positive relationship between board independence and CEO turnover. I also follow Coles, Daniel, and Naveen (2008; 2014[44]) to control for board size and female director ratio in addition to CEO power and entrenchment measures such as CEO-founder, CEO-duality, CEO tenure and CEO age. Owing to the documented relationship between CEO turnover and firm performance, I also include ROA (Huson, Malatesta, and Parrino, 2004; Jenter and Kanaan, 2015). Most of these control variables are used in prior CEO turnover studies.

3.3.3 Empirical Strategy

For this research, I use three major empirical models to test my hypotheses. First, I use event studies for both the regular CEO turnover events for S&P1500 firms and CEO death events for US-listed firms. I further use fixed-effect models in different specifications to exploit the different stock reactions to both cross-section and cross-time for firms with and without CEO succession

---

[43] Detailed explanation about the event study procedures please refer to the appendix.
[44] I would like to thanks Coles, Daniel and Naveen for providing the code to clean the RiskMetrics director database.

plan, controlling for incumbent CEO characteristics and firm-level attributes. Second, I use panel regression to identify the reasons and timing of firm adopting CEO succession plan. I use lag of independent variables to avoid reverse causality, though this process may compromise the strict endogeneity assumption for panel regression. Finally, I use bias-corrected matching estimator following Abadie and Imbens (2006) to find more appropriate matched control firms so that I can more accurately estimate the causal effects of CEO succession plans on firm risks as a robustness test.

3.4 Empirical Results

3.4.1 Succession Planning and Stock Return Volatility

In this section, I examine the effects of CEO succession plans on firm stock volatility surrounding CEO turnover events. I begin with the S&P 1500 CEO turnover sample. Figure III compares the changes in idiosyncratic volatility surrounding CEO turnover between firms with and without succession plans, as measured by ex-ante proxy statement disclosures. On average, firms without CEO succession plans have higher idiosyncratic volatility during CEO turnover events. I observe that for the S&P 1500 firms turnover sample, the average difference in idiosyncratic volatility increases by 81.25% (0.32% to 0.58%) during turnover periods comparing to the period prior to the turnover event (-30, -1). Following the CEO turnover events, it takes 30 trading days for the difference in idiosyncratic volatility between firms with and without succession plans to return to the level observed prior to the turnover. Figure IV uses the backward-looking historical return volatility and forward-looking implied volatility to show the similar trend of difference between firms with and firms CEO succession plans during CEO turnover.

<Insert Figure III here.>

<Insert Figure IV here.>

To further test the effects of CEO succession plans on firm volatility, I estimate the effects on idiosyncratic volatility for different event windows for the S&P 1500 CEO turnover sample. In Table IV, the dependent variable is the idiosyncratic volatility, which I estimate following Ang, Hodrick, Xing, and Zhang (2006). The key independent variable is an indicator for firms that discuss succession planning in proxy statement filings prior to the CEO turnover events. In all models list in Table IV, the coefficients on the succession planning measures are negative. This is consistent with the hypothesis that firms with succession plans have lower stock return volatility surrounding CEO turnover. Model I estimates the relationship in the period immediately prior to the turnover event (-20,-5). I find that the succession planning variable is negative and significant at the 1% level. This significant result confirms there is information leakage before the regular CEO turnover and most of the CEO turnover is scheduled due to the end of term limit in employment contracts or the mandatory retirement policy in corporate bylaws. Model II to IV examine the period immediately surrounding the CEO turnover event (-1,+10), I find negative and significant results (between the 5% and 1% statistical significant levels) for the succession planning variable, which are robust to the inclusion of industry or firm fixed effects.

<Insert Table IV here.>

Next, I examine how succession plans affect idiosyncratic volatility at longer time horizons. This is performed to provide preliminary evidence for when succession plans are valuable for firms. Models V to VII measure idiosyncratic volatility at incrementally longer time horizons and include industry fixed effects. I observe across all the models are with negative succession plan coefficients. These confirm the negative and generally statistically significant relationship between succession plans and idiosyncratic volatility. Model VI is nearly significant. Importantly, the size of the succession plan coefficient decreases over longer time horizons. This provides some early evidence of the value of CEO succession plans. I also observe that the effect of CEO succession planning on firm volatility is the greatest in the period immediately surrounding the CEO turnover events and diminishes as uncertainty is resolved over time.

A potential concern with examining all CEO turnovers is that the results are being driven by the reason for the turnover, which leads to a sample selection bias. For example, Bushman, Dai, and Wang (2010) and Pan, Wang, and Weisbach (2015) document how the type of turnover can be associated with high stock volatility. Additionally, the results presented so far cannot rule out reverse causality and confounding factors. A firm may prepare in advance for CEO turnover. Therefore the succession plan leads to the CEO turnover. Also, firms with CEO succession plans can be systematically different from the firm without secession plans. For example, the firms with succession plans are better at corporate long-term strategy management and may plan for the CEO turnover events for a long time. To address these concerns, I run the same model specification but on the sample of CEO turnover events that are induced by an exogenous shock, CEO deaths. Table V presents the effects of CEO succession plans on firm volatility surrounding the CEO deaths. The placebo test (Model I) estimates the relationship of CEO succession planning and firm idiosyncratic return volatility in the period prior to the turnover events (-20,-5). The coefficient of succession planning variable is negative but no longer significant at 10% statistical significant level. This insignificant coefficient confirms that the CEO succession planning has no significant impact on the idiosyncratic volatility as the investors have no expectation of the CEO sudden death events and that the firms with or without CEO succession plan are not significant influenced by other omitted factors as CEO succession planning have more significant effect on firm risk during the CEO turnover periods. This result indicates that the use of CEO deaths as an exogenous event is appropriate as theories in corporate governance cannot predict a strong relationship between CEO succession plans and firm volatility in periods in which no CEO turnover event is expected.

Table V uses three different measures to proxy for the presence of a CEO succession plan. First, proxy statement disclosures prior to CEO turnover events referencing the presence of a succession plan. Second, media disclosures referencing a succession plan and finally, a time-based measure, designed to capture a firm’s ability to appoint a successor following an exogenous CEO turnover event. For all specifications I observe a consistent negative and statistically significant relationship between the various measures of a CEO succession plan and firm idiosyncratic volatility. Taken together these results provide evidence isolating the value of CEO succession plans and show that a negative relationship exists between succession plans and firm volatility during CEO turnover events.

<Insert Table V here.>

3.4.2 Succession Planning and Firm Value

In this section, I examine the effects of CEO succession planning on firm value. First, I illustrate how the CEO succession planning impacts on firm performance by both accounting measure and market measure. In Figure V, I illustrate the changes in ROA and stock returns in firms both with and without CEO succession plans during CEO turnover periods. ROA and share price drop significantly surrounding CEO turnover for firms without CEO succession plans.

<Insert Figure V here.>

After showing the anecdotal illustrations, I conduct more scientific examinations of the influence of CEO succession plans on firm value. As shown by Parrino (1997) and Huson, Malatesta, and Parrino (2004), the cause of CEO turnover--i.e., whether it is forced or voluntary--, will affect the firm's performance after the turnover event. Therefore, to disentangle the effects of the turnover from succession planning, I restrict this section of the analysis to the CEO death sample.

Table VI reports the estimates of the relationship between firm performance and succession planning. Firm performance is measured by the buy-and-hold abnormal returns for four different event windows. Again, I identify firms CEO succession plan using ex-ante three alternate proxies: first, an indicator variable equal to one if a firm discusses a succession plans in the prior to the CEO death event in proxy statements; second, an indicator variable equal to one if a firm references a succession plan in media releases following the turnover event; and finally, an indicator variable equal to one if a firm can appoint a CEO successor in three or fewer days following a CEO death event.

As reported in Table VI, for all specifications, I observe a positive relationship between firms having CEO succession plans and firm performance. Model I to VIII are significant at the 5% level or higher. To investigate the effects of succession plans on long term firm performance I look at firms that are able to announce a CEO successor (interim or permanent) within 3 days of the exogenous CEO turnover events. In unreported results, I examine the alternate succession plan measures and find consistent results. I observe across model III (-1, +10) to model VIII (-1, +252) that the succession plan coefficient is positive and that a stronger effect is found between the succession plan variable and firm performance at longer time horizons.

<Insert Table VI here.>

A potential concern with using the time taken to appoint a CEO as evidence of an ex-ante succession plan is that using this measure may induce a potential selection bias. I capture the effect of firms with a CEO succession plan and, at the same time, firms who quickly appoint a CEO whoever is the optimal candidate or not. Therefore, I pool the good and the bad. The effect of this pooling will bias against me finding a positive relationship between firms with succession plans and longer-term firm performance.

Next, I test the relationship between the search time for a CEO and firm performance. The dependent variable is the buy and hold abnormal returns at different investment horizons. The key independent variable of interest is the log of CEO search time (measured by days between the death announcement and the earliest reference to a successor). Table VII reports the results. At short time horizons--fewer than 21 days--, a negative relationship exists between the search time and firm performance. However, it is not found to be statistically significant. This provides evidence that at short time horizons the returns of the firms' stock prices are not adversely affected by the searching time. Or, this may result from the measurement errors due the mismatch of time period. The search time can be greater than 21 days and shareholders cannot predict the exact search time within 21 days. Therefore, the stock reaction cannot accurately reflect the search time. However, for model III and model IV, 64 days and 252 days respectively, both coefficients are negative and statistically significant at the 5% statistical significant level. This result is consistent with Bennedsen, Pérez-González, and Wolfenzon (2012) that the longer absence of the CEO will lead to more negative impact on firm performance.

<Insert Table VII here.>

To address concerns of potential survivorship bias, I investigate the relationship between the risk of firm delisting and having a succession plan after the departure of an incumbent CEO. In the previous analysis, these observations cannot be present because of the missing price information due to delisting. Table VIII presents the results, in which the dependent variable is an indicator variable equal to one if a firm delists within one year of the CEO turnover. Model I through V use alternate measures of CEO succession plans. I observe a negative and statistically significant relationship between firms that have a succession plan and the risk of delisting across all specifications.

<Insert Table VIII here.>

Table VI to Table VIII, taken together, provide evidence of the positive effect that CEO succession planning has on firm performance. Table VI shows the positive effect of succession planning on firm performance, by allowing firms to smooth the turnover process. Table VII provides evidence of the negative effects of not having a succession plan by showing the negative impact of the search time on firm performance. Table VI illustrates the value of CEO succession plan by reducing the risk of delisting.

For the effects on firm performance, I next examine how succession planning affects investor wealth around CEO turnover events. By assumption, the price reaction following CEO turnover should reflects not only the loss of the CEO but also market expectations about the quality of the successor and expected search time. The earlier literature that has investigated at the announcement effects of CEO deaths is mixed. For example, Worrell, Davidson, Chandy, and Garrison (1986) find a negative announcement effect. Johnson, Magee, Nagarajan, and Newman (1985) and Hayes and Schaefer (1999) observe positive abnormal returns following the deaths of CEOs. A limitation of these earlier studies is their small sample size. The aforementioned studies have samples of fewer than 30 observations. In addition, these studies do not control for confounding events related to the loss of the CEO and instead imply that the price reaction reflects only the loss of the CEO.

Table IX reports the results of multivariate regression analysis. The dependent variables in Model I to Model V are the announcement CARs for the (-1, +5) window around the earliest reference to the death of the incumbent CEO. Models I through V report the results for alternate succession plan measures, to examine whether investors react differently to different evidence of firms' succession plans. To ensure that the results are robust to alternate event windows, Model VI and Model VII report result for shorter event windows. The results are consistent for changes in the specification of the dependent variable. For models I through VII, I observe that the succession planning coefficients are positive and statistically significant at the 5% or higher statistical significant level. This indicates that the firms with evidence of CEO succession plans experience a positive price response following CEO turnovers. The sample is restricted to the CEO death sample to mitigate concerns of confounding fators.

<Insert Table IX here.>

3.5 Additional Tests and Robustness Checks

3.5.1 Other Measure of Firm Risk

<Insert Table X here.>

To examine the relationship between CEO succession plans and firm volatility, I use idiosyncratic volatility as dependent variable in the baseline regression, which is the volatility of the residual returns estimated from the market model and Fama-French three-factor model. Although I believe that this is a reliable measure of the firm level of equity volatility, to ensure that the results are robust, I re-run the analysis using two alternative volatility measures: the option-implied volatility and the realized return volatility. Furthermore, to address concerns that the results might be driven by the cause of the turnover I examine both the S&P1500 CEO turnover sample and the CEO death subsample. I find a consistent negative relationship between firm volatility, implied and realized, and firms with succession plans. This result is robust for the larger S&P1500 sample and the CEO death sample as well as the in addition to the inclusion of industry fixed effects.

3.5.2 Interim or Permanent

<Insert Table XI here.>

Table XI explores the heterogeneity in the announcement effect created by interim versus permanent successor announcements. Prior research focusing on executives' (Zhang and Rajagopalan, 2004) and CEO's (Ballinger and Marcel, 2010) successions examines the effect of disruptive successions on firm performance. I link this earlier research to succession planning by exploiting differences in death type, --i.e. sudden and non-sudden deaths--, and test the valuation effects. To measure the valuation impact, I measure the announcement effects for the death, interim successor announcements and permanent successor announcements. I then aggregate CAR to measure the full effect of the turnover and succession process. For the non-sudden CEO death sample, I find that the announcement effect for interim successors is -1.02% and the full effect is -2.102%. This compares with the sudden death sample, where firms are not punished for naming an interim successor 0.133% and the full effect is 8.085%. I argue that if a firm experiences a non-sudden death and names an interim successor, this will be viewed as a lapse in monitoring by the board. These findings provide evidence that firms are punished for lapses in succession planning.

<Insert Table XII here.>

In Table XII, I illatrate the value of strategic announcements. However, the effect of interim successor announcements only lasts for a short time. In the short-sun, if the firm can timely announce a temporary successor, shareholders do react positively to this quick reaction and decision by the board members to avoid a vacancy in CEO talent. However, in the long run, when shareholders realize the true capability of the successor CEO, they will adjust their beliefs accordingly, rather than continue to believe that the interim CEO is the best for the firm.

3.5.3 Subsample Test: Firms with CEO as Key Risk Factors

<Insert Table XIII here.>

In this section I seek to exploit the heterogeneity in the importance of the CEO succession planning to different firms. I demonstrate this variation using the relationship between succession planning and firm volatility around CEO turnover events. Prior studies have shown that the importance of the CEO varies among different firms (Eisfeldt and Kuhnen, 2013). I use the *Sales, Goods and Administrative (SG&A)* expense measure and key risk factors measure to identify whether the CEO is the key factor driving the success of the firm. First, following Eisfeldt and Papanikolaou (2013), I proxy the importance of organizational capital by using the *SG&A* ranking. I form five portfolios according to the rank of SG&A expense of all S&P 1500 firms during

CEO turnovers. I choose the top and last portfolio of firms according to their SG&A rankings. The results are shown in Column I and II, V and VI, and IX and X for three types of volatility measures: idiosyncratic volatility, implied volatility and realized volatility, respectively. My second measure is based on whether firms identify the loss of their CEO as a key business risk in SEC filings. I use Ruby codes to scan all the 10-K filings in the Edgar database and identify the key risk factors described in the section Item 1A - "Risk Factors" of a company's annual report on Form 10-K. By using human language processing tools, I can accurately identify whether the CEO or other executives is one of the key risk factors for a firm. The results are shown in Column III and IV, VII and VIIII, and XI and XII for three types of volatility measures: idiosyncratic volatility, implied volatility and realized volatility, respectively. I observe that the effect of succession plans on firm volatility around CEO turnovers is greater for firms with higher organizational capital or with greater CEO key risk. This is consistent with my implications from theory: the CEO succession plan is more important for firms with high demand for CEO talents. I find that the coefficient is consistently negative between succession planning and the three volatility measures for all the firms, especially for firms with high CEO importance.

3.4 Conclusion

In this chapter, I present evidence of the importance of CEO succession planning. I find early evidence that firms that have CEO succession plans have lower volatility and positive announcement effects during CEO turnover events, and better long term performance following CEO turnover events. To address endogeneity concerns relating to CEO turnover, I use CEO death events. CEO deaths randomly force firms to reveal their succession plans to overcome the identification problems and reduce the reverse causality caused by voluntary CEO turnover events. This presents an attractive natural experiment to allow us to conduct a cleaner study. To my knowledge, this is the first empirical study to document the value of CEO succession plans for all firms.

3.5 References

Abadie, A. and Imbens, G.W., 2006. Large sample properties of matching estimators for average treatment effects. *Econometrica*, 74(1), pp.235-267.

Acharya, V.V., Myers, S.C. and Rajan, R.G., 2011. The internal governance of firms. *The Journal of Finance*, *66*(3), pp.689-720.

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), pp.58-107.

Almeida, H., Campello, M., Laranjeira, B. and Weisbenner, S., 2009. *Corporate debt maturity and the real effects of the 2007 credit crisis* (No. w14990). National Bureau of Economic Research.

Ang, A., Hodrick, R.J., Xing, Y. and Zhang, X., 2006. The cross-section of volatility and expected returns. *Journal of Finance, forthcoming*.

Ballinger, G.A. and Marcel, J.J., 2010. The use of an interim CEO during succession episodes and firm performance. *Strategic Management Journal*, *31*(3), p.262.

Beliankou, A. 2011. Tokenizer.

Bennedsen, M., Pérez-González, F. and Wolfenzon, D., 2012. Evaluating the impact of the boss: Evidence from CEO hospitalization events. *Unpublished manuscript*.

Borokhovich, K.A., Brunarski, K.R., Donahue, M.S. and Harman, Y.S., 2006. The importance of board quality in the event of a CEO death. *Financial Review*, *41*(3), pp.307-337.

Bushman, R., Dai, Z. and Wang, X., 2010. Risk and CEO turnover. *Journal of Financial Economics*, *96*(3), pp.381-398.

Campbell, T.C., 2014. CEO optimism and the board's choice of successor. *Journal of Corporate Finance*, *29*, pp.495-510.

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

Coles, J.L., Daniel, N.D. and Naveen, L., 2014. Board groupthink. In *University of Utah Working paper*.

Denis, D.J. and Denis, D.K., 1995. Performance changes following top management dismissals. *The Journal of finance*, 50(4), pp.1029-1057.

Eisfeldt, A.L. and Kuhnen, C.M., 2013. CEO turnover in a competitive assignment framework. *Journal of Financial Economics*, *109*(2), pp.351-372.

Eisfeldt, A.L. and Papanikolaou, D., 2013. Organization capital and the cross-section of expected returns. *The Journal of Finance*, *68*(4), pp.1365-1406.

Etebari, A., Horrigan, J.O. and Landwehr, J.L., 1987. To Be Or Not to Be-Reaction of Stock Returns to Sudden Deaths of Corporate Chief Executive Officers. *Journal of Business Finance & Accounting*, *14*(2), pp.255-278.

Falato, A., Kadyrzhanova, D. and Lel, U., 2014. Distracted directors: Does board busyness hurt shareholder value?. *Journal of Financial Economics*, *113*(3), pp.404-426.

Fama, E.F., 1980. Agency Problems and the Theory of the Firm. *The journal of political economy*, pp.288-307.

Fama, E.F. and Jensen, M.C., 1983. Agency problems and residual claims. *The journal of law & Economics*, *26*(2), pp.327-349.

Fee, C.E. and Hadlock, C.J., 2004. Management turnover across the corporate hierarchy. *Journal of Accounting and Economics*, *37*(1), pp.3-38.

Fee, C.E., Hadlock, C.J. and Pierce, J.R., 2013. Managers with and without style: Evidence using exogenous variation. *Review of Financial Studies*, *26*(3), pp.567-601.

Fracassi, C. and Tate, G., 2012. External networking and internal firm governance. *The Journal of Finance*, *67*(1), pp.153-194.

Guo, L. and Masulis, R.W., 2015. Board structure and monitoring: New evidence from CEO turnovers. *Review of Financial Studies*, *28*(10), pp.2770-2811.

Goel, A.M. and Thakor, A.V., 2008. Overconfidence, CEO selection, and corporate governance. *The Journal of Finance*, 63(6), pp.2737-2784.

Hayes, R.M. and Schaefer, S., 1999. How much are differences in managerial ability worth?. *Journal of Accounting and Economics*, *27*(2), pp.125-148.

Hazarika, S., Karpoff, J.M. and Nahata, R., 2012. Internal corporate governance, CEO turnover, and earnings management. *Journal of Financial Economics*, *104*(1), pp.44-69.

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

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

Hermalin, B.E., 2005. Trends in corporate governance. *The Journal of Finance*, *60*(5), pp.2351-2384.

Huson, M.R., Malatesta, P.H. and Parrino, R., 2004. Managerial succession and firm performance. *Journal of Financial Economics*, *74*(2), pp.237-275.

Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, *3*(4), pp.305-360.

Jenter, D. and Kanaan, F., 2015. CEO turnover and relative performance evaluation. *The Journal of Finance*, *70*(5), pp.2155-2184.

Johnson, W.B., Magee, R.P., Nagarajan, N.J. and Newman, H.A., 1985. An analysis of the stock price reaction to sudden executive deaths: Implications for the managerial labor market. *Journal of Accounting and Economics*, *7*(1-3), pp.151-174.

Kim, Y., 1996. Long-term firm performance and chief executive turnover: An empirical study of the dynamics. *Journal of Law, Economics, and Organization*, *12*(2), pp.480-496.

Larcker, D.F. and Saslow, S., 2014. Report on Senior Executive Succession Planning and Talent Development Survey. *Institute of Executive Development and Stanford University*.

Marcel, J.J., Cowen, A.P. and Ballinger, G.A., 2013. Are disruptive CEO successions viewed as a governance lapse? Evidence from board turnover. *Journal of Management*, p.0149206313503011.

Mobbs, S. and Raheja, C.G., 2012. Internal managerial promotions: Insider incentives and CEO succession. *Journal of Corporate Finance*, *18*(5), pp.1337-1353.

Murphy, K.J. and Zimmerman, J.L., 1993. Financial performance surrounding CEO turnover. *Journal of Accounting and Economics*, *16*(1), pp.273-315.

Naveen, L., 2006. Organizational complexity and succession planning. *Journal of Financial and Quantitative Analysis*, *41*(3), p.661.

Nguyen, B.D. and Nielsen, K.M., 2010. The value of independent directors: Evidence from sudden deaths. *Journal of Financial Economics*, *98*(3), pp.550-567.

Nguyen, B.D. and Nielsen, K.M., 2014. What death can tell: Are executives paid for their contributions to firm value?. *Management Science*, *60*(12), pp.2994-3010.

Pan, Y., Wang, T.Y. and Weisbach, M.S., 2015. Learning about CEO ability and stock return volatility. *Review of Financial Studies*, p.hhv014.

Parrino, R., 1997. CEO turnover and outside succession a cross-sectional analysis. *Journal of Financial Economics*, *46*(2), pp.165-197.

Rosenberg, J.V., Clayton, M.J. and Hartzell, J.C., 2003. The Impact of CEO Turnover on Equity Volatility.

Salas, J.M., 2010. Entrenchment, governance, and the stock price reaction to sudden executive deaths. *Journal of banking & finance*, *34*(3), pp.656-666.

SEC. 2009. Staff Legal Bulletin No. 14E (Shareholder Proposals). *Staff Legal Bulliten* .

Shen, W. and Cannella, A.A., 2003. Will succession planning increase shareholder wealth? Evidence from investor reactions to relay CEO successions. *Strategic Management Journal*, *24*(2), pp.191-198.

Shivdasani, A. and Yermack, D., 1999. CEO involvement in the selection of new board members: An empirical analysis. *The Journal of Finance*, *54*(5), pp.1829-1853.

Song Shin, H., 2003. Disclosures and asset returns. *Econometrica*, *71*(1), pp.105-133.

Song Shin, H., 2006. Disclosure risk and price drift. *Journal of Accounting Research*, *44*(2), pp.351-379.

Taylor, L.A., 2013. CEO wage dynamics: Estimates from a learning model. *Journal of Financial Economics*, *108*(1), pp.79-98.

Vancil, R.F., 1987. *Passing the baton: Managing the process of CEO succession*. Harvard Business School Press.

Weisbach, M.S., 1995. CEO turnover and the firm's investment decisions. *Journal of Financial Economics*, *37*(2), pp.159-188.

Worrell, D.L., Davidson, W.N., Chandy, P.R. and Garrison, S.L., 1986. Management turnover through deaths of key executives: Effects on investor wealth. *Academy of Management Journal*, *29*(4), pp.674-694.

Zhang, Y. and Rajagopalan, N., 2004. When the known devil is better than an unknown god: An empirical study of the antecedents and consequences of relay CEO successions. *Academy of Management Journal*, *47*(4), pp.483-500.

Zhang, Y., 2006. The presence of a separate COO/president and its impact on strategic change and CEO dismissal. *Strategic Management Journal*, *27*(3), pp.283-300.

Figure I

Percentage of Firms Mentioning Succession Plan in Their Proxy Statement

This figure shows the time trends of references to succession plans mentioned in DEF14A for all listed firms during the period from 1994 to 2014. Data for 2014 is currently being collected. Also shown is the average CEO tenure for S&P 1500 firms during the period of 1992-2014.

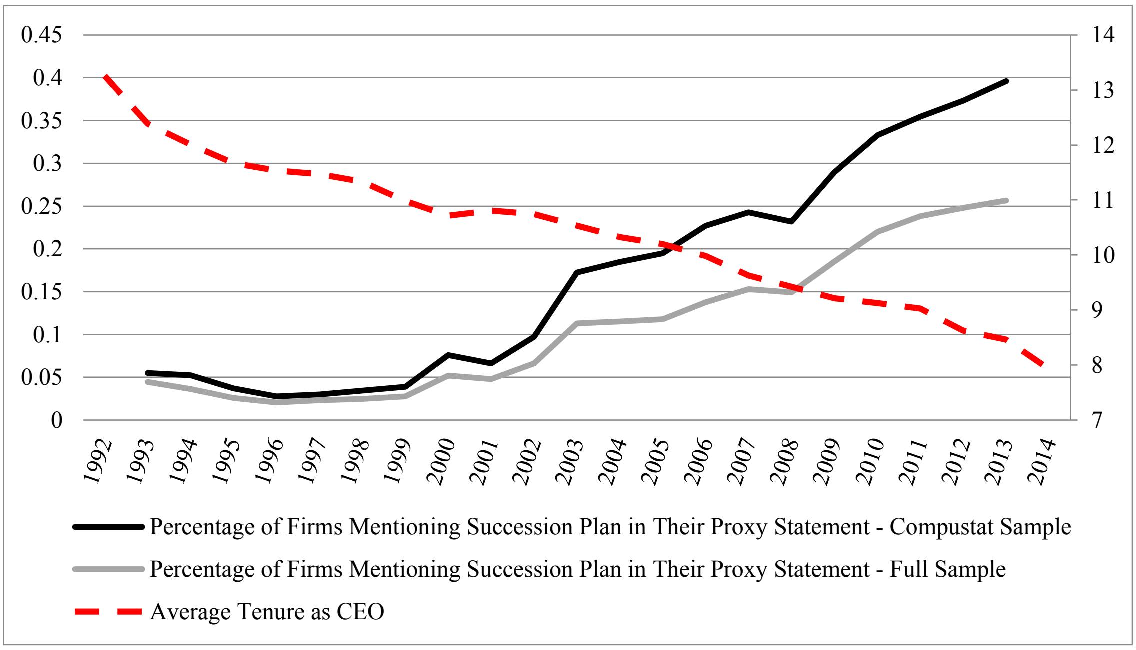


Figure II

Number of Days between Turnover and Successor Announcement

This figure shows the succession gap for all CEO turnover events in the S&P 1500 firms during the period from 1992 to 2014. The overlap succession histogram shows turnover events where the incumbent CEO and CEO successor appointments have been publically made. The Succession gap histogram shows the period of time between the CEO turnover event and the appointment of the CEO successor. This CEO Death figure shows the succession gap for all CEO death events in all listed firms during the period from 1994 to 2014. The figures show the period of time between the turnover event and the appointment of the successor.

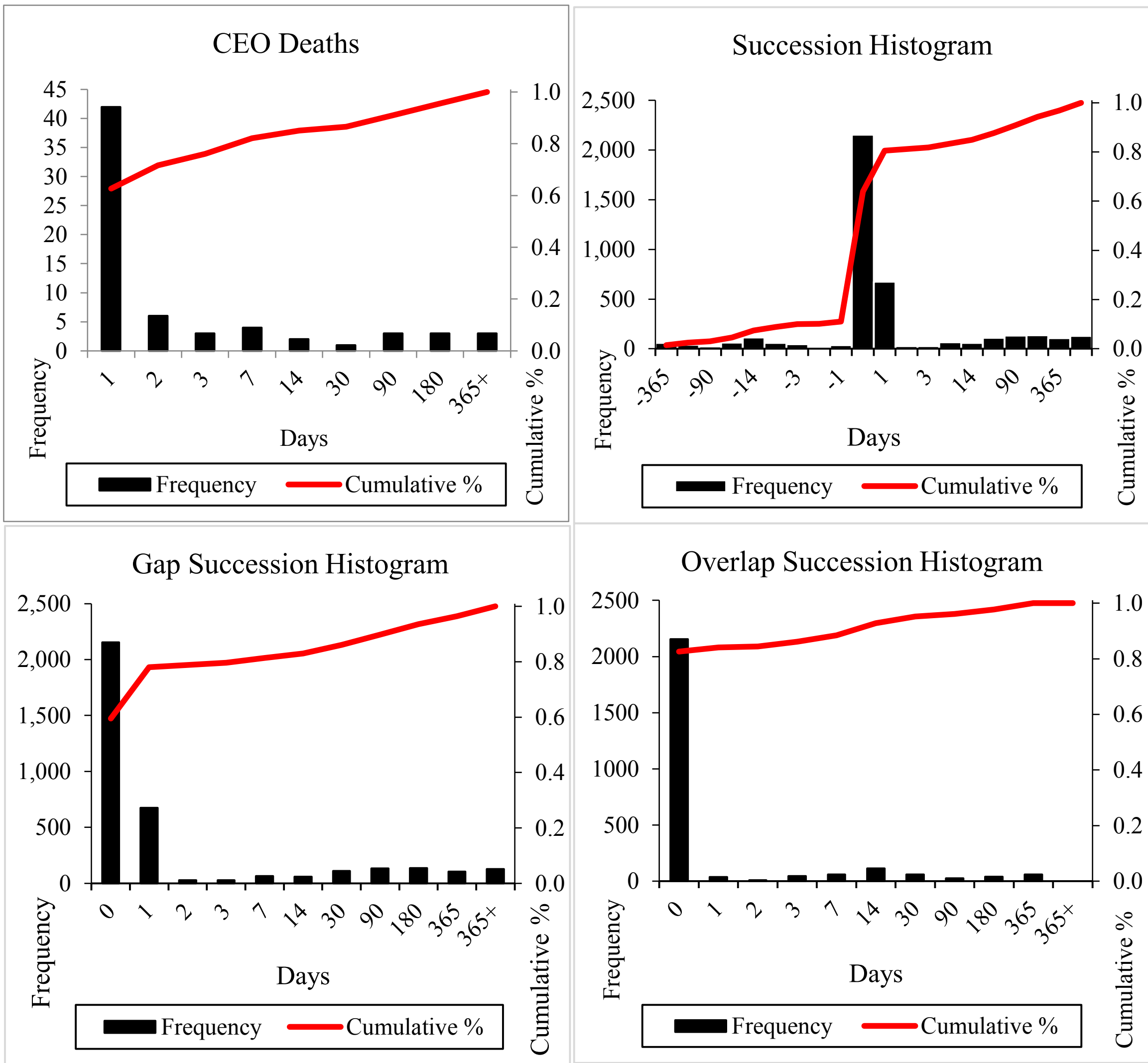


Figure III

Volatility surrounding the CEO Turnovers

This figure shows the average idiosyncratic volatility surrounding all CEO Turnover events in the S&P 1500 firms during the period from 1992 to 2014. The Idiosyncratic Volatility is calculated with 10-day window.

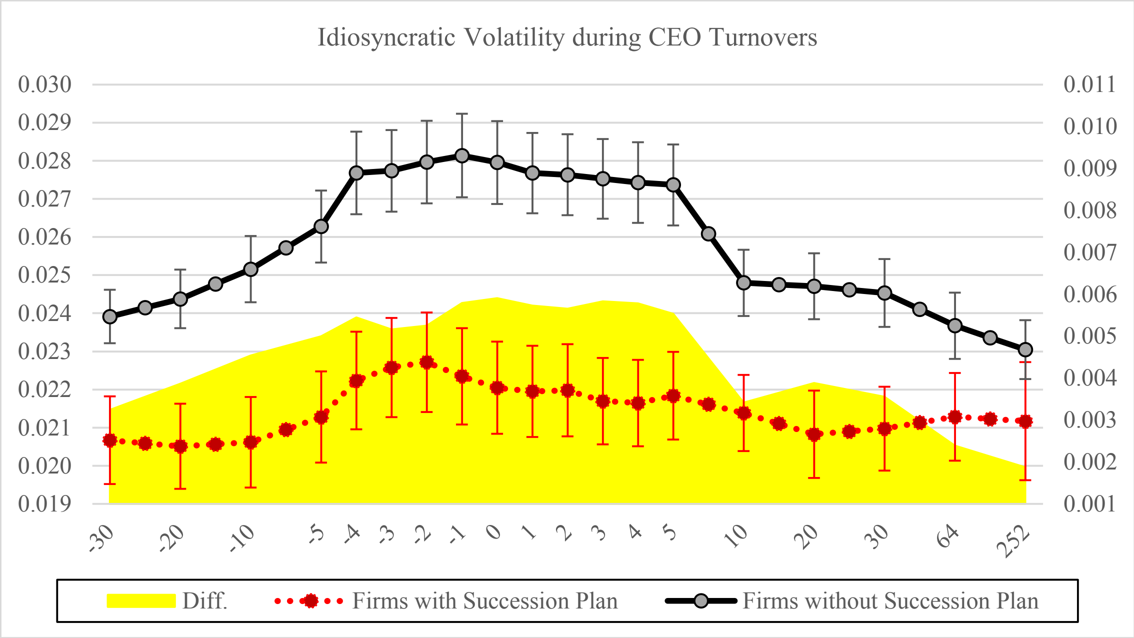


Figure IV

Volatility surrounding the CEO Turnovers

This figure shows the historical volatility and implied volatility surrounding all CEO Turnover events in the S&P 1500 firms during the period from 1992 to 2014. The historical volatility are calculated over date ranges of (-730, 0), (-547, 0), (-252, 0), (-195, 0), (-130, 0), (-108, 0), (-87, 0), (-65, 0), (-42, 0) and (-20, 0) trading days, using a simple standard deviation calculation on the logarithm of the close-to-close daily total return. And, the implied volatility is calculated from standard (interpolated) at-the-money-forward options in OptionMetrics database with expirations of 20, 42, 65, 87, 108, 130, 195 and 252 trading days.

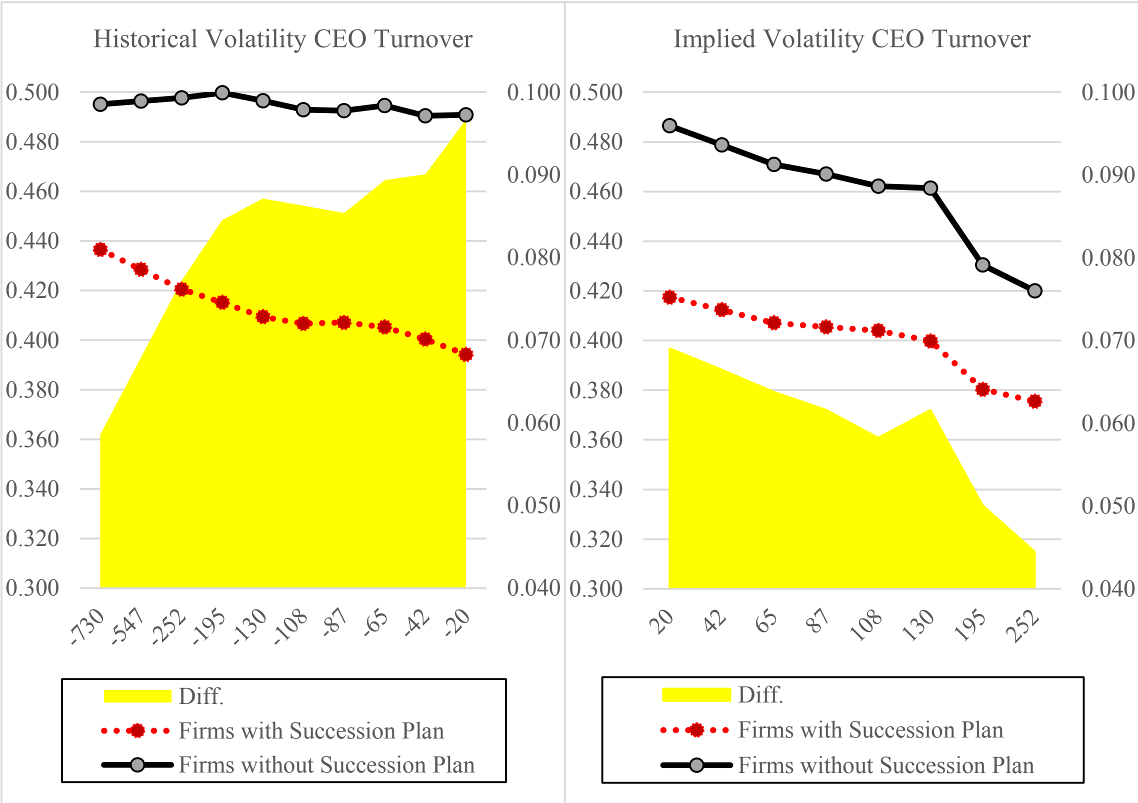


Figure V

Accounting Performance and Market Performance surrounding the CEO Turnovers

This figure shows the change of accounting performance and market performance surrounding all CEO Turnover events in the S&P 1500 firms during the period from 1992 to 2014. The red solid lines represent the firms with CEO succession plan and the black dash lines represent the firms without CEO succession plan. The R&D expenditure is measured by the R&D expenditure to sales ratios. The accounting performance is measured by ROA and the marking performance is measured by accumulated raw return from the end of fiscal year price [prcc_f]. The ROA dropps a lot surround the CEO turnovers for the firms without CEO succession plans in left figure; and the stock prices drop for all firms but the stock prices drop more for the firms without CEO succession plans.

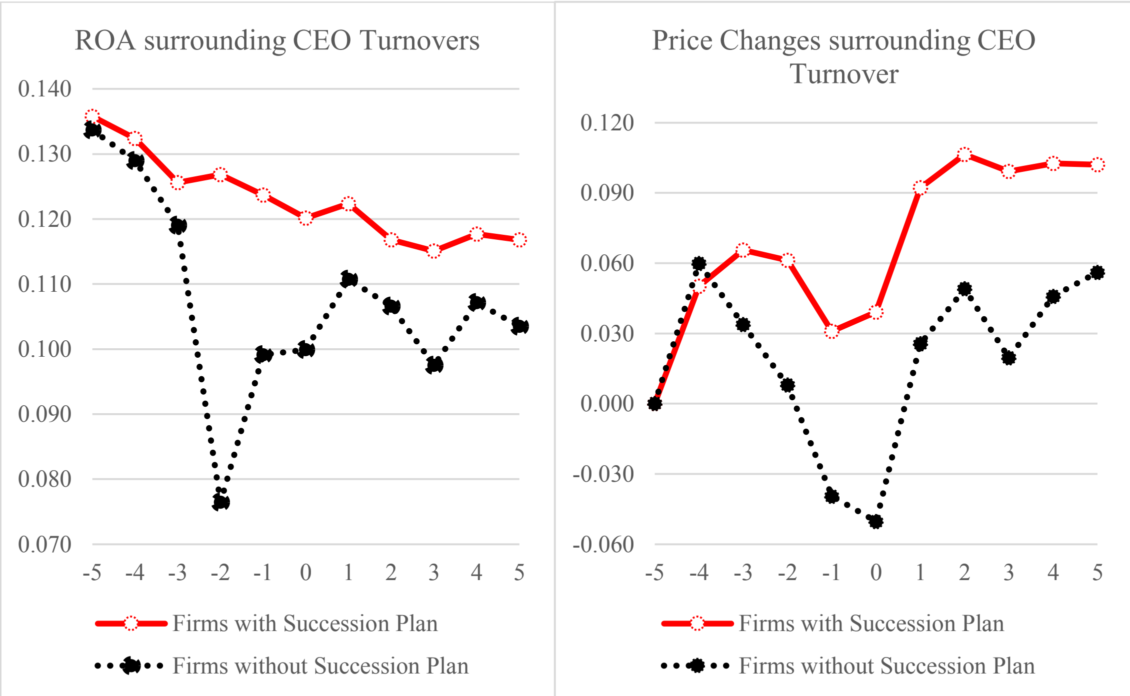


Table I

Summary Statistics of All CEO Turnover Events of S&P 1500 Firms

This sample consists of all CEO turnover events in the Standard and Poor's 1500 firms from 1996 to 2014 identified in ExecuComp for CEOs that have tenure of three years or longer. I use the information on Annual Title, Date became CEO, Date Left as CEO and CEO Annual Flag provided by ExecuComp to identify CEOs at the firm year level following Pan, Wang and Weisbach (2015). Panel A reports the summary statistics for incumbent CEO at the turnover year identified as the year of left as CEO in ExecuComp; Panel B reports the summary statistics for the dummy variable of whether the firm mentioned CEO succession plan in their proxy statements or 10-K, manually collected by scanning all the filing in Edgar database from SEC; Panel C reports the summary statistics for successor CEO at the CEO turnover year identified as the year of Became CEO in ExecuComp; Panel D reports the summary statistics for firm level attributes at the CEO turnover years provided in Compustat; and Panel E reports the board data available in RiskMetrics or BoardEx at the CEO turnover years. All variables are defined in Table A1 of the Appendix.

Variables	**N**	**Mean**	**SD**	**25 percen-tile**	**Median**	**75 percentile**
Panel A: Incumbent CEO Information						
CEO Age	*3164*	58.67	7.94	53	59	64
CEO Female	*3267*	0.02	0.13	0	0	0
CEO Tenure	*3101*	10.26	6.89	5	9	14
Founder	*1524*	0.06	0.24	0	0	0
# of Outside Positions	*1710*	0.98	1.32	0	1	2
CEO Network Size	*1922*	26.99	26.25	10	16	35
Outsider CEO	*1924*	0.12	0.32	0	0	0
Panel B: Successor CEO Information						
CEO Age	*4669*	52.23	7.24	47	52	57
CEO Female	*4728*	0.03	0.18	0	0	0
# of Outside Positions	*2294*	0.96	1.31	0	0	2
CEO Network Size	*2543*	26.86	25.71	10	17	34
Outsider CEO	*2544*	0.09	0.29	0	0	0
Panel C: CEO Succession Plan Information						
Succession Plan Motioned in DEF 14A	*3232*	0.29	0.45	0	0	1
Panel D: Firm Fundamental Information						
Total Assets ($ mil)	*4404*	15252.95	101464.60	433.04	1567.52	5448.13
Market Capitalization ($ mil)	*4404*	6552.67	22678.09	380.92	1187.10	4097.96
Tobin's Q	*4404*	1.93	3.29	1.11	1.41	2.01
ROA	*4305*	0.10	0.17	0.06	0.11	0.17
Sale	*4404*	5604.42	17827.99	420.10	1262.48	3980.80
Cash Flow	*4402*	0.08	0.14	0.03	0.08	0.13
Earnings Volatility	*4307*	0.10	0.17	0.06	0.11	0.17
Research and Development	*4400*	112.57	600.56	0	0	28.01
R&D Missing	*4399*	0.44	0.50	0	0	1
Capital Expenditure	*4393*	0.09	0.26	0.02	0.04	0.08
Long-Term Leverage	*4115*	0.20	0.22	0.03	0.17	0.31
Leverage	*4120*	0.24	0.24	0.06	0.22	0.35
Panel D: Board Information						
Average Age of the Board (years)	*2634*	59.58	4.32	57.14	59.84	62.43
Board Female	*2660*	0.10	0.10	0	0.1	0.15
Average Board Tenure	*2634*	7.21	3.94	4.49	6.85	9.48
CEO-Chairman Duality	*2660*	0.51	0.50	0	1	1
Board Size	*2665*	9.61	2.77	8	9	11
Independence Ratio	*2660*	0.73	0.16	0.67	0.78	0.86
Average Number of Outside Positions	*1225*	3.14	2.50	0	4.10	6.00

Table II

Summary Statistics of CEO Sudden Death Sample

This sample consists of all 181 CEO sudden death events in all US listed firms from 1996 to 2014 identified in 8-K filings and media releases (detailed procedure see Appendix). Panel A reports the summary statistics for the dead CEO at the turnover year provided in proxy statements, 8-k filings, news releases as well as ExecuComp, Capital IQ, RiskMetrics and BoardEx databases; Panel B reports the summary statistics for CEO Succession Plan related information; Panel C reports the summary statistics for successor CEO at the CEO turnover years identified in proxy statements, 8-k filings, news releases as well as ExecuComp, Capital IQ, RiskMetrics and BoardEx databases; Panel D reports the summary statistics for firm level attributes at the CEO death years provided in Compustat; and Panel E reports the board data available in Capital IQ, RiskMetrics or BoardEx at the CEO death years. All variables are defined in Table A1 of the Appendix.

Variables	N	Mean	SD	25 percen-tile	Median	75 percen-tile
Panel A: Dead CEO Information						
CEO Age	*129*	63.94	11.21	56	63	70
CEO Female	*180*	0.01	0.10	0	0	0
CEO Tenure	*113*	13.81	10.58	6.10	11.90	20.90
Founder	*151*	0.08	0.27	0	0	0
# of Outside Positions	*114*	1.34	0.93	1	1	2
CEO Network Size	*107*	39.92	267.98	0	0	0
Panel B: Successor CEO Information						
CEO Age	*170*	54.29	10.53	48	53	61
CEO Female	*181*	0.05	0.22	0	0	0
# of Outside Positions	*65*	1.38	0.98	1	1	1
CEO Network Size	*65*	38.88	478.16	1	29	45
Outsider CEO	*181*	0.17	0.37	0	0	0
Panel C: CEO Succession Plan Informatio						
Succession Plan Motioned in DEF 14A	*181*	0.27	0.44	0	0	1
Succession Plan Motioned in News Release	*181*	0.14	0.35	0	0	0
Successor Announcement within 1-day	*181*	0.70	0.46	0	1	1
Successor Announcement within 2-day	*181*	0.77	0.42	1	1	1
Successor Announcement within 3-day	*181*	0.82	0.38	1	1	1
Transitional Committee Formed	*151*	0.03	0.13	0	0	1
Panel D: Firm Fundamental Information						
Total Assets ($ mil)	*151*	12794.03	49017.87	193.88	817.25	4891.83
Market Capitalization ($ mil)	*151*	9308.01	34404.89	146.24	806.40	3331.42
Tobin's Q	*151*	1.91	2.05	1.04	1.37	1.99
ROA	*146*	0.09	0.22	0.03	0.12	0.18
Sale	*151*	5487.83	18400.34	92.05	569.59	2414.20
Cash Flow	*151*	0.07	0.15	0.01	0.07	0.14
Earnings Volatility	*146*	0.09	0.22	0.03	0.12	0.18
Research and Development	*151*	123.40	662.17	0.00	0.00	12.60
R&D Missing	*151*	0.50	0.50	0	0	1
Capital Expenditure	*148*	0.07	0.18	0.01	0.03	0.06
Long-Term Leverage	*142*	0.16	0.18	0.00	0.10	0.27
Leverage	*142*	0.21	0.28	0.01	0.15	0.33
Panel E: Board Information						
Average Age of the Board (years)	*130*	60.94	4.30	58.58	61.00	63.20
Board Female	*129*	0.09	0.10	0.00	0.09	0.15
Average Board Tenure	*130*	8.63	4.68	4.95	7.94	11.25
CEO-Chairman Duality	*131*	0.53	0.50	0	1	1
Board Size	*131*	8.78	2.91	6	9	11
Independence Ratio	*131*	0.63	0.48	0.63	0.75	0.83
Average Number of Outside Positions	*130*	3.42	6.51	0.00	0.41	5.00

Table III

Summary Statistics S&P 1500 Firms

This sample consists of all firm-year observations from 1996 to 2014 of the Standard and Poor's 1500 firms in the ExecuComp database. Panel A reports the summary statistics for incumbent CEOs in ExecuComp; Panel B reports the summary statistics for the dummy variable of whether the firm mentioned CEO succession plan in their proxy statements or 10-K, manually collected by scanning all the filing in Edgar database from SEC; Panel C reports the summary statistics for other firm level attributes provided in Compustat; and Panel D reports the board data available in RiskMetrics or BoardEx. All variables are defined in Table A1 of the Appendix.

Variables	N	Mean	SD	25 percentile	Median	75 percentile
Panel A: Incumbent CEO Information						
CEO Age	*45,763*	55.21	7.70	50	55	60
CEO Female	*46,310*	0.02	0.15	0	0	0
CEO Tenure	*45,064*	6.83	7.18	2	5	9
Founder	*17,145*	0.07	0.25	0	0	0
# of Outside Positions	*23,283*	0.87	1.21	0	0	1
CEO Network Size	*25,985*	25.69	25.87	9	16	32
Outsider CEO	*25,996*	0.15	0.35	0	0	0
Panel B: CEO Succession Plan Information						
Succession Plan Motioned in DEF 14A	*33,465*	0.25	0.43	0	0	1
Panel C: Firm Fundamental Information						
Total Assets ($ mil)	*43,536*	12886.58	87726.45	452.08	1439.79	5165.57
Market Capitalization ($ mil)	*43,536*	6583.83	22268.52	465.43	1284.26	4107.66
Tobin's Q	*43,536*	2.00	2.25	1.15	1.49	2.18
ROA	42,225	0.12	0.53	0.08	0.13	0.18
Sale	*43,536*	5063.64	16347.37	396.76	1116.55	3525.62
Cash Flow	*43,460*	0.08	0.41	0.04	0.09	0.14
Earnings Volatility	*42,312*	0.12	0.53	0.08	0.13	0.18
Research and Development	*43,356*	97.92	528.71	0	0	25.62
R&D Missing	*43,267*	0.45	0.50	0	0	1
Capital Expenditure	*43,390*	0.10	1.38	0.02	0.04	0.08
Long-Term Leverage	*40,244*	0.19	0.19	0.02	0.16	0.30
Leverage	*40,513*	0.23	0.74	0.05	0.20	0.34
Panel D: Board Information						
Average Age of the Board (years)	*26,865*	60.17	4.39	57.6	60.42	63
Board Female	*26,976*	0.10	0.10	0	0.1	0.17
Average Board Tenure	*26,865*	8.43	4.15	5.55	7.94	10.73
CEO-Chairman Duality	*26,976*	0.65	0.48	0	1	1
Board Size	*27,245*	9.41	2.65	8	9	11
Independence Ratio	*26,976*	0.75	0.16	0.67	0.78	0.88
Average Number of Outside Positions	*12,433*	3.70	2.24	0	2.25	6.33

Table IV

Succession Planning and the Prior and Post Return Volatility surrounding CEO Turnovers

The table presents the result estimated using all CEO turnover events among S&P1500 firms. The sample includes CEO turnover events with successor announcements and available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are idiosyncratic return volatility surrounding CEO turnovers. To estimate idiosyncratic return volatility, I follow Ang et al. (2006) and calculate volatility of the residual daily stock returns of market model with in the periods of (-20, -5), (-1, +10), (-1, +21), (-1, +64), and (-1, +252). All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Idiosyncratic Return Volatility						
	(-20, -5)	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +21)	(-1, +64)	(-1, +252)
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Succession Plan	-0.0022***	-0.0033***	-0.0030***	-0.0059**	-0.0021**	-0.0013	-0.0013*
Mentioned in DEF 14.	(-2.622)	(-2.874)	(-2.618)	(-2.141)	(-2.091)	(-1.579)	(-1.686)
Incumbent CEO							
Founder Title	0.0037*	0.0043**	0.0045**	0.0049	0.0035**	0.0031**	0.0018
	(1.937)	(2.224)	(2.345)	(1.133)	(2.022)	(2.112)	(1.394)
Chairman Title	0.0000	-0.0007	-0.0002	0.0009	-0.0011	-0.0007	-0.0008
	(0.022)	(-0.487)	(-0.169)	(0.247)	(-0.813)	(-0.574)	(-0.691)
Age	-0.0000	-0.0002***	-0.0002***	-0.0001	-0.0002***	-0.0002***	-0.0002***
	(-0.537)	(-3.037)	(-2.642)	(-0.589)	(-3.491)	(-4.233)	(-3.611)
Tenure	-0.0001***	-0.0002***	-0.0002***	-0.0001	-0.0002***	-0.0002***	-0.0002***
	(-3.249)	(-4.629)	(-4.276)	(-0.961)	(-5.160)	(-5.130)	(-5.120)
Firm Controls							
ROA	-0.0420***	-0.0262***	-0.0252***	-0.0257	-0.0285***	-0.0274***	-0.0350***
	(-10.200)	(-3.687)	(-3.754)	(-1.285)	(-4.352)	(-4.770)	(-6.194)
Total Asset	-0.0000	0.0000	0.0000	-0.0000	0.0000	0.0000	0.0000
	(-1.298)	(0.920)	(0.260)	(-0.850)	(0.231)	(0.291)	(0.878)
Independent Ratio	-0.0125***	-0.0069*	-0.0051	-0.0110	-0.0175***	-0.0196***	-0.0208***
	(-3.779)	(-1.778)	(-1.276)	(-1.292)	(-6.124)	(-7.966)	(-9.075)
Board Size	-0.0007***	-0.0011***	-0.0011***	-0.0010	-0.0011***	-0.0010***	-0.0009***
	(-4.142)	(-4.906)	(-4.257)	(-1.422)	(-4.523)	(-4.793)	(-4.391)
Board Female Ratio	-0.0101*	-0.0047	-0.0063	0.0006	-0.0001	-0.0026	0.0001
	(-1.720)	(-0.816)	(-1.107)	(0.040)	(-0.015)	(-0.550)	(0.016)
Constant	0.0495***	0.0620***	0.0583***	0.0545***	0.0687***	0.0686***	0.0661***
	(10.465)	(11.184)	(10.876)	(3.953)	(13.955)	(16.389)	(16.803)
Fixed Effect	Industry	No	Industry	Firm	Industry	Industry	Industry
R-squared	0.205	0.106	0.158	0.653	0.206	0.235	0.246
N	1,524	1,524	1,524	1,524	1,524	1,524	1,524

Table V

Succession Planning and the Return Volatility Post and Prior to Sudden Deaths

The table presents the result estimated using CEO sudden death events. The sample includes CEO sudden death events with successor announcements and available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are idiosyncratic return volatility surrounding CEO turnovers. To estimate idiosyncratic return volatility, I follow Ang et al. (2006) and calculate volatility of the residual daily stock returns of market model with in the periods of (-20, -5), (-1, +10), (-1, +21), (-1, +64), and (-1, +252). All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Idiosyncratic Return Volatility								
	(-20, -5)	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +21)	(-1, +46)	(-1, +252)
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Succession Plan	-0.0050	-0.0060*							
Mentioned in DEF 14A	(-0.923)	(-1.741)							
Succession Plan			-0.0073**						
Mentioned in News Release			(-2.175)						
Successor Announcement				-0.0099**					
within 1-day				(-2.179)					
Successor Announcement					-0.0085*				
within 2-day					(-1.728)				
Successor Announcement						-0.0082	-0.0130***	-0.0100***	-0.0070**
within 3-day						(-1.635)	(-3.377)	(-2.768)	(-2.106)
Transitional Committee	-0.0099**	-0.0010	-0.0024	-0.0069*	-0.0071	-0.0070	-0.0085**	-0.0074**	-0.0039
Formed	(-2.026)	(-0.317)	(-0.986)	(-1.758)	(-1.589)	(-1.530)	(-2.415)	(-2.253)	(-1.292)
Dead CEO Founder Title	-0.0128	-0.0032	-0.0058	-0.0040	-0.0034	-0.0033	-0.0052	-0.0019	-0.0042
	(-1.246)	(-0.534)	(-1.281)	(-0.664)	(-0.564)	(-0.552)	(-1.120)	(-0.441)	(-1.053)
Dead CEO Chairman Title	0.0051	-0.0016	-0.0046	-0.0019	-0.0022	-0.0020	-0.0016	0.0006	-0.0007
	(0.760)	(-0.462)	(-1.420)	(-0.546)	(-0.617)	(-0.579)	(-0.593)	(0.227)	(-0.300)
Dead CEO Age	0.0000	-0.0001	0.0001	-0.0000	-0.0000	-0.0000	0.0001	0.0001	0.0002
	(0.113)	(-0.358)	(0.977)	(-0.127)	(-0.196)	(-0.251)	(0.815)	(0.501)	(1.267)
Dead CEO Tenure	0.0001	0.0002	0.0000	0.0002	0.0002	0.0002	0.0002	0.0001	-0.0000
	(0.506)	(1.235)	(0.405)	(1.197)	(1.370)	(1.386)	(1.529)	(0.615)	(-0.257)
ROA	0.0029	-0.0184*	-0.0152*	-0.0171*	-0.0183*	-0.0181*	-0.0191**	-0.0171**	-0.0154**
	(0.170)	(-1.815)	(-1.807)	(-1.696)	(-1.806)	(-1.784)	(-2.444)	(-2.328)	(-2.271)
Total Asset	-0.1880	-0.0514	-0.0352	-0.1195	-0.1218	-0.1270	-0.1256	-0.1552*	-0.1478*
	(-1.051)	(-0.452)	(-0.365)	(-1.072)	(-1.076)	(-1.112)	(-1.430)	(-1.881)	(-1.940)
Independent Ratio	-0.0202	-0.0066	-0.0041	-0.0056	-0.0038	-0.0035	-0.0052	-0.0018	-0.0047
	(-1.131)	(-0.538)	(-0.488)	(-0.461)	(-0.304)	(-0.274)	(-0.530)	(-0.200)	(-0.554)
Board Size	0.0005	-0.0011*	-0.0008*	-0.0009	-0.0009	-0.0010*	-0.0005	-0.0002	-0.0004
	(0.498)	(-1.871)	(-1.842)	(-1.618)	(-1.631)	(-1.742)	(-1.203)	(-0.569)	(-0.971)
Board Female Ratio	-0.0449*	0.0058	0.0072	0.0090	0.0061	0.0089	0.0215*	0.0038	0.0001

	(-1.855)	(0.381)	(0.615)	(0.595)	(0.401)	(0.578)	(1.817)	(0.346)	(0.009)
Constant	0.0280	0.0417***	0.0264**	0.0412***	0.0412***	0.0416***	0.0291**	0.0281***	0.0261***
	(1.187)	(2.844)	(2.296)	(2.836)	(2.810)	(2.834)	(2.580)	(2.652)	(2.666)
R-squared	0.144	0.184	0.165	0.199	0.184	0.181	0.310	0.226	0.236
N	100	100	100	100	100	100	100	100	100

Table VI

The Effects of CEO Succession Plans on Long-term Firm Performance

The table presents the result estimated using CEO sudden death events. The sample includes CEO sudden death events with successor announcements and available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are the long-term buy and hold abnormal returns (BHARs). Column I to IV capture the BHARs around the death events in the window from (-1, +10). And Column V, VI and VII capture the event window of (-1, +21), (-1, +64) and (-1, +252), respectively. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Long-term BHAR							
	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +10)	(-1, +21)	(-1, +46)	(-1, +252)
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Succession Plan	0.0512**							
Mentioned in DEF 14A	(2.093)							
Succession Plan		0.0204*						
Mentioned in News Release		(1.727)						
Successor Announcement			0.0649**					
within 1-day			(2.524)					
Successor Announcement				0.0786***				
within 2-day				(2.867)				
Successor Announcement					0.0594**	0.1100**	0.2117**	0.4355**
within 3-day					(2.065)	(2.359)	(2.628)	(2.195)
Transitional Committee	-0.0177	0.0092	0.0191	0.0362	0.0195	0.0635	0.1494**	0.3612**
Formed	(-1.015)	(0.648)	(0.862)	(1.450)	(0.748)	(1.503)	(2.049)	(2.011)
Dead CEO Founder Title	-0.0649*	-0.0476*	-0.0634*	-0.0678**	-0.0643*	-0.1236**	-0.2438**	-0.3232
	(-1.858)	(-1.746)	(-1.871)	(-2.020)	(-1.861)	(-2.206)	(-2.521)	(-1.356)
Dead CEO Chairman Title	0.0056	0.0086	0.0104	0.0148	0.0070	0.0549*	0.1404**	0.2420*
	(0.276)	(0.442)	(0.529)	(0.758)	(0.352)	(1.708)	(2.529)	(1.770)
Dead CEO Age	-0.0001	-0.0000	-0.0002	-0.0001	0.0002	-0.0017	-0.0046	-0.0074
	(-0.067)	(-0.003)	(-0.194)	(-0.111)	(0.228)	(-1.012)	(-1.616)	(-1.062)
Dead CEO Tenure	0.0009	0.0014*	0.0008	0.0006	0.0005	0.0009	0.0024	0.0028
	(0.958)	(1.970)	(0.980)	(0.655)	(0.626)	(0.656)	(0.992)	(0.475)
ROA	0.0822	0.1142**	0.0736	0.0781	0.1027*	0.1255	0.1096	0.5618
	(1.393)	(2.252)	(1.288)	(1.385)	(1.794)	(1.353)	(0.684)	(1.423)
Total Asset	-0.4221	-0.4826	-0.0960	0.0060	-0.0520	-0.3517	-0.2661	2.0183
	(-0.640)	(-0.860)	(-0.152)	(0.009)	(-0.080)	(-0.332)	(-0.145)	(0.448)
Independent Ratio	-0.0509	-0.0311	-0.0663	-0.0937	-0.0649	-0.0820	-0.0097	-0.0475
	(-0.718)	(-0.606)	(-0.965)	(-1.342)	(-0.931)	(-0.726)	(-0.049)	(-0.099)
Board Size	-0.0007	-0.0008	-0.0018	-0.0023	-0.0007	0.0003	-0.0016	-0.0256
	(-0.205)	(-0.321)	(-0.554)	(-0.712)	(-0.204)	(0.065)	(-0.169)	(-1.131)
Board Female Ratio	-0.0174	-0.0121	-0.0310	-0.0088	-0.0177	-0.2486*	-0.2916	-0.4968

	(-0.197)	(-0.172)	(-0.359)	(-0.103)	(-0.201)	(-1.735)	(-1.178)	(-0.815)
Constant	0.0458	0.0020	0.0412	0.0423	0.0019	0.0748	0.0612	0.1579
	(0.537)	(0.029)	(0.500)	(0.519)	(0.023)	(0.555)	(0.263)	(0.276)
R-squared	0.094	0.123	0.146	0.163	0.132	0.165	0.204	0.141
N	100	100	100	100	100	100	100	100

Table VII

The Effects of CEO Successor Search Process Duration on Long-Term Firm Performance

The table presents the result estimated using CEO sudden death events. The sample includes CEO sudden death events with successor announcements and available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are the long-term buy and hold abnormal returns (BHARs). Column I, II, III and IV capture the BHARs around the death events in the window from (-1, +10), (-1, +21), (-1, +64) and (-1, +252), respectively. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Long-term BHAR			
	(-1, +10)	(-1, +21)	(-1, +64)	(-1, +252)
	(I)	(II)	(III)	(IV)
Log(Search Time+1)	-0.0133	-0.0258	-0.0685**	-0.1353**
	(-1.253)	(-1.600)	(-2.502)	(-2.252)
Dead CEO Founder Title	-0.0795	-0.2362*	-0.5139**	-0.9173**
	(-1.003)	(-1.953)	(-2.508)	(-2.038)
Dead CEO Chairman Title	0.0216	0.0643	0.1476	0.2581
	(0.561)	(1.096)	(1.486)	(1.183)
Dead CEO Age	-0.0020	-0.0025	-0.0024	-0.0029
	(-0.988)	(-0.793)	(-0.451)	(-0.247)
Dead CEO Tenure	0.0024	0.0059**	0.0112**	0.0184*
	(1.390)	(2.248)	(2.528)	(1.892)
ROA	0.1528	0.2609	0.2710	0.4331
	(1.425)	(1.595)	(0.978)	(0.712)
Total Asset	-0.9703	-1.8001	-1.7281	0.4335
	(-1.066)	(-1.297)	(-0.735)	(0.084)
Independent Ratio	-0.0288	0.0196	-0.0148	-0.4699
	(-0.210)	(0.094)	(-0.042)	(-0.605)
Board Size	0.0015	0.0129	0.0121	-0.0061
	(0.229)	(1.266)	(0.699)	(-0.160)
Board Female Ratio	-0.0742	-0.3281	-0.3655	-0.5920
	(-0.513)	(-1.487)	(-0.978)	(-0.721)
Constant	0.1317	-0.0096	-0.0629	0.3152
	(0.818)	(-0.039)	(-0.151)	(0.345)
R-squared	0.026	0.219	0.266	0.093
N	100	100	100	100

Table VIII

Succession Planning and the Risk of Delisting

The table presents the result estimated using CEO sudden death events. The sample includes CEO sudden death events with available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes, Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are the delisting dummies, which equal one if the firm delists after the death event within a year. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Risk of Delisting				
	(I)	(II)	(III)	(IV)	(V)
Succession Plan	-0.0588*				
Mentioned in DEF 14A	(-1.692)				
Successor Announcement		-0.0785**			
within 1-day		(-2.393)			
Successor Announcement			-0.0948**		
within 2-day			(-2.511)		
Successor Announcement				-0.0974**	
within 3-day				(-2.505)	
Transitional Committee					-0.1350***
Formed					(-2.842)
Dead CEO Founder Title	0.1251	0.1159	0.1205	0.1214	0.1158
	(0.839)	(0.821)	(0.860)	(0.871)	(0.851)
Dead CEO Chairman Title	0.0070	0.0071	0.0030	0.0040	0.0173
	(0.135)	(0.138)	(0.058)	(0.078)	(0.343)
Dead CEO Age	-0.0025	-0.0024	-0.0026	-0.0028	-0.0030
	(-0.842)	(-0.790)	(-0.871)	(-0.912)	(-1.007)
Dead CEO Tenure	-0.0010	-0.0009	-0.0005	-0.0005	-0.0007
	(-0.689)	(-0.654)	(-0.383)	(-0.332)	(-0.497)
ROA	-0.1541	-0.1521	-0.1578	-0.1550	-0.1695
	(-1.015)	(-0.959)	(-0.988)	(-0.974)	(-1.125)
Total Asset	3.2252	2.8761	2.7567	2.6715	3.1242
	(0.961)	(0.835)	(0.804)	(0.780)	(0.986)
Independent Ratio	0.1986	0.1976	0.2323	0.2409	0.1751
	(1.009)	(0.969)	(1.109)	(1.138)	(0.924)
Board Size	-0.0109	-0.0111	-0.0108	-0.0113	-0.0144
	(-1.172)	(-1.203)	(-1.182)	(-1.235)	(-1.574)
Board Female Ratio	-0.2133	-0.1616	-0.1730	-0.1396	-0.1033
	(-1.424)	(-1.125)	(-1.208)	(-1.011)	(-0.776)
Constant	0.2040	0.2002	0.1942	0.1985	0.3121
	(0.762)	(0.751)	(0.735)	(0.750)	(1.184)
R-squared	0.097	0.104	0.115	0.116	0.155
N	115	115	115	115	115

Table IX

Does Succession Plan for CEO Create Value?

The table presents the result estimated using CEO sudden death events. The sample includes CEO sudden death events with available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes, Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are the cumulative abnormal returns (CARs). Column I, II, III and IV capture the CARs around the death events in the window from (-1, +5). Column V, VI and VII capture the CARs around the death events in the window from (-1, +3), (-1, +4) and (-1, +5), respectively. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	CAR							
	(-1, +5)	(-1, +5)	(-1, +5)	(-1, +5)	(-1, +5)	(-1, +3)	(-1, +4)	(-1, +5)
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Succession Plan	0.0177**							
Mentioned in DEF 14A	(2.121)							
Succession Plan		0.0175**						
Mentioned in News Release		(2.334)						
Successor Announcement			0.0535**			0.0500**		
within 1-day			(2.349)			(2.369)		
Successor Announcement				0.0617**			0.0570**	
within 2-day				(2.529)			(2.478)	
Successor Announcement					0.0530**			0.0530**
within 3-day					(2.115)			(2.115)
Transitional Committee	-0.0142	-0.0001	0.0159	0.0279	0.0224	0.0080	0.0205	0.0224
Formed	(-0.921)	(-0.016)	(0.809)	(1.256)	(0.983)	(0.439)	(0.980)	(0.983)
Dead CEO Founder Title	-0.0242	-0.0156	-0.0228	-0.0263	-0.0265	-0.0154	-0.0160	-0.0265
	(-0.783)	(-1.380)	(-0.759)	(-0.880)	(-0.879)	(-0.554)	(-0.568)	(-0.879)
Dead CEO Chairman Title	0.0102	-0.0188**	0.0141	0.0174	0.0158	0.0129	0.0172	0.0158
	(0.574)	(-2.333)	(0.812)	(1.000)	(0.899)	(0.800)	(1.047)	(0.899)
Dead CEO Age	-0.0008	0.0005	-0.0009	-0.0008	-0.0008	-0.0013	-0.0014	-0.0008
	(-0.835)	(1.478)	(-0.961)	(-0.887)	(-0.808)	(-1.493)	(-1.525)	(-0.808)
Dead CEO Tenure	0.0004	0.0003	0.0004	0.0002	0.0002	0.0009	0.0005	0.0002
	(0.489)	(0.886)	(0.494)	(0.204)	(0.207)	(1.243)	(0.643)	(0.207)
ROA	0.0416	0.0121	0.0324	0.0366	0.0365	0.0029	0.0076	0.0365
	(0.798)	(0.578)	(0.641)	(0.729)	(0.720)	(0.061)	(0.160)	(0.720)
Total Asset	-0.6325	-0.3671	-0.3984	-0.3260	-0.3181	-0.4551	-0.2834	-0.3181
	(-1.085)	(-1.581)	(-0.711)	(-0.581)	(-0.557)	(-0.876)	(-0.536)	(-0.557)
Independent Ratio	0.0088	-0.0080	-0.0072	-0.0276	-0.0251	-0.0366	-0.0502	-0.0251
	(0.141)	(-0.374)	(-0.118)	(-0.445)	(-0.397)	(-0.650)	(-0.858)	(-0.397)
Board Size	0.0024	0.0011	0.0013	0.0010	0.0016	0.0013	-0.0004	0.0016
	(0.828)	(1.050)	(0.466)	(0.350)	(0.544)	(0.502)	(-0.145)	(0.544)
Board Female Ratio	-0.0108	0.0040	-0.0214	-0.0035	-0.0221	0.0009	0.0066	-0.0221

	(-0.138)	(0.138)	(-0.280)	(-0.046)	(-0.288)	(0.013)	(0.092)	(-0.288)
Constant	0.0255	-0.0265	0.0239	0.0246	0.0215	0.0737	0.0930	0.0215
	(0.338)	(-0.918)	(0.327)	(0.339)	(0.293)	(1.088)	(1.358)	(0.293)
R-squared	0.061	0.142	0.112	0.120	0.102	0.135	0.126	0.102
N	100	100	100	100	100	100	100	100

Table X

Succession Planning and the Return Volatility: Different Volatility Measures

The table presents the result estimated using all CEO turnover events among S&P1500 firms and all CEO death turnovers among all US listed firms from 1994 to 2014. The sample includes CEO turnover and death events with successor announcements and available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes Compustat for firm fundamentals and CRSP for stock returns. The dependent variables for Column I and III are implied volatility for 20 trading days after the CEO turnover or death event; the dependent variables for Column II and IV are implied volatility for 252 trading days after the CEO turnover or death event. And, the dependent variables for Column V and VII are the realized volatility for 20 trading days after the CEO turnover or death event; the dependent variables for Column VI and VIII are the realized volatility for 252 trading days after the CEO turnover or death event. The sample of Column I, II, V and VI consist all CEO turnover events among S&P1500 firms, and the sample of Column III, IV, VII and VIII consist all CEO death turnovers among all US listed firms. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Volatility Measures							
	Implied Volatility				Realized Volatility			
	SP1500 Sample		Deaths Sample		SP1500 Sample		Deaths Sample	
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Succession Plan	-0.0258*	-0.0320**	-0.2889*	-0.1937	-0.0499**	-0.0288*	-0.3225*	-0.1185
Mentioned in DEF 14A	(-1.843)	(-2.124)	(-1.827)	(-1.501)	(-2.382)	(-1.870)	(-1.704)	(-1.040)
Incumbent CEO:								
Founder Title	0.0343	0.0367	-0.1882*	-0.1149	0.0917**	0.0734**	-0.0676	-0.0687
	(1.434)	(1.479)	(-1.806)	(-1.040)	(2.399)	(2.534)	(-0.426)	(-0.745)
Chairman Title	0.0061	0.0145	-0.0679	0.0578	0.0138	0.0261	-0.0515	-0.0091
	(0.259)	(0.560)	(-0.636)	(0.749)	(0.333)	(0.965)	(-0.646)	(-0.117)
Age	-0.0025**	-0.0017*	0.0040	-0.0010	-0.0026*	-0.0029**	0.0082	0.0015
	(-2.451)	(-1.653)	(0.508)	(-0.167)	(-1.730)	(-2.513)	(0.758)	(0.243)
Tenure	-0.0028***	-0.0028***	-0.0005	0.0023	-0.0030***	-0.0033***	0.0027	0.0042
	(-4.773)	(-4.182)	(-0.161)	(0.679)	(-3.282)	(-5.407)	(0.665)	(1.131)
Firm Controls								
ROA	-0.4364***	-0.3726***	0.0078	-0.3597	-0.5640***	-0.4483***	0.3711	-0.0532
	(-6.492)	(-4.599)	(0.027)	(-1.127)	(-5.530)	(-5.942)	(1.220)	(-0.295)
Total Asset	0.0000	0.0000	1.9552	1.4526	0.0000	0.0000	2.1930	-0.3116
	(0.638)	(0.748)	(0.572)	(0.567)	(0.860)	(0.705)	(0.538)	(-0.134)
Independent Ratio	-0.2735***	-0.2375***	0.4201	0.1146	-0.2554***	-0.2742***	0.5238	0.1007
	(-6.988)	(-5.416)	(0.822)	(0.239)	(-4.070)	(-5.975)	(0.986)	(0.303)
Board Size	-0.0153***	-0.0138***	0.0026	0.0055	-0.0146***	-0.0125***	0.0538	0.0085
	(-4.753)	(-4.331)	(0.080)	(0.217)	(-3.398)	(-3.632)	(1.445)	(0.392)
Board Female Ratio	-0.0206	-0.0527	-0.7028	-0.5208	-0.0772	-0.0225	-1.8900	-0.5414
	(-0.255)	(-0.649)	(-0.387)	(-0.382)	(-0.618)	(-0.255)	(-0.872)	(-0.451)
Constant	1.0347***	0.9286***	0.0291	0.3776	1.0345***	1.0313***	-0.8487	0.1620
	(16.948)	(13.764)	(0.032)	(0.532)	(10.899)	(13.394)	(-0.830)	(0.265)
Fixed Effect	Industry	Industry	No	No	Industry	Industry	No	No
R-squared	0.334	0.317	0.341	0.380	0.216	0.282	0.310	0.307
N	970	756	30	25	981	981	30	30

Table XI

Announcement Effects of Interim vs. Permanent Successor

The table presents the result estimated using CEO death events. I illustrate CARs at the announcement of CEO deaths, interim successor appointment and permanent successor appointment. I compare the effect (CARs) of appointing a permanent CEO directly versus appointing an interim CEO firstly and then appointing the same person as a permanent successor. This empirical test was designed to examine the impact of Milgrom (2008) versus Beyer and Guttman (2012) and the impact of strategic disclosure.

	CEO Sample			
	Deaths Announcement	**Interim Successor Announcement**	**Permanent Successor Announcement**	**Full Effect**
	Full Sample			
Interim Successor Sample				
# of Observations	*136*	*135*	*109*	
Announcement CAR (-1, +1)	-0.431%	-0.454%	4.589%	3.703%
Direct Successor Sample				
# of Observations	*146*		*141*	
Announcement CAR (-1, +1)	0.186%		1.472%	1.658%
	Sudden Deaths Sample			
Interim Successor Sample				
# of Observations	*70*	*69*	*55*	
Announcement CAR (-1, +1)	0.584%	0.133%	7.368%	8.085%
Direct Successor Sample				
# of Observations	*75*		*70*	
Announcement CAR (-1, +1)	-1.329%		1.049%	-0.280%
	Non-Sudden Deaths Sample			
Interim Successor Sample				
# of Observations	*66*	*66*	*54*	
Announcement CAR (-1, +1)	-1.882%	-1.020%	0.800%	-2.102%
Direct Successor Sample				
# of Observations	*71*		*71*	
Announcement CAR (-1, +1)	1.494%		1.837%	3.331%

Table XII

Announcement Effects of Interim vs. Permanent Successor

The table presents the result estimated using CEO sudden death events. The sample includes CEO sudden death events with permanent successor announcements directly or with the interim successor announcements where the permanent successors are the same as the interim successors. This sample requires available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes, Compustat for firm fundamentals and CRSP for stock returns. The dependent variables are the long-term buy and hold abnormal returns (BHARs). Column I, II, III and IV capture the BHARs around the death events in the window from (-1, +10), (-1, +21), (-1, +64) and (-1, +252), respectively. The interim announcement dummy is a dummy, which equals to one if there is interim CEO successor announced. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Long-term BHAR			
	(-1, +10)	(-1, +21)	(-1, +46)	(-1, +252)
	(I)	(II)	(III)	(IV)
Interim Announcement	0.0557**	0.0777*	0.1076	0.1395
Dummy	(2.094)	(1.694)	(1.382)	(0.791)
Dead CEO Founder Title	-0.0629	-0.1590	-0.3706	-0.7453
	(-1.152)	(-1.287)	(-1.436)	(-1.588)
Dead CEO Chairman Title	0.0010	0.0288	0.1097	0.0477
	(0.030)	(0.407)	(0.881)	(0.203)
Dead CEO Age	-0.0030*	-0.0031	-0.0025	0.0012
	(-1.790)	(-0.934)	(-0.416)	(0.098)
Dead CEO Tenure	0.0024	0.0035	0.0071	0.0099
	(1.487)	(1.176)	(1.471)	(0.969)
ROA	0.1328	0.0649	-0.3091	-0.0107
	(1.057)	(0.338)	(-0.673)	(-0.015)
Total Asset	-1.2060**	-1.8572**	-1.1954	0.7959
	(-2.507)	(-2.569)	(-0.811)	(0.302)
Independent Ratio	-0.0431	-0.0135	0.1016	-0.0091
	(-0.344)	(-0.069)	(0.267)	(-0.011)
Board Size	0.0018	0.0112	0.0209	0.0239
	(0.233)	(0.842)	(1.215)	(0.678)
Board Female Ratio	0.0757	0.0307	-0.3414	-0.6672
	(0.375)	(0.095)	(-0.464)	(-0.497)
Constant	0.1691	0.0573	-0.2196	-0.4467
	(1.164)	(0.234)	(-0.499)	(-0.522)
R-squared	0.01	0.01	0.01	0.01
N	100	100	100	100

Table XIII

Organizational Capital and the Importance of Succession Plan

The table presents the effects of CEO succession plan on uncertainty resolution during CEO turnover events among different types of firms. The sample includes all non-financial firms from 1996 to 2013 with available information available information in ExecuComp/Capital IQ for incumbent CEO related variables, BoardEx and RiskMetrics for board and corporate governance related attributes, Compustat for firm fundamentals and CRSP for stock returns. The firms are divided into two sub-samples according to dependence on their executive talent and human capital, measured by their SG&A ranking and CEO key risk factor. The dependent variables for Column I, II, III and IV are idiosyncratic risks for 20 trading days after the CEO turnover event; Column V, VI, VII and VIII are implied volatility for 20 trading days after the CEO turnover event, and the dependent variables for Column IX, X, XI and XII are the realized volatility for 20 trading days after the CEO turnover event. All regressions include a constant. All standard errors are clustered at firm level. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Idiosyncratic Return Volatility				Implied Volatility				Realized Volatility			
Portfolio	SG&A Ranking		CEO Key Risk Factor		SG&A Ranking		CEO Key Risk Factor		SG&A Ranking		CEO Key Risk Factor	
	Low	High	No	Yes	Low	High	No	Yes	Low	High	No	Yes
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Succession Plan	0.0011	-0.0040**	-0.0021	-0.0027*	-0.0146	-0.0312	-0.0006	-0.0430*	0.0168	-0.0397	-0.0303	-0.0541*
Mentioned in DEF 14/	(0.604)	(-2.233)	(-1.340)	(-1.722)	(-0.471)	(-0.895)	(-0.026)	(-1.951)	(0.326)	(-0.897)	(-0.947)	(-1.725)
Incumbent CEO	0.0011	0.0033	0.0020	0.0036	0.0283	0.0651	0.0174	0.0347	0.0900	0.1182*	0.1242	0.0582
Founder Title	(0.413)	(0.929)	(1.040)	(1.139)	(0.576)	(1.236)	(0.385)	(1.095)	(1.413)	(1.761)	(1.508)	(1.286)
Incumbent CEO	-0.0001	0.0004	-0.0007	-0.0010	0.0041	0.1281*	0.0341	-0.0132	0.0347	0.1946	0.1148	-0.0175
Chairman Title	(-0.057)	(0.123)	(-0.413)	(-0.412)	(0.101)	(1.871)	(0.762)	(-0.570)	(0.644)	(1.288)	(1.177)	(-0.352)
Incumbent CEO	-0.0003***	-0.0002	-0.0003**	-0.0001	-0.0002	-0.0004	-0.0009	-0.0023	0.0039	-0.0019	-0.0012	-0.0017
Age	(-2.767)	(-1.220)	(-2.403)	(-1.460)	(-0.109)	(-0.205)	(-0.585)	(-1.516)	(1.086)	(-0.706)	(-0.548)	(-0.717)
Incumbent CEO	-0.0000	-0.0002**	-0.0002***	-0.0002***	-0.0018*	-0.0055***	-0.0028***	-0.0032***	-0.0027*	-0.0047**	-0.0034**	-0.0028***
Tenure	(-0.717)	(-2.281)	(-3.516)	(-2.822)	(-1.699)	(-3.396)	(-2.740)	(-3.919)	(-1.831)	(-2.033)	(-2.174)	(-2.655)
ROA	-0.0660***	-0.0347***	-0.0328***	-0.0300***	-0.8456***	-0.4582***	-0.5173***	-0.4754***	-0.7455**	-0.6696***	-0.6421***	-0.3267
	(-4.246)	(-3.779)	(-2.662)	(-5.241)	(-3.210)	(-3.217)	(-3.899)	(-2.657)	(-2.440)	(-2.930)	(-3.175)	(-1.567)
Total Asset	-0.0000**	0.0000	-0.0000	0.0000	-0.0000**	-0.0000	0.0000	-0.0000	-0.0000	0.0000	0.0000	-0.0000
	(-2.047)	(1.102)	(-1.461)	(1.065)	(-1.984)	(-0.720)	(0.798)	(-0.312)	(-0.805)	(0.073)	(1.431)	(-0.935)
Independent Ratio	-0.0127**	-0.0263***	-0.0173***	-0.0140***	-0.1653	-0.2500**	-0.2289***	-0.2842***	-0.0893	-0.2535	-0.1967*	-0.1891*
	(-2.358)	(-3.471)	(-4.421)	(-2.788)	(-1.655)	(-2.525)	(-3.380)	(-4.734)	(-0.551)	(-1.649)	(-1.847)	(-1.842)
Board Size	-0.0006	-0.0010**	-0.0011***	-0.0011***	-0.0071	-0.0106	-0.0190***	-0.0151***	-0.0178*	-0.0058	-0.0216**	-0.0153**
	(-1.350)	(-2.190)	(-3.649)	(-2.892)	(-1.046)	(-1.461)	(-3.244)	(-3.511)	(-1.765)	(-0.453)	(-2.549)	(-2.389)
Board Female Ratio	-0.0055	0.0095	0.0028	-0.0045	-0.0834	-0.2384	-0.1998*	0.2177*	-0.3419	-0.0698	-0.3498**	0.1691
	(-0.411)	(0.731)	(0.357)	(-0.621)	(-0.332)	(-1.163)	(-1.868)	(1.697)	(-0.814)	(-0.256)	(-2.338)	(0.766)
Constant	0.0684***	0.0723***	0.0712***	0.0588***	0.8016***	0.9400***	0.9638***	1.0251***	0.6000***	0.9642***	0.9949***	0.8867***
	(7.321)	(5.377)	(8.766)	(9.257)	(5.362)	(6.079)	(9.778)	(9.991)	(2.738)	(4.190)	(6.707)	(5.981)
Fixed Effect	Industry	Industry	Industry	Industry	Industry	Industry	Industry	Industry	Industry	Industry	Industry	Industry
R-squared	0.397	0.385	0.251	0.281	0.432	0.542	0.381	0.392	0.270	0.398	0.352	0.195
N	303	336	702	621	207	212	421	428	210	214	426	432

3.6 Appendix

3.6-A.1 Variable Definitions

Table 3.6-A1-1

Definitions of Variables

Variables	Definitions	Source
CEO Characteristics		
CEO Age	The age of CEO.	Execucomp/RiskMetrics/ BoardEx/Capital IQ/Edgar
CEO Female	Indicator that equals one if the CEO is female, and equals zero otherwise.	Execucomp and etc.
CEO Tenure	One plus the total number of years a CEO has been the CEO in certain Firm and calculated fiscal year end date minus date became CEO	Execucomp/RiskMetrics/ BoardEx/Capital IQ/Edgar
Founding CEO	Indicator that equals one if the CEO is the founder, co-founder or founding partner of the firm, and equals zero otherwise.	BoardEx
CEO Voting Power	Percent ownership of the CEO in the firm.	RiskMetrics
CEO Network Size	The number of social connections the CEO has outside the firm	BoardEx
# of Outside Positions	Number of additional public firm positions identified by RiskMetrics, BoardEx and Capital IQ data set.	Execucomp and etc.
Total CEO pay	Total CEO compensation (including value of option grants), in million, divided by total assets.	Execucomp
CEO turnover	Indicator that equals one if a change in the CEO has occurred compared to the previous year, and equals zero otherwise.	Execucomp
Outsider CEO	Indicator that equals one if the CEO is promoted outside the firm, and equals zero otherwise.	
Board Characteristics		
Board Size	The number of directors on the board.	RiskMetrics
Board Female	Percent of Female Directors on the board.	
Independent Ratio	Percent of independent directors on the board.	RiskMetrics
CEO-Chairman Duality	Indicator that equals one if the CEO is also the chairperson of the board and equals zero otherwise.	RiskMetrics
Busy Board	Indicator variable that equals one if a majority of the independent outside directors each hold 3 or more additional directorships and equals zero otherwise.	RiskMetrics
Nominating Committee (NC) Characteristics		
Founder on NC	Indicator that equals one if the found sits on the nominating committee and equals zero otherwise..	
Chairman on NC	Indicator that equals one if the chairman sits on the nominating committee and equals zero otherwise..	
Chairman or Lead Independent Director on NC	Indicator that equals one if the chairman or lead independent director sits on the nominating committee and equals zero otherwise.	BoardEx (2004-2013)
Firm Characteristics		

Tobin's Q	The market value of common equity plus the book value of total liabilities divided by the book value of total assets. [(at + (prcc_f*csho) - ceq - txdb)/at]	Compustat
ROA	Ratio of net income to total assets. ROA (%) is ROA expressed as a percent of total assets. [oibdp/at]	Compustat
Earnings Volatility	Standard deviation of annual EBIT scaled by beginning of year total assets over the past five years	
R&D	The ratio of research and development (R&D) expenditures to total asset. Missing observations are set to zero. [xrd / at]	
R&D Missing	Indicator that equals one if the ratio of research and development (R&D) expenditures is missing, and equals zero otherwise.	
Leverage	Year-ending Long-term Debt plus Debt in Current Liabilities divided by year-end Total Assets. [(dltt + dlc)/at]	Compustat
Capital Expenditure	The ratio of capital expenditure to total assets. [capex/at]	Compustat
E-index	Calculated using staggered board, poison pill, limits to amend bylaws, limits to amend charter, supermajority and golden parachutes based on Bebchuk, Cohen and Ferrell (2009).	RiskMetrics
Family Firm	Standard deviation of daily excess returns expressed in percent in a given year, following	
Institutional Ownership	Total percentage institutional ownership. Institutional block equals one if the firm has a 5% institutional blockholder.	Thomson Reuters.
High-tech indicator	Indicator that equals one if the high-tech firms are identified by SIC codes 2833-2836, 3570-3577, 3600-3674, 7371-7379 or 8731-8734, following Baginski et al. (2004), and equals zero otherwise.	Compustat
Firm age	Natural logarithm of one plus the number of years from the firm's IPO or log of one plus the number of years since its first appearance in CRSP.	CRSP/CIQ/SDC and etc.
Stock Return Volatility	Following Pan et al. (2015)	
Stock Performance Standard Deviation	Standard deviation of monthly excess returns in a given fiscal year.	CRSP
Realized Stock Volatility	Standard deviation of daily stock returns	CRSP
Idiosyncratic Return Volatility	Calculated volatility of the residual daily stock returns of market model following Ang et al. (2006) and Knyazeva, Knyazeva and Masulis (2013).	
Option Implied Volatility	Implied volatility calculated based on the daily prices of the thirty-day at-the-money call options written on the firm's common stock.	OptionMetrics
Death Related		
Takeover interest (indicator)	Indicator that equals one if rumors exist that the firm will be taken over after the death of the executive, and equals zero otherwise.	
Sudden deaths	Indicator that equals one if death of directors or officer is unexpected, and equals zero otherwise. Sudden death is defined as "an unexpected death that occurs instantaneously or within 24 hours of an abrupt change in the person's previous clinical state" (Nguyen and Nielsen (2010)). To include deaths that are sudden and not expected by the stock market, Nguyen and Nielsen (2010) exclude deaths attributed to cancer, complications from illness, past strokes, and surgery.	
Succession Plan Proxies		
CEO Appointments within 3 Days following a Death Event	The dummy variable equals to one if the successor is appointed within 3 days after the CEO death event, and equals zero otherwise.	
Succession Planning Mentioned in Proxy Statement	The dummy variable equals to one if succession planning is mentioned in its DEF14A before the CEO succession events, and equals zero otherwise.	

Revealed succession planning in News Release	The dummy variable equals to one if a news article or firm announcement references a succession plan in appointing the successor, and equals zero otherwise.
Directors with Succession Planning Experience	The dummy variable equals to one if the director has seat in the nominating committees of the firms mentioning succession planning in their proxy statement, and equals zero otherwise.
Directors with CEO Turnover Experience	The dummy variable equals to one if the director has experienced a CEO turnover in her/his director career, and equals zero otherwise.

3.6-A.2 Voting Results Related to Succession Planning Proposal

Table 3.6-A1-2
Voting Results Related to Succession Planning Proposal

Name	Year	Sponsor	MGMT Rec	ISS Rec	Voted For	Vote Result
Apple Inc.	2011	Central Laborers Pension Fund	Against	For	18.70%	Fail
Bank of America	2001	Bouhadiba, Omar	Against			Fail
Bank of America Corporation	2008	Laborers' International Union of NA	Against			Fail
Bank of America Corporation	2010	Laborers National Staff Pension Fund	Against	For	26.31%	Fail
Bank of America Corporation	2010	Connecticut Retirement Plans & Trust Funds	Against			Fail
Bank of America Corporation	2010	Laborers' International Union of NA	Against		40.10%	Fail
Berkshire Hathaway Inc.	2012	The AFL-CIO Reserve Fund	Against	For	3.09%	Fail
Citigroup Inc.	2009	Central Laborers' Pension, Welfare & Annuity Fund	Against			Fail
Comcast Corporation	2010	Central Laborers' Pension	Against	For	12.18%	Fail
FedEx Corporation	2010	Massachusetts Laborers' Pension Fund	Against	For	19.10%	Fail
Fedex Corporation	2010	unknown	Against		23.80%	Fail
Fortune Brands, Inc.	2009	Central Laborers' Pension, Welfare & Annuity Fund	Against			Fail
Google Inc.	2013	Laborers' District Council and Contractors' Pension Fund of Ohio	Against	For	5.88%	Fail
Intel Corporation	2010	United for a Fair Economy/Resp. Wealth	Against			Fail
Kohl's Corporation	2011	Trustee of Trowel Trades S&P 500 Index Fund	Against	For	19.65%	Fail
Kohl's Corporation	2012	Trowel Trades S&P 500 Index Fund of the International Union of Bricklayers and Allied Craftworkers	Against	For	14.90%	Fail
Meritage Homes Corp	2008	Laborers' International Union of NA	Against			Fail
National Instruments Corporation	2009	Laborers' International Union of NA	Against			Fail
Pinnacle Entertainment, Inc.	2009	Laborers District Council & Contractors Pension Fund of OH	Against			Fail
Safeway Inc.	2012	Laborers National Pension Fund	Against	For	23.25%	Fail
Sirius XM Holdings, Inc.	2013	The Central Laborers' Pension Fund	Against	For	6.45%	Fail
SOTHEBY'S	2012	NOT DISCLOSED	Against	For	28.83%	Fail
The Black & Decker Corporation	2009	Massachusetts Laborers' Pension Fund	Against			Fail
Toll Brothers, Inc.	2008	Laborers' International Union of NA	Against			Fail
United Natural Foods, Inc.	2011	International Brotherhood of Teamsters T.A.P.P. Fund	Against	For	25.64%	Fail
Verizon Communications	2008	Laborers' International Union of NA	Against			Fail
Verizon Communications Inc.	2010	Laborers Staff & Affiliates Pension Fund	Against	For	20.62%	Fail
Verizon Communications Inc.	2010	Laborers' International Union of NA	Against		32.40%	Fail
Whole Foods Market, Inc.	2009	Laborers' International Union of NA	Against			Fail
Whole Foods Market, Inc.	2010	Central Laborers' Pension	Against	For	20.08%	Fail
Whole Foods Market, Inc.	2010	Laborers' International Union of NA	Against		29.40%	Fail
Zions Bancorporation	2009	Laborers' International Union of NA	Against			Fail

3.6-A.3 Creation of CEO Death Sample

Similar to the method used to collect director death sample discussed in Chapter 2, I use a variety of sources to identify CEO deaths events. I identify death events from three sources: 8-K filings (1993-2014)[45], BoardEx (1999-2013) and the Notable Names Database (1900-2015). 8-K filings were the primary source examined, this data source is selected as it is a comprehensive source for firm disclosures required by the SEC for major events, including director and executive changes. I examine all electronically available 8-Ks via the Edgar database[46], as it is ideally structured for the use of computational searches, such as web scrapping and text matching techniques. Firms disclose key employee deaths through a variety of mediums and in no standard way format. My initial sample contains over 1.2 million documents (observations), making manual examination challenging. To provide scalability to the search process, I use a textual analysis approach. like a number of existing papers use keyword searches (Nguyen and Nielsen 2010; Falato, Kadyrzhanova, and Lel 2013; Nguyen and Nielsen 2014); I extend on the keyword search approach, using natural language processing techniques. This result is the development of the largest death sample, 181 unique CEO sudden deaths, spanning the longest sample period, 1900 – 2014, to the best of our knowledge.

A potential concern is non-disclosure of CEO deaths prior to 2006, because of no formal requirement to report director and executive departures. SEC requires via *Item 5.02, Departure of Directors or Principal Officers; Election of Directors; Appointment of Principal Officers*. However, despite this "Item 5.02(b) of Form 8-K does not require a registrant to report the death of a director or listed officer (April 2, 2008)"[47] Therefore, I supplement our examination with the other data sets (e.g. Capital IQ Key Development) to ensure a comprehensive search. BoardEx is used as it captures changes in board structure, including hiring and departures as well as the reason for the changes. To further extend the search I use Notable Names Database (NNDB)[48], which is a data source on people of influence, it is included as it captures information on deaths of individuals who are in positions of influence but do not receive public attention. This source

[45] 2014 1st Quarter

[46] The Edgar database captures all 8-K forms filed after May 6th, 1996. This represents over 1.2 million 8-K forms filed by public companies. See Table X.

[47] http://www.sec.gov/divisions/corpfin/guidance/8-kinterp.htm (May 16, 2013 update) provides guidance of the SEC's interpretation of 8-K reporting requirements. See Section 217.04.

[48] http://www.nndb.com/about/. NNDB includes the deaths of "holders of certain public offices, civic, or business positions. In some cases, people of importance may have escaped public notice yet may hold a position of substantial power. Thus, I may select a member of the board of directors of a specific company for listing."

is included to overcome concerns about capturing only directors and executives that receive media coverage (for example, large firms and powerful executives and directors).

To supplement and verify information on the deceased directors and officers I use a number of sources including; Marquis Who's Who, Wikipedia, Factiva, Lexis Nexis, Business Week, Bloomberg, Legacy.com, search.ancenstry.com, and company websites. These sources are primarily used to verify date and cause of death.

3.6-A.4 Supplementary Tests for Executive Death Sample

Table 3.6-A4-1

Does Succession Plan for Top Executives Create Value?

The table presents the result estimated using executive deaths. The sample includes 323 executive death events with available information in COMPUSAT and CRSP. The dependent variables are the cumulative abnormal returns (CAR). Column I, II and III capture the CARs around the death events in the window from (-1, +3). Column IV, V and VI capture the CARs around the death events in the window from (-1, +3), (-1, +4) and (-1, +5), respectively. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	CAR					
	(-1, +3)	(-1, +3)	(-1, +3)	(-1, +3)	(-1, +4)	(-1, +5)
	(I)	(II)	(III)	(IV)	(V)	(VI)
Successor Announcement	0.0267*			0.0309**		
within 1-day	(1.675)			(2.247)		
Successor Announcement		0.0290*			0.0264*	
within 2-day		(1.808)			(1.736)	
Successor Announcement			0.0228			0.0239
within 3-day			(1.508)			(1.492)
No Successor	0.0003	0.0027	0.0020	0.0002	0.0031	0.0010
Announcement	(0.026)	(0.219)	(0.171)	(0.017)	(0.264)	(0.076)
Dead Executive Founder Title	-0.0057	-0.0058	-0.0058	-0.0084	-0.0058	-0.0060
	(-0.359)	(-0.366)	(-0.388)	(-0.616)	(-0.388)	(-0.375)
Dead Executive Chairman Title	0.0142	0.0149	0.0105	0.0088	0.0110	0.0144
	(1.549)	(1.626)	(1.218)	(1.114)	(1.268)	(1.573)
Dead Executive CEO Title	-0.0124	-0.0136	-0.0073	-0.0111	-0.0077	-0.0129
	(-1.260)	(-1.371)	(-0.777)	(-1.306)	(-0.828)	(-1.306)
Dead Executive Age	-0.0008*	-0.0008*	-0.0009**	-0.0007*	-0.0009**	-0.0008*
	(-1.692)	(-1.667)	(-2.027)	(-1.755)	(-2.012)	(-1.690)
Dead Executive Tenure	0.0003	0.0002	0.0003	0.0002	0.0003	0.0003
	(0.746)	(0.665)	(0.821)	(0.695)	(0.777)	(0.716)
ROA	-0.0405	-0.0395	-0.0510*	-0.0563**	-0.0503*	-0.0403
	(-1.316)	(-1.284)	(-1.750)	(-2.120)	(-1.727)	(-1.309)
Total Asset ($Trillion)	-0.0795	-0.0779	-0.1218	-0.1388	-0.1207	-0.0796
	(-0.603)	(-0.592)	(-0.977)	(-1.223)	(-0.970)	(-0.604)
Independent Ratio	-0.0830***	-0.0851***	-0.0955***	-0.0881***	-0.0958***	-0.0846***
	(-2.934)	(-3.002)	(-3.556)	(-3.610)	(-3.574)	(-2.975)
Board Size	0.0022	0.0022	0.0011	0.0007	0.0010	0.0023
	(1.413)	(1.399)	(0.713)	(0.490)	(0.663)	(1.458)
Board Female Ratio	0.0781*	0.0821*	0.0915**	0.0688*	0.0939**	0.0792*
	(1.875)	(1.964)	(2.319)	(1.918)	(2.376)	(1.896)
CEO-Chairman	-0.0083	-0.0078	-0.0063	-0.0005	-0.0058	-0.0084
	(-0.989)	(-0.928)	(-0.791)	(-0.074)	(-0.729)	(-0.996)
Constant	0.0889**	0.0871**	0.1165***	0.1071***	0.1154***	0.0889**
	(2.244)	(2.197)	(3.099)	(3.137)	(3.077)	(2.235)
R-squared	0.076	0.077	0.090	0.098	0.092	0.074
N	323	323	323	323	323	323

Table 3.6-A4-2

The Effects of Top Executives Succession Plans on Long-Term Firm Performance

The table presents the result estimated using executive deaths. The sample includes 322 executive death events with available information in COMPUSAT and CRSP. The dependent variables are the cumulative abnormal returns (CAR). Column I, II, III and IV capture the CARs around the death events in the window from (-1, +10), (-1, +21), (-1, +64) and (-1, +252), respectively. All regressions include a constant. All standard errors are White Robust Standard Errors. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Long-term BHAR			
	(-1, +10)	(-1, +21)	(-1, +64)	(-1, +252)
	(I)	(II)	(III)	(IV)
Successor Announcement	0.0217	0.0588**	0.1352***	0.2741**
within 3-day	(1.103)	(2.072)	(2.711)	(2.084)
No Successor	-0.0056	0.0251	0.0486	0.0770
Announcement	(-0.357)	(1.118)	(1.232)	(0.739)
Dead Executive Founder Title	-0.0115	-0.0457	-0.0633	-0.1179
	(-0.592)	(-1.630)	(-1.285)	(-0.908)
Dead Executive Chairman Title	0.0026	0.0381**	0.0687**	0.1319*
	(0.234)	(2.372)	(2.431)	(1.770)
Dead Executive CEO Title	-0.0064	-0.0270	-0.0699**	-0.1043
	(-0.528)	(-1.551)	(-2.287)	(-1.293)
Dead Executive Age	-0.0009	-0.0014*	-0.0052***	-0.0107***
	(-1.581)	(-1.785)	(-3.692)	(-2.882)
Dead Executive Tenure	0.0006	0.0002	0.0013	0.0020
	(1.367)	(0.373)	(1.146)	(0.680)
ROA	0.0174	0.0668	-0.0356	0.1659
	(0.467)	(1.238)	(-0.375)	(0.664)
Total Asset	-0.0338	0.0132	0.2125	1.5137
	(-0.210)	(0.057)	(0.521)	(1.406)
Independent Ratio	-0.1011***	-0.1178**	-0.1708*	-0.2881
	(-2.926)	(-2.361)	(-1.948)	(-1.246)
Board Size	0.0007	-0.0020	-0.0007	-0.0080
	(0.338)	(-0.729)	(-0.137)	(-0.616)
Board Female Ratio	0.0288	-0.0407	-0.0908	-0.0181
	(0.564)	(-0.554)	(-0.702)	(-0.053)
Constant	0.1205**	0.1723**	0.4069***	0.7754**
	(2.510)	(2.485)	(3.340)	(2.413)
R-squared	0.050	0.069	0.097	0.065
N	322	322	322	322

Chapter 4

Name Bias

Abstract[49]

In this chapter, I document the impact of investor attention and sentiment on stock performance. To do so, I break a company's name into constituent words (name-terms) and compute the weekly unexpected Internet search volume for name-term news that is unrelated to the company. Using the resulting measure, I find that an increase in unexpected name-term attention increases both return volatility and trading in linked securities. Furthermore, consistent with prospect theory, stock returns are low when name-term sentiment is negative, but are not affected by positive name-term sentiment. I provide suggestive evidence that institutional investors trade stocks to take advantage of the prevailing sentiment trends. My results are in line with limited attention theory and sentiment theory.

[49] I am grateful to Robert Tumarkin and Bohui Zhang for their generous help and insightful suggestions. All comments are welcomed. I remain responsible for any remaining errors or omissions.

Last year some investors mistakenly bought shares in an obscure company called Tweeter Home Entertainment, ticker symbol TWTRQ, thinking that they were investing in Twitter, which had just announced its intention to list its shares under the symbol TWTR.

Thomas J. Herzfeld

Chairman and President of CUBA Fund

4.1 Introduction

What is a corporate name? It is a label that integrates all past corporate behavior, reputation, performance, and other attributes of the firm, accompanied by the behavior bias associated with the name term itself. In this paper, I identify the effects of the unexpected name term attention and sentiment as a word, which is unrelated to the carrier of the name: the firm itself, on stock prices.

Does firm name create value? This question has been answered by a number of scholars in both psychology and finance. Firms adopt unique names to distinguish themselves from other firms, to establish their reputation, and to attract consumers in the product market and investors in the financial market (Grullon, Kanatas, and Weston, 2004). Names help firms to be recognized, memorized and understood. Any related or unrelated information received and perceived by individuals, relating to the name terms will influence their emotional link with the name term (Tafelis, 1997). In a rational asset pricing framework, the efficient capital market predicts that stock prices should only reflect the fundamental changes of firms. However, in reality, many historical events illustrate the important role of noise traders in shaping asset price bubbles (Shiller, 2000; Kindleberger, 1978). In this chapter, I show that investors react to the unexpected reputational or sentimental adjustments associated with the name term of a firm, which is consistent with the predictions from limited attention theory and sentiment theory.

Prior literature documents the effect of names on asset prices (e.g. Green and Jame, 2013; Kumar, Niessen-Ruenzi, and Spalt, 2015). Two major channels that the naming of corporation affects stock prices through are the potential real impacts on firm fundamentals and psychological stereotypes associated with names terms. These two channels have been well studied in the literature (e.g. Tadelis, 1997; Grullon, Kanatas, and Weston, 2004; Alter and Oppenherimer, 2006; Green and Jame, 2013). In this paper, I propose an additional channel: unexpected attention and sentiment (image of the word) changes associated with the name term by investors. This paper aims to construct a plausible measure of investor attention and sentiment related to name terms and convincingly show it affects prices not through other risk channels.

Due to limited attention, when hearing news that mentions a name term shared with a corporate name, individuals usually link the news to the firm, especially when their trading portfolio includes the firm's stock. These news articles, regardless of whether or not they are truly related to the firm, typically stimulate a shock to the individuals' attention and sentiment regarding the firm. This unrelated name attention and sentiment change of investors triggers revaluation processes and trading activities. Empirical evidence that unexpected investor attention and sentiment affect asset prices is enormous before. However, the key question remains: does unrelated name sentiment move stock prices today? Technology improvements (e.g. the invention of the telephone and the Internet) eliminate the biased information, reduce the price anomalies, and make the market more efficient. In this paper, I conduct an examination of the effect of unexpected name attention and name sentiment on stock performance. I illustrate two recent demonstrations as follows.

An illustration of unexpected Attention is that arising from the corporate name "ISIS"; many companies named ISIS change their names. "When you say your company name, you want people to think about the work you're doing—not an unfortunate namesake," Sarah Boyce, the company's chief business officer, tells CNN Money[50]. ISIS is an ancient Egyptian health goddess and historically has been worshipped as the ideal mother and wife as well as the patroness of nature and magic. However, nowadays, the name ISIS is currently famed for the terrorist organization (Islamic State of Iraq and the Levant) that threatens the lives of millions of civilians. Although some companies named after ISIS may not need to worry about the negative association with the terrorist group, negative associations can be extremely detrimental to a company. A web search for "ISIS" is flooded with global news articles of atrocities and attacks by the Islamic State of Iraq and the Levant, which moves any businesses named ISIS down on the list of search results. ISIS Pharmaceuticals, a California based biotech company which has been established for nearly a quarter century is thereby linked not health and wellness, but to the ISIS terrorist group associated with death and destruction. Search attention towards "ISIS" as identified by Google is illustrated in Figure I. The share price drops 4% the day after the Paris terror attack though even though the company has not released any major news and the ISIS terrorist group in Syria is totally unrelated to ISIS Pharma. After months of exasperation at having been linked with being linked with the terrorist group, ISIS Pharmaceuticals (Ticker: ISIS) announces plans on December 18, 2015 to rebrand itself as Ionis Pharmaceuticals to avoid these negative connotations. As part of the rebranding its name, Isis Pharma also eliminates the "ISIS" ticker symbol in favor of "IONS," before the U.S. markets opens on December 22, 2015.

<Insert Figure I here.>

Although most institutional investors are not concerned and will not make their investment decision according to company names, the concerns of individual investors still compel this firm to change its name. The name change was already being welcomed by some users on StockTwits, a social network for traders. StockTwists user Thorgood asks, "Smart of them what took Crooke so long?" referring to CEO Stanley Crooke. Historically, ISIS Pharma is forced to rebrand its diet

[50] Detailed see http://money.cnn.com/2015/12/18/investing/isis-pharmaceuticals-name-change/.

candy in the 1980s when the AIDS epidemic is raging. More than ten firms named after ISIS have changed their names worldwide.

A second case relating to unexpected sentiment change toward corporate names involves the CUBA Fund ticker. Securities listed in New York Stock Exchange (NYSE) are required to adopt a one- to three-letter ticker symbol (plus additional characters to identify the type of security), and in NASDAQ are required to adopt a four- to five-letters ticker symbol (the fifth character identifies the type of security). Some tickers are only the abbreviation of a company name (e.g. GM and IBM), but the others may have physical meanings (e.g. CAB for Cabela's Inc., CELL for Brightpoint Inc., and ROCK for Gibraltar Industries). The meanings of tickers are occasionally, but not always, related to their business. Head, Smith, and Wilson (2009) show that stocks with meaningful and memorable ticker symbols can outperform the market, based on a study of the years 1984-2005. Some ticker symbols share abbreviations with other companies or organizations. For example, AA is the ticker symbol for Alcoa Inc., but it is also the acronym or nick name for American Airlines, which is a more well-known corporation. Many news articles covering the financial market are tagged with corporate tickers. It then becomes natural to link this news to company represented by the ticker without careful examination. However, the "tickers" in the news article titles can sometimes be misleading.

In December 2014, President Barack Obama, alongside his entire national security team announces a restoration of diplomatic rapprochement between the United States (U.S.) and Cuba, demonstrating political courage to change the course of history. As a result, business interest and capital flows in Cuba have the potential to increase for U.S. businesses and investors, and investments related to Cuba can potentially benefit from the end of the decades-long trading embargo. With the announcement of these U.S. policy changes toward Cuba, investors bid up the Herzfeld Caribbean Basin Fund, which is a closed-end fund with the ticker "CUBA". This fund contains no actual Cuban assets in the fund's holdings and no access to the nonexistent stock market of Cuba, which can be the only companies that might benefit from a shift in policy toward Cuba.

This unrelated optimism sentiment elevates the price more than doubled with a substantial increase in volume (See Figure II). Before noon on the first day, price is as much as 47% higher. More importantly, it represents an unsustainable 29% premium to its Net Asset Value (NAV) of $7.80 and reaches to an astounding 70% premium over NAV thereafter. Figure II illustrates that this good news leads to a flood of search quieries regarding to both the country of Cuba and the Herzfeld Caribbean Basin Fund Inc. (Ticker: CUBA). At that point, price of the CUBA fund surges. However, the CUBA Fund is later found to hold no actual Cuban companies and it takes nearly one year for the CUBA Fund price to reverse back to its NAV (Figure III).

In an efficient financial market, such a wide divergence should not occur, as arbitrageurs will short the fund to earn an arbitrage profit, and rational investors would not buy the CUBA Fund at a 70% premium because they can buy the underlying holdings at no premium. However, sentiment traders wish to take advantage of this positive sentiment inside the financial market. When the unrelated optimism sentiment has dissipated, people will return to rationally held beliefs.

<Insert Figure II here.>

<Insert Figure III here.>

“Investors in a tiny American fund have received an extraordinary windfall, apparently as a result of the four-letter symbol used to identify the fund on the U.S. stock market.” Thomas J. Herzfeld, Chairman and President of CUBA Fund, says, “This is not the first time that a share’s ticker symbol, rather than the fundamentals of the business, has influenced trading. Last year some investors mistakenly bought shares in an obscure company called Tweeter Home Entertainment, ticker symbol TWTRQ, thinking that they were investing in Twitter, which had just announced its intention to list its shares under the symbol TWTR.” Likewise, Rashes (2001) systematically documents the co-movements of stocks with similar ticker symbols.

Limited attention and sentiment drive people far from rational beliefs and create huge market inefficiency. As human behavior is one of the driving forces in financial markets, the belief bias will lead to mispricing. There is no denying that the choice of ticker is endogenous and determined by the firm, but the unexpected sentiment and attention changes in the language related to the word itself are exogenous and cannot be controlled by firms. Returning to the case of ISIS Pharmaceuticals, ISIS is well-known as a symbol of health, and it has been the ticker symbol for ISIS Pharmaceuticals for more than two decades since 1989. However, Paris Attack changes public cognition and emotion abounded with the word ISIS, associating it more readily with mass murder and the terrorist organization named "Islamic State of Iraq and the Levant".

Does the market become with more efficient with the help of the Internet (e.g. search engine)? A lot challenges have arisen in behavioral finance (Malkiel and Fama, 1970; Fama, 1991; Malkiel, 2003). With the rapid development of the Internet, the greatest invention in 21st century, most people believe that information asymmetry has been reduced and the market has become more efficient. Admittedly, thanks to the Internet, all types of information (e.g. news releases, and company filing) can be easily assessed and trading can be conveniently conducted from every corner of the world, simply with an Internet connection. It is widely believed that with more available information and fewer trading barriers, investors will behave in a less biased manner and complete trades in a timelier fashion (Ofek and Richardson, 2003). However, this flood of information challenges the analytical capability of human being. With a more rapid pace of life and more information available to digest, people pay less attention to each news article and are unable to process the information carefully and comprehensively. Sometimes individuals merely consider the titles of the news article titles and key word tags to judge the content and infer the possible consequences. The stock return instability profoundly results from more unreliable and rapid dissemination of information fragments on the Internet. Misinterpreted information often lures individuals to make more bias decisions due to limited attention. In addition, the combination of news and stock price movement further impacts other investors and causes the herding effects in trading (e.g. fire sale). The herding effect stimulates the panic sentiment among bonded rational investors, pushing them to react more hastily and carelessly. Hence, the increased information flow stimulates stock market performance and stock markets have become more volatile in the U.S. since 1960 (Campbell, Lettau, Malkiel, and Xu, 2001).

Following these two recent anecdote illustrations, I conduct scientific examinations of the unexpected unrelated name attention and sentiment on stock performance. First, I examine whether the unexpected firm name attention influence on the trading behaviors and stock prices volatility. I manually select 147 firms whose name meanings are unrelated to the firms' business conductions for a clinical test. For example, the business conduction of Apple Inc. is not related to the fruit – apple, which sharing the same name with this iPhone company. Using this clinic sample of firms with meaningful but business unrelated names, I test my hypothesis using a hand-collected measure of investor name attention and name sentiment for all firms. The search volume densities for firms and firm names are collected to represent the investor attention to firm and firm names respectively. The total search volume density is a good proxy for time-varying investor attention (Da, Engelberg, and Gao, 2011) and sentiment (Da, Engelberg, and Gao, 2015). I discover this unrelated name attention surge increases the trading activities of stocks and the volatility of stock return. Our results hold for the extended sample: all S&P 1500 firms. This positive and significant impact is consistent with the predictions from limited attention theories.

In the next sets of tests, I further classify the attitudes of attention: positive or negative sentiment (moods) by adding positive and negative keywords to the searches of firms and firm name terms. The regression results show that the investors react more aggressively to the negative unexpected name sentiment. In addition, the changes in sentiment, both positive and negative, regarding the firm itself drive the stock price movement. This implication is consistent with prediction of prospect theory in psychology and both limited attention and sentiment theory in behavioral finance. Last, it is discovered that the sentiment of institutions can reduce volatility.

The role of institutional investors is related to name sentiment by investigating the effect of ticker attention and sentiment on stock prices. Ticker is more frequently used by institutional investors for trading purposes (Barber and Odean, 2008). Some hedge funds use tickers to identify news sentiment for the purposes of automatic trading algorithms and their trading will have impact on stock prices. I find the institutional investors trade stocks aligning with prevailing trends to take advantage of the sentiment trading.

Then, to generalize my findings, I use all Standard & Poor's (S&P) 1500 firms and additional measures of investor attention and sentiment. With firm-week panel data setups and more controls, I find all results hold. Moreover, as some firm-related searches can result from general searches for contact or address information rather than related to the investors, I use the news-related search from 2008 for robustness test[51]. The coefficients of unexpected name search become more significant. This is consistent with the finding that individuals care more about the news and become more sensitive to risks associated with their investments following the Global Financial Crisis.

In the final stage, I adopt dynamic penal models to address the timing and size of the effect. I find the effect of attention on stock volatility is not permanent and I observe some reversion during the following week. Furthermore, I find the negative the effect of negative sentiment occurs simultaneously with some reversion but the effect of positive sentiment is of long duration, although it does not have significant effect on stock prices.

In summary, my findings confirm the conjectures from the combination of limited attention theory and sentiment theory. Name bias affects the trading behavior of individual and institutional investors, and has a real impact on asset prices. The results of this chapter demonstrate an inefficient financial market from another perspective.

[51] The news search volumes provided by Google Trends start from 2008.

This chapter contributes to the behavioral finance literature. First, I create a direct measure of investor attention to a specific name term. Internet search engines (e.g. Google) provide a measure of attention by counting the density of search volume regarding market trends (Da, Engelberg, and Gao, 2015) or individual securities. I use Google search density provided by Google Trends[52] as a direct measure of retail investor attention. This measure of individual attention to each firm can be identified with more time variance (weekly basis). These search volume densities provide us an excellent opportunity to track the heat of information among all individuals.

Second, in this research, I further identify the effect of attitude of attention (sentiment) on stock performance. The primary difficulty to prove the behavior story in finance is the nonexistence of proper measures of investor sentiment toward individual firms. Baker and Wurgler (2006) propose that the question in behavioral finance is not whether investor sentiment affects stock price, but how to measure investor sentiment and quantify its effect. In this paper, I provide a proper solution to measure the sentiment for individual firms: investor sentiment directly measured by the Internet search behavior of individuals. By adding a set of positive or negative search keywords, the search volumes can further capture the unexpected sentiment intensity changes of individual stocks for both optimistic and pessimistic attitudes. My active measure of sentiment is more accurate and direct, as Internet searches are conducted by investors themselves. This stands in contracts to other news sentiment measures, where there are measurement errors as the audience reception and actual reactions are not available.

This measure is supplementary to exiting measures. Prior literature documents the effect of investor sentiment on asset prices using market-level sentiment (Da, Engelberg, and Gao, 2015). However, empirical tests of behavioral models face a number of challenges as measuring the market sentiment is too complicated (Baker and Wurgler, 2006) and models cannot be easily tested with aggregate data (Campbell, 2000). Traditional proxies for market sentiment include the

[52] Detailed information will be discussed in Session Data and Empirical Design.

closed end fund discount (e.g. Lee, Shleifer, and Thaler, 1991), consumer confidence index (e.g. DeLong, Shleifer, Summers and Waldmann, 1990) and surveys (e.g. Bloomberg Heat, UBS/Gallup, Twitter) (Lemmon and Portniaguina, 2006) and media article sentiment (Tetlock, 2007). Compared to these traditional proxies, this proxy reveals more accurate individual beliefs and attitude changes. In addition, the variation inside this measure provides more insights into how investors react to new information about fundamental asset values.

Some scholars may argue that searching activities do not reflect the individual's underlying optimism or pessimism. They may search for a positive or negative news article regarding a firm, not due to their concern about the firm, but to perform research or gather information about a certain firm. To mitigate this concern, I use the unexpected change in the searches volume density in order to naturally discard routine search volumes. Moreover, by using mean regression models, the coefficients are still consistent, as random errors can be eliminated. Finally, the evidence presented in Figure I and II, supports chosen measure of investor attention and sentiment. I find the variation of search volume for both the name term and the corporation reflect the major news releases and raised investor concerns.

Third, this research contributes to the name-related literature. I further explore the question of whether or not corporate names create value. Cognitive psychologists have discovered many judgment biases associated with names. Individuals believe that names are more favorably accepted or memorized with rhyme aphorism (McGlone and Tofighbakhsh, 2000), with increased fluency (Reber, Winkielman, and Schwarz, 1998), with better alphabetic placement (Einav and Yariv, 2006), with colors (Reber and Schwartz, 1999), and with simplicity. Individuals tend to value items with familiar names more than the items with uncommon and infrequently used names, and are willing to assign value to the ease of information processing. These characteristics of names serve as processing stimuli and bias the view of individuals. Prior finance research confirms these theories or implications from the field of psychology and demonstrates the influence of personal name or corporate name on asset prices. Alter and Oppenherimer (2006) find the securities with pronounceable tickers have higher first day returns as new investors shape the information by its simplicity. Knewtson and Sias (2010) document a name letter effect—a psychological predisposition to select securities that start with leading letter of one's own name—and find that institutional ownership of stocks is higher if the stock's name begins with more frequently used letters. Green and Jame (2013) find the companies with fluent names have a higher breadth of institutional ownership, greater share turnover and higher firm value. Jacobs and Hiller (2013) find stocks with names early in the alphabet have a 5% to 15% higher trading activity and lower cost of trading. My findings of this study are consistent with those of prior research. The empirical results provide exogenous evidence that name bias affects asset prices in short run and fundamentals determine the firm value in long term.

I provide a better way to isolate the name term effect arising from irrational behavior from the classic pricing valuation models using discount rate and expected future cash flow. Prior research on corporate name issues uses corporate name changes as a dummy variable to identify the effects. However, a decision to change a corporate name is endogenous and made by the firm itself. The firm may change its name alongside other reforms related to the firm (Carson, Cole and Fier, 2016). Carson, Cole, and Fier (2016) find the higher growth rates after rebranding primarily cluster in firms focusing on individual lines of the life insurance business. To avoid this potential endogeneity, this study uses the attention or sentiment caused by news that is unrelated to the firm but associated with the firm because it shares the same name, as measured by Google search counts. The unexpected sentiment changes incorporated in the corporate name terms are exogenous to firms. These unexpected sentiment changes happen so quickly that the firms have no control over them. This research successfully avoids endogeneity because the sentiment change cannot be influenced by the firm. A minor influence by the firm does not disqualify the measure of sentiment, as these are subtracted from the measure.

Last but not least, I use a more direct method to support limited attention theory and sentiment theory. I show that individuals make mistakes when interpreting news with company names.

Moreover, individual investors may not conduct complete research regarding the company before they invest, particularly when they infer characteristics of the business simply from their names.

The reminder of the paper is organized as follows. Section 2 discusses the related literature and hypothesis development. Section 3 develops the empirical strategy and data collection methods. Section 4 discusses the results of the paper. Section 5 presents additional tests and robustness checks. Section 6 concludes.

4.2 Literature Review and Hypothesis Development

The naming of a corporation plays an important role in the determination of firm value. Previous literature has documented the phenomenon that names or tickers of securities influence investors' decision making processes. The following section outlines the existing research and the theoretical predictions. Then, I develop testable hypothesis for this study.

Prior literature documents the effect of names on asset prices, related to both individual names (e.g. Kumar, Niessen-Ruenzi and Spalt, 2015) and corporate names (e.g. Green and Jame, 2013). The naming of a corporation affects its stock price in two major economic channels: the potential changes to fundamentals and the stereotypes associated with names. However, in this paper, I propose an additional channel: unexpected investor attention and sentiment associated with the name term.

4.2.1 Classic Valuation Models: Firm Images and Brand Values

On one hand, names and brands can directly influence the valuation of firms, as a better name can be used as signal of intelligence, indicating a clever or diligent company. Some firms advertise to target shareholders so that they can reduce the uncertainty among stock investors and further reduce the discount rate of future cash flows. Prior theories (Hall, 1992; Meyer, Milgrom, and Roberts, 1992; Kreps, 1990) prove that the brand name representing a firm's reputation creates intangible value for the firms, sometime presented as goodwill. This theory is confirmed by Tadelis (1997) using a simple adverse selection model to represent the name as a firm's reputation. Grullon, Kanatas and Weston (2004) find the branding effort and advertisement of the firm increase the visibility and familiarity of the corporate name to its shareholders, and this increased familiarity and visibility has great impact on stock market prices. Also, the firms with better investor-advertised names have better liquidity and attract more retail and institutional investors. Alter and Oppenherimer (2006) find that securities with pronounceable tickers perform better during IPO events. Green and Jame (2013) establish that the companies with fluent names have higher breadth of institutional ownership, greater share turnover and higher firm value.

On the other hand, the corporate name has a real impact on daily operations. Professional corporate names indicate the professions of the firm. This stereotyped image of the name may have great impact on the behavior of its suppliers and clients. Bertrand and Mullainathan (2004) document that employers use indiviuals' names to infer race and social classes. Differential treatment based on names in the job market is uniform across occupation, industry and employer size (Bertrand and Mullainathan, 2004).

Moreover, certain names are preferred by some customers in certain cultures. As for ISIS Pharma, which is named after a heath god in Egyptian, the original image the firm hopes to deliver to its consumers is health, but after the terrorist attack in Paris, people related this name more to mass murder and terrorists. The psychological stereotype linked with a name can further develop into emotions of panic, fear and even hostility (Allport, 1954).[53] Kumar, Niessen-Ruenzi and Spalt (2015) find these potential stereotypes associated with a person's name affect the selection decision of mutual funds products. Individual investors tend to select the fund product with fund manager that has familiar and preferred regional names. Also, Carson, Cole and Fier (2016) find that

[53] For a detailed discussion, see section 2.4 entitled, "Investor Sentiment and Fear Sentiment".

corporate name changes can successfully attract more targeted business and provide positive wealth effects for firms in the insurance industry. In general, these product market level differences will amend the value of these firms.

Moreover, certain names are preferred by some customers in certain cultures. As for ISIS Pharma, named follow a heath god in Egyptian, the original image the firms hope to deliver to its consumer is the health, but after the terrorist attack in Paris, people more related this name to deaths and terrorists. This psychological stereotype linked with name can further develop to emotions of panic, fear, even hostility (Allport, 1979).[54] Kumar, Niessen-Ruenzi, and Spalt (2015) find these potential stereotypes associated with a person's name affect the investment decision of mutual funds product. Also, in the literature, Carson, Cole, and Fier (2016) find that company changes can successful attract more targeted customs and provide positive wealth effects for firms in insurance industry. In general, these product market level differences will amend the value of these firms.

4.2.2 Psychological Stereotypes associated with Names

In standard and classic finance models, investors are believed to be rational and to always make consistent and instant valuation estimates regarding the present value of expected future cash flows using all available information in the market. However, these models are not sufficient to explain all patterns of stock price performance (Baker and Wurgler, 2006). A potential alternative explanation is stereotyping associated with existing names. Stereotype biases in social decision making process are well studied and documented (e.g. Bodenhausen, 1988). The conscious or subconscious image or attributes assigned to a firm's name may influence the investment decision related to a firm. Cognitive psychologists have discovered many judgment biases associated with names. They believe that words with rhyme aphorism (McGlone and Tofighbakhsh, 2000), with increased fluency (Reber, Winkielman, and Schwarz, 1998), with highlighted color (Reber and

[54] Detailed discussion sees section 4.2.4: Investor Sentiment and Fear Sentiment.

Schwartz, 1999), and with easiness are a more favorable choice for people to believe or to memorize. Individuals tend to value items with familiar names more than items with unfamiliar and difficult-to-pronounce names, and are willing to assign value to the ease of information processing. These characteristics of names serve as processing stimuli and bias the view of individuals.

Prior research in the field of finance confirmed the implications of psychological theory. Alter and Oppenherimer (2006) find that securities with pronounceable tickers have higher first day returns as new investors shape the information by its straightforwardness. Knewtson and Sias (2010) have documented a letter effect—a psychological predisposition to select securities that start with the same leading letter of one's own name—and find the institutional ownership of stocks is higher if the stock's name begins with more frequently used letters. Green and Jame (2013) find that the companies with fluent names have higher breadth of institutional ownership, greater share turnover and higher firm value.

The familiar and memorable name or ticker can serve as a great advantage as individual investors have limited time to select stocks, which are selected according to name and tickers (Barber and Odean, 2008). Kumar, Niessen-Ruenzi and Spalt (2015) find the investment choices of U.S. mutual fund investors are influenced by name-induced stereotypes. They find name-related stereotypes are activated almost spontaneously without much conscious effort (Kunda, 1999). The mutual funds managed by individuals with names that appeared to be Middle Eastern sounding experience serious and abnormal decline in their fund flow following the terrorist attacks of September 11, 2001, with the performance ranking unchanged. In addition, investors reacted irrationally by cosmetic effects.

4.2.3 Limited Attention

Simon (1978) documents the scarcity of attention as one of the most important scarcity resources. Meanwhile, Culter, Poterba and Summers (1989) empirically prove the relationship between news and security prices. Generally, individual investors cannot provide infinite cognitive resources or allocate enough attention to the financial market news (Yuan, 2008). Individuals obtain a great deal of information from different sources. Due to their limited time and energy, they may only have the opportunity to read through the titles and try to infer the content having regard to the title. The implied information from the news title, both advantageous and disadvantageous, can change the sentiment of certain items mentioned in the news article titles. Limited attention and time constraints prevent retail investors from fully digesting and understanding the news titled with company names, particularly unrelated corporate names. For example, people commonly speak of a "bad apple". However, the proverbial "bad apple" has nothing to do with Apple Inc., which produces high-tech products. Pennington and Hastie (1988) provide experimental evidence that the story model, rather than the Bayesian or linear updating models (1968, 1986), determines the valuation of securities. They argue the title of a story or the consequence of information flow can impact verdict judgment and the story completeness has a significant effect on decision making. People currently face more information fragments on the Internet without the complete story and are more likely to relate misleading information to the stock performance.

The efficient market hypothesis assumes all investors are rational and can re-value the asset immediately after a news release (Fama, 1965). The valuation process is a part of human judgment, based on individuals' understanding and interpretation of the news. Thus, this process of value estimation is incomplete analysis with incomplete information. NYSE specialists cite the exchange sound level to be informative and use this information to set prices (Madhavan and Panchapagesan, 1998; Coval and Shumway, 2001). Coval and Shumway (2001) record the sound level and find a rise in sound level will lead to more volatile prices, increased information asymmetry and higher trading volume.

This leads to my first hypothesis:

Hypothesis 1-a: Increased un-related corporate name attention will increase stock return volatility and increase trading volume.

Individuals routinely update their estimation of their holdings and assets when new information arrives, especially for the earnings lost after negative shocks (Alter and Oppenheimer, 2008). This unclear news and information can result in emergency trading of "Apple" stock, for example, which induces a price drop for Apple Inc. (the company with "apple" in its name). Moreover, when individuals experience negative news regarding the firm name, and its stock performance is poor for some other reason, this can trigger fire sales of the firm, and the herding effect among individual investors can deepen this effect.

This leads to the following hypothesis:

Hypothesis 1-b: Un-related name sentiment will influence the stock prices due to limited attention.

4.2.4 Investor Sentiment and Fear Sentiment

Investor sentiment theory predicts the trading activities and price movements of securities resulting from the attitude of investors, the tone of a market and its crowd psychology (Keynes, 2006; Culter, Poterba, and Summers 1989; De Long, Shleifer, Summers, and Waldmann, 1990; Citations Needed). Cooper, Dimitrov, and Rau (2001) document that the change of name creates value for a firm, representing an average cumulative abnormal return of 74% as a reaction to the announcement of corporate name changes to Internet-related dotcom company names. The effect is uniform, regardless of the firm's involvement with the Internet. Moreover, the effect is permanent without a post announcement negative drift, even for firms merely associated with the Internet. Cooper, Gulen, and Rau (2005) document that when mutual funds change their product name to include hot-style keywords, and they experience an average abnormal inflow of 28%, without any holding change or performance improvement.

This leads to the second hypothesis.

Hypothesis 2-a: Stock returns are affected by unexpected sentiment changes.

Moreover, when individuals hear the news, and begin to Google "bad apple" or bad news associated with Apple Inc., they are always able to find some negative news regarding Apple Inc. on the Internet. These investors can become panicked and lose rational judgment regarding the release time of the negative news and expected influence on stock prices, especially if it is the first time these investors have learned about this undesirable news. This negative sentiment can be easily and widely communicated over the Internet and cause the stock price of Apple to fall. However, this media pessimism will be followed by high long-term returns (Tetlock, 2007). After the major events of Enron (collapse of a Wall Street darling), WorldCom (Internet bubble burst and 7% drop in 2002), and Lehman Brothers (2007 financial crisis), the retail investor is more sensitive to negative news and the accumulated fear among them leads to market collapse (Da, Engelberg and Gao, 2015). The panic after hearing negative news may further blind individuals' judgment. Moreover, this fear, combined with the herding effect and spillover effect, can cause the Global Financial Crisis. Coval and Shumway (2001) believe the chaos and fear caused by an open outcry creates anxiety among traders, which in turn causes deep declines in price. Also, Tetlock (2007) finds the pessimism factor in investor sentiment is largely the result of the negative sentiment of news articles. Da, Engelberg and Gao (2015) find the fear sentiment of household investors can have great impact on asset prices. They construct a FEAR index according to the Internet search volumes from millions of households as a new measure of sentiment. Moreover, the psychological findings concerning name biases discussed above, may develop into an extreme form; individuals may generate emotions of panic, fear and even hostility (Allport, 1979), which may lead to a sale of stocks.

This leads to the following hypothesis:

Hypothesis 2-b: The effects associated with a negative news search are greater, among the asset price fluctuations caused by un-related name sentiment.

4.2.5 Potential Roles of Institutional Investors: Quantitative Institutional trading and HFTs' "going with the wind"

Many studies have shown institutional investors tend to be more rational and have less behavior bias (Daniel, Hirshleifer, and Subrahmanyam, 1998; Barber and Odean, 2008). Long-term investment with institutional investors is generally less influenced by life or business cycle, and more consistent with the fundamental value of assets. Alter and Oppenheimer (2008) have documented that this valuation bias regarding name processing diminishes together with more familiarity with the asset, and familiarity creates value (Huberman 2001). As institutions usually hire full-time professionals with an information and knowledge advantage to manage and monitor their portfolios, these professionals usually process less belief bias regarding the fundamentals.

This leads to the following hypothesis:

Hypothesis 3-a: Institutional investors trade against the wind and push the stock price back to reflect the true firm value, ceteris paribus.

However, Choi and Sias (2009) reveal evidence of institutional herding: institutional investors follow each other into and out of the same industries. The popular press often portrays institutional investors as driving prices from fundamental values and generating excess volatility as they herd to and from the latest "fad". One commentator notes, "The gains represent institutional herding, in which money managers chase each other into the hot performing areas regardless of the price they are paying" (Financial Times, July 5, 2004). Rich theoretical literature suggests five potential reasons institutions may herd, including underlying investors' flows, institutional positive feedback trading, an attempt to preserve reputation by behaving like other managers (reputational herding), inference of information from each others' trades (informational cascades) and adherence to correlated signals (investigative herding). Moreover, some quantitative funds endeavor to use automatic trading algorithms to identify the sentiment of the market and to make money ahead of retail investor trading. Institutional trading is often triggered by the news sentiment regarding the corporate ticker. Knewtson and Sias (2010) also demonstrate that undergraduate students managing university endowment funds are more likely to select securities for evaluation when the stock's name begins with the same letter as their own name. Institutional investment decisions are also made by human fund managers. Consequently, although it cannot be confirmed that this is a rational behavior of institutional investors or the behavior bias of human investment managers, institutional investors consequently trade according to sentiment.

This leads to the following hypothesis:

Hypothesis 3-b (competing hypothesis): Institutional investors trade with the wind, ceteris paribus.

4.3 Data and Empirical Design

I start this section by illustrating the sample construction and variable calculation methods, including unique attention and sentiment measures. Then, I describe the experimental design, robustness tests and fixed effect models.

4.3.1 Data Collection and Sample Formation

I test my hypothesis using a novel, hand-collected dataset that contains a unique measure of sentiment change, using Google search volume density data, from the perspective of retail investors.

4.3.1.1 Variable Construction and Descriptive Statistics

4.3.1.1.1 Measures of Name Attention

First, I measure investor unexpected attention to the company name terms by the change of search density provided by Google Trends. Google is the largest global search engine and provides information services to all household with access to the Internet throughout the entire world. Google accounts for 87.63% of all search traffic in September 2015.[55] On average, Google now processes over 40,000 search queries each second, which translates into more than 3.5 billion searches per day and 1.2 trillion searches per year worldwide.[56] When a user inputs a search term into Google[57], Google returns the all the articles related to the search terms. At the same time, Google will record the user's characteristics (e.g. location, gender, and age) and behavior (e.g. time of the inquiry, interest type, and previous searches) for further improvement of the search engine. Since 2004, Google has made the search volume density of search terms publicly available via its product named "Google Trends" (http://www.google.com/trends/). When seeking to measure interest in a search query (e.g. Apple – search term), Google server will count the number of searches that include that string of text ("Apple"). Moreover, Google currently provides a new service that counts the search volume density for certain topics with more accurate measures. When seeking to measure interest in a search topic (e.g. Apple – a technology company), Google provides an algorithm to count the many different search queries that may relate to the same topic (e.g. 苹果公司, Apple Inc., 애플, Apple Computer, AAPL). In this way, the interest identified by the search will represent the interest in Apple Inc., rather than the fruit or the general term "apple". Measuring search interest in topics is a feature which quickly provides accurate measurements of search interest.

As an illustration, Figure I plots the search volume density for the terms ISIS as "Islamic State of Iraq and the Levant" and ISIS as "Ionis Pharmaceuticals" (formerly known as ISIS Pharmaceuticals), respectively. The graph conforms to expectations. Figure I demonstrates that there is an upsurge in the search volume for Islamic State of Iraq and the Levant after they organize the notorious Paris attack. Also, the search volume for ISIS Pharmaceuticals peaks after it changes its name to Ionis Pharmaceuticals.

[55] For detailed information, see: http://www.thesearchguru.com/search-stats.asp/
[56] For detailed information, see: https://www.internetlivestats.com/google-search-statistics/
[57] https://www.google.com/

As an illustration, Figure I plots the search volume density for the terms ISIS as Islamic State of Iraq and the Levant and ISIS as Ionis Pharmaceuticals (former name: ISIS Pharmaceuticals) respectively. The plots conform to intuition. From Figure I, we can observe that the search volume for Islamic State of Iraq and the Levant upsurge after they organize the notorious Paris Attack. Also, the search volume for ISIS Pharmaceuticals peaks after it changes its name to Ionis Pharmaceuticals.

Google Trends Data is becoming a popular source of identification of investor attention and sentiment in finance literature (Han, 2008; Da, Engelberg and Gao, 2015; Gao, Ren and Zhang, 2016). This new measure offered by Google provides an excellent opportunity to track the changes in investor attention and sentiment more precisely. Although some researchers still express concern as to potential errors in measurement of search intensity, this does not disqualify search density as a measure of investor attention and sentiment. First, some scholars are concern the reverse causality from the Google Trends to Google Search. However, the search volume from Google Trends is relatively small compared to the general search queries in the search engine and this effect is quite limited. Second, Google Trends may become a useful mechanism to disseminate information on the investor attention and sentiment but this sentiment caused by Google search engine is also recorded in the search density data. Finally, the Google Trends data is merely a part of the search interest for firms or name term. In summary, Google search counts for 87.63% of all search traffic, and I use the unexpected search volume density rather the absolute value, which is less biased to the total count of the search density. Consequently, this measure provided by Google Trends is still one of best measures for investor attention and sentiment for individual firms. Additional concerns have been addressed by Da, Engelbeg and Gao (2011, 2014).

The unexpected attention change is calculated by the search density changes minus the expected attention predicted with historical value of Google search density (e.g. the seasonal search density, the search density of the previous week and the search density one year ago).

$$Unexpected\ Attention_{i,t} = Google\ Search\ Density_{i,t} - E\left[Google\ Search\ Density_i \mid \Omega_{i,t}\right]$$

$\Omega_{i,t}$ includes $Google\ Search\ Density_{i,t-1}$, and $Google\ Search\ Density_{i,t-52}$.

Next, with the initial sample of firms that have names with an unrelated meaning, I directly assign the topic category of the firm name term itself (other than the company) according to the suggestion by Google. To obtain the search intensity for corporate name term with unrelated meanings, I assign the category property using the most popular search category (excluding the corporation itself) provided by Google Trends. For example, when searching for Apple, the search term used is “Apple”. To identify the unrelated searches, I assign the most popular search category (“Fruit”) to obtain the unrelated name attention data. In addition, to isolate the searches for Apple Inc. itself, I assign apple to the “technology company” category. The results are shown in Table I.

Another concern is that the change in volume may not be related to the news. For example, an increase in the number of consumers can also increase the search volume for a firm, such as searches for manuals, warranty policies or contact information. These unrelated information searches may invalidate the findings. Consequently, the searches are further limited to company news.

4.3.1.1.2 Measures of Name Sentiment

I use similar strategy to create the measures of unexpected sentiment for both the company itself and the name term.

$$\begin{aligned} Unexpected\ Positive/Negative\ Sentiment_{i,t} \\ &= Google\ Positive/Negative\ Search\ Density_{i,t} \\ &- E[Google\ Positive/Negative\ Search\ Density_i \mid \Omega] \end{aligned}$$

Ω includes $Google\ Search\ Density_{i,t-1}$, and $Google\ Search\ Density_{i,t-52}$.

The detailed definitions see the Appendix A1.

Second, as robustness check, I further limit it to news searches. Since other parties of interest may also search for the companies, such as consumers and employees, these searches are not related to the news releases and sentiment changes. The search volumes from news articles only date from 2008.

Last, I adopt Twitter and Bloomberg heat measures of sentiment as alternative options for robustness check. I find these two measures are highly correlated with the Google search volume for the firm. This confirms that the search volume density provided by Google is a good proxy for the sentiment of individual and institutional investors.

4.3.1.1.3 Descriptive Statistics of Name Attention and Sentiment

I clean the names of corporations following Green and Jame (2013). To create the search name term, first, I remover the expressions that are part of the legal name but are often omitted when referring to the company, e.g. “Co.”, “Limited”, “Inc.”, “LLC”, “FSB” and “Corporation”. Second, I drop the articles and conjunctions (e.g. “a”, “an”, “the”, “and”), Third, I eliminate the expressions of industry and state of incorporation. The effects mentioning industry and state of incorporation on the sentiment of the firm is tested in the course of the robustness test session. As a result, I remove the financial service firms as most of the banks name themselves after the location. Last but not least, if the final name term after this cleaning is still more than one word, I identify the name related sentiment using the sum of two words (e.g. “Procter” and “Gamble” for “Procter & Gamble”).

<Insert Table I here.>

<Insert Table II here.>

<Insert Table III here.>

Table I provides the summary statistics for all variables used in this paper. The detailed definitions can be found in Table 3-A1 in Appendix. Panel A illustrates the key variables regarding the sentiment or emotion of both retail and institutional investors. Panel B illustrates some of the fundamental information of the firm reflecting the business operation. Panel C illustrates the information of analysts' forecasts and recommendations. These control variables are used to isolate the effect of investor attention and investor sentiment from the rational behavior of the market player. Panel D illustrates the different measures of firm performance.

A correlation matrix of all variables is provided to identify the potential collinearity problems with these time series variables. I find the sentiment for negative news and positive news are highly correlated, which means when people search for positive news, they likely to search for negative news at the same time. Moreover, people react more significantly towards negative news, since the average change in search counts for negative news is higher than the average change in search counts for positive news. The correlation coefficient between the number of searches for company-related positive news (d) and the number of searches for company related negative news (g) is 0.268.

Table I presents the summary statistics of the search variables. The search density returned from the Google Trends server is the search volume history for that term scaled by the time-series maximum. After unitization, the search volume for company-related contents (0.044) is significantly lower than the search density of the name term itself (0.355). The summary statistics also indicates the search volume change of positive corporate news is lower the search volume change of negative corporate news. This is consistent with the prediction of prospect theory in psychology as investor negative sentiment is consistently deeper than the positive sentiment. These summary statistics, combined with the correlation matrix, provide evidence that this is a valid measure of sentiment rather than the number of news articles.

One of the key implicit assumptions in my empirical strategy is that all the searches conducted through the search engine are made by investors. However, the sentiment changes among individuals are very similar to investors in a similar environment. In addition, I aadopt percentage change to partially mitigate this problem, as it is commonly believed that investors are a relatively constant proportion of the entire population.

The search volume density for a ticker is used to represent the sentiment for professional investors, as those who use a ticker to search usually have some basic knowledge of finance. NYSE adopts the ticker symbol in 1867 to allow traders to participate easily in the market. Tickers are initiated to accelerate trading, as stock names can be long and difficult to memorize. Actively traded stocks can be assigned single-letter tickers, such as "C" for "Citigroup" or "F" for "Ford". However, as ticker selection may have an impact on security prices (Head, Smith and Wilson, 2009). Dummies are created to control these effects: the *Is_Pronounceable* dummy, the *Is_meaningful* dummy and the *Is_related* dummy. The search volume for ticker is, on average, lower than search volume for the company name, as it is only popular among professional investors. It is also confirmed by the highest correlation confidence with the sentiment measure from Bloomberg.

4.3.1.1.3 Measures of Outcome Variables

The impact of sentiment outcome is measured using three major variables on a weekly basis: stock volatility, trading volume and stock returns.

4.3.1.1.4 Controls Variables

This study also controls for the institutional sentiment using the news-searching and news-reading activity for specific stocks on Bloomberg terminals (Ben-Rephael, Da, and Israelsen, 2015). Ben-Rephael, Da, and Israelsen (2015) provide evidence that this direct measure of abnormal institutional investor attention (AIA) is highly correlated with institutional trading but different from other investor attention proxies.

Analysts' recommendations also play an important role on both retail investors' and intuitional investors' decisions. Controls for "buy", "sell" or "hold" recommendation percentage and changes are introduced following (Antweiler and Frank, 2004). Da Engelberg and Gao (2011) show that the Internet search volume for firms' products has the power to predict revenue surprises, earning surprises and earning announcement returns. Seasonally-adjusted standard earning surprise (Livnat and Mendenhall, 2006) is also controlled for fundamental and future cash flow changes that the market has not fully incorporated into prices.

The accounting fundamentals are also included to control the influence on the stock price (Da, Engelberg, and Gao, 2011). In the regression specification the following explanatory controls are included. Firm size is measured by natural logarithm of total assets. It has been observed that the size of the organization can affect stock returns. Because of the documented relationship between accounting performance and stock performance, I also include Return of Assets (ROA). Most of these control variables are prevalent in prior behavior finance studies.

4.3.1.2 Sample Formation

4.3.1.2.1 Unique Biased Name Sample

First, to avoid potential overlap of the investor attention and sentiment attached to the firm name and the firm itself, I manually create a unique sample of firm from S&P 1500 firms where the meaning of the firm name was unrelated to the business they conduct, This sample consists of firms that have firm names unrelated to their business description. For example, Apple Inc. is named apple, but this technology company has nothing to do with the fruit except for its symbol. All the information on corporate names is retrieved from the of SEC Edgar database daily index master file. Then, the corporation names are manually verified by searching them using the Merriam-Webster Dictionary online[58] to ensure the meaning of the company name is unrelated to its business. As a result, I successfully identify 147 firms that satisfy this criterion from over 3,000 firm names. This sample of firms can easily attract attention based on unrelated news by mistake. One of the advantages of this sample is that the category for name terms can be clearly assigned to restrict the search volume density to particular topic that is unrelated to the firm itself. This unrelated name attention and sentiment are clean and attached to lexical meanings other than the firm.

4.3.1.2.2 Standard & Poor's (S&P) 1500 Sample

To avoid sample selection bias and to generalize my findings, I use all S&P 1500 firms to conduct this study following prior literature. This sample uses 11 year panel data from 2004 – 2014. Due to data availability of Google Trends, the general search volume variable is calculated from 2004, and the news search sample is calculated from 2008. All firm fundamental information is updated annually from Compustat, and the weekly stock returns, volatility and trading volume data is retrieved from CRSP. The intuitional sentiment data is downloaded using Bloomberg terminal following the method of Da, Engelberg, and Gao (2015). I also download the twitter sentiment data from Bloomberg as another measure for individual investor measure. Table I illustrates the summary statistics of all variables in the S&P 1500 sample.

4.3.2 Empirical Models

4.3.2.1 Ordinary Panel Regression (LSDV)

For this research, two major empirical models are used to test my hypotheses. First, fixed effect models are used to exploit the different stock reactions for firms towards to unexpected corporate name attention and sentiment changes. The hypothesis is tested using cross-section and cross-

[58] http://www.merriam-webster.com/

time vibrations and controlling for firm-level attributes. I control firm fixed effect to further eliminate this time-invariant effect. At the same time, weekly fixed effect is controlled to address potential calendar effects (e.g. French, 1980; Keim, 1983; Ariel, 1987). As variables are in different layers (e.g. yearly, quarterly monthly, weekly), clustered standard errors are used to avoid potential serial correlation. Different cluster methods are used, including firm+week, firm-year, and firm+year to further reduce this bias.

4.3.2.2 Dynamic Panel Regression

Second, dynamic panel regression is used to identify the size and timing of the effect of investor sentiment. Due to serial correlation of the dependent and independent variables, the lag sentiment may also have impact on stock returns and volatility (e.g. reversion or moment). As the lagged independent variable and lagged independent variables appear to be explanatory variables, strict exogeneity is violated. The least square dummy variable (LSDV) estimator is no longer consistent if T is not long enough (Kiviet 1995; Nickell, 1981; Anderseon and Hsiao, 1982). Although T = 520, which is higher due to the high frequency of the Google search data (weekly), the dynamic panels are adopted to further address the inconsistency of the LSDV estimators. In this chapter, the Instrument Variable (IV) approach (Anderson and Hsiao, 1982) and the generalized method of moments GMM approach (Arenallo and Bond, 1991) are used to correct the inconsistency.

4.4 Main Results

To begin the panel regressions, the clean sample of firms that have names with obviously unrelated meanings are used. Table IV to Table IX illustrate the results using the manually-selected sample. Next, the sample is expanded to include the full S&P 1500 sample in order to generalize the results. Table X to Table XVIII illustrate the results using the full sample.

4.4.1 Corporate Name Term Attention and Stock Return Volatility

To obtain the search counts for unrelated corporation name searches, the category property was manually incorporated, using the most popular search category (excluding the corporation itself) provided by Google Trends. For example, in searching for Apple, the search term used is “apple”. To identify the unrelated searches, the most popular search category (“Fruit”) is assigned to the name term to obtain the search volume data from Google Trends. To isolate the search for Apple Inc. itself, “apple” is assigned to the Technology Company category.

<Insert Table IV here.>

<Insert Table V here.>

4.4.2 Corporate Name Term Attention and Stock Returns

The effect of investor attention on stock return volatility is presented in Table IV and Table V. In Table IV, the unrelated name attention is observed to have a positive effect on the weekly stock return volatility. When more controls are added in Column II, III and IV, the results still hold. In Table V, lag terms are used to capture the reverse effect of this attention. The increased volatility is more likely to be reserved within a one-week period of time.

<Insert Table VI here.>

<Insert Table VII here.>

4.4.3 Corporate Name Term Related Sentiment and Stock Returns

Next, the direct impact of unrelated name attention on stock returns is investigated. This attention was found to have a negative effect on stock prices. This may have resulted from the fact that the most attention is gained through negative news, or that people are generally risk averse in reacting to neutral news.

<Insert Table VIII here.>

<Insert Table IX here.>

4.4.4 Unexpected Corporate Name Attention and Stock Returns – S&P 1500 Firms

To further investigate this problem, we classify the attention into positive or negative sentiment associated with this attention in Table VIII. I find stock price react positively with the sentiment difference. And the return is driven by the negative sentiment created by the unexpected attention. This is consistent with result in Table VII. The negative impact from the investor attention is caused by the negative sentiment. Next, I observe a reverse effect of the sentiment difference on stock returns. The effect is not significant and happens from the third week. The insignificant coefficients can be the results of different stocks require different time periods to wait for the reverse effect to happen. As I have shown in the Figure II, it takes almost one year for the CUBA fund to adjust its price to its NAV.

<Insert Table X here.>

<Insert Table XI here.>

<Insert Table XII here.>

From Table X to Table XVIII, the results are generalized to the full sample of S&P 1500 firms. In Column III and Column IV of Table XI, the results show that the difference between the change in positive and negative sentiment has predictive power over stock returns. The higher difference led to an increase of 12 basis points of stock returns for the full S&P 1500 sample, compared to an increase of 76 basis points of stock returns for the unrelated name subsample. Consequently, I can confidently argue that the seemingly unrelated sentiment surges caused by the company name will be reflected in its stock price. This is consistent with limited attention theory. People may judge the firm from its name, and occasionally they may not even have an idea of its business conduct.

Table X, XI and XII present the panel regression results. These tables test how attention regarding the company or the company name will affect trading behavior. Consequently, the unrelated sentiment surges caused by the company name will be reflected in the stock price volatility. Column I of these tables shows the positive and significant correlations between company attention and weekly stock volatility. The attention regarding each firm is measured by the absolute density of Google search volume, the unexpected change in Google search volume density and the percentage of unexpected change in Google search volume in Table X, Table XI and Table XII, respectively.

It is also possible to adopt the abnormal changes in search volume to represent the sentiment change among different firms (Da, Engelberg, and Gao, 2015). The results are similar. In Column II, the increase of sentiment related to corporate name term (measured by the Google search density) resulted in a surge in the stock return volatility. This result may is affected by both the corporate-related sentiment and the change in the sentiment related to corporate name term. Accordingly, in Column III, IV and V, I endeavor to differentiate the effect from corporate name term and the corporation itself. In Column III, the unexpected changes in search volume due to corporate searches are eliminated from the searches related to corporate name terms. The remaining unrelated search variation consistently contributes to the variation of weekly stock price variations. Specifically, in Table X, a maximum unexpected change of Google search volume results in a 23.6% increase in stock return volatility. In addition, as a percentage, Table XII shows that a double volume of Google searches results in a 14% percent increase in weekly stock volatility.

Similarly, the increased institutional attention, measured by unexpected change of ticker search volume density, can increase the search volatility of stock returns. However, both economic significance and statistical significance are not as high as that of the individual investor. This result is consistent with most of the empirical and theoretical findings from prior literature, which hold that, for the most part, intuitional investors are more rational and demonstrate less behavior bias (e.g. Barberis and Thaler, 2003; Barber and Odean, 2008).

<Insert Table XIII here.>

Specifically, investors are much more likely to sell the extreme winning and extreme losing position in a portfolio, even after controlling for a number of possibly confounding factors associated with extreme rank (Hartzmark, 2014). The tendency to sell extreme positions is exhibited by both retail traders and mutual fund managers, and is large enough to induce significant price reversals in stocks of 40–160 basis points per month. I present evidence that this effect is related to extreme portfolio positions being more salient to investors.

4.4.5 Corporate Name Term Related Sentiment and Trading Activities – S&P 1500 Firms

<Insert Table XIV here.>

This section examines the effect of unexpected name attention on trading behavior. Table XIV demonstrates that both the sentiment regarding the company and the company name affect trading behavior. The size of the impact of the firm-related sentiment is three times larger than that of sentiment related to corporate name term and four times larger than that of corporate ticker sentiment.

<Insert Table XV here.>

Next, an in-depth analysis is conducted by adding the factor of sentiment attitude. The attitude is identified by adding positive and negative wording to the search queries. In Table XV, an increase in trading volume may be seen as a result of the positive related sentiment, both for retail investors and institutional investors. Furthermore, negative sentiment decreases the trading volume. One possible explanation is that some investors take the opportunity of positive sentiment to cash out and secure their capital gain. However, in relation to the increase in the face of negative sentiment, people are less likely to trade because they are not willing to confirm loss. At the same time, the rational traders cannot easily take advantage of this trading opportunity due to short sale constraints. Further, the concern about emotional panic resulting in future further deterioration stops them from trading against the sentiment traders.

The increase in the heat or sentiment of firm-name-related news will have a positive effect on the weekly trading volume. However, the absolute value of the effect is smaller than the effect of company-related news. Column IV and V show that the effect is still significant, controlling for the firm-related news searches.

To test the effect of ticker-symbol-related sentiment on stock returns, the results are quite similar to the effect of firm-name-related sentiment. However, without knowing the direction of trading behavior, it is not possible to determine whether intuitional investors are trading in accordance with, or in opposition to, the prevailing trend. This is potential future word incorporating the transaction-level institutional trading data database (e.g. Abel Noser Solutions, a leading execution quality measurement service provider for institutional investors following Anand, Irvine, Puckett, and Venkataraman (2013) and Hu, McLean Pontiff, and Wang (2014)).

4.4.6 Sentiment Related to Corporate Name Term and Stock Returns – Evidence from S&P 1500 Firms

Finally, the relation between unexpected change of name-related sentiment and stock returns across all S&P 1500 firms is investigated. In Table XVI, investors react to irrelevant name term searches, whether positive or negative. However, the impact of positive news is not significant. The impact of negative news is eight times the size of the impact of positive news. These results correspond with many previous studies, as retail investors easily respond with fear and panic to negative news, which results in an overreaction toward negative news. This anxiety can reduce the capacity for judgment of the investor. Among sentiment trading activties, the biased investors will push the asset price from its fundamental value if arbitrage trading is limited. This panic is one of the key drivers of “bubble burst” and financial crisis.

<Insert Table XVI here.>

In Table XVI, the results show that sentiment investors react to changes in both sentiment related to the firm name and related to firms itself. However, the reaction toward unrelated name term sentiment is only significant for the negative sentiment (5% statistically significant level). Moreover, a change of one standard deviation in negative name sentiment will result in a drop of 120.9 basis points (BPS) in stock return, which is 10 times the size of the effect of positive name sentiment.

4.4.7 The Role of Institutional investors – Evidence from S&P 1500 Firms

Last but not least, the institutional investors are also affected by the sentiment bias according to the stock price reaction toward the ticker-symbol term sentiment. As most of the institutional investors search the company news by their ticker, the sentiment change regarding the tickers will influence on the investment decisions of intuitional investors. The institutional investors react to both positive and negative sentiment change but the size of effects is much smaller. Due to limit ability to short, I observe the size reaction to positive news is higher than the reaction towards negative news. This result combine with the result in previous tables regarding the individual investors trading pattern confirm the findings of Griffin, Harris, and Topaloglu (2003). Individual investors tend to sell the top preforming stocks. The alternative explanations would be the automatic trading of some quantitative fund. These hedge funds try to use computing algorithms to parse the news articles on the websites and to detect the sentiment of the language used to describe the news. And, this type of machine initialized trading facilitates the realized returns of sentiment trading.

4.5. Robustness Tests and Alternative Explanations

In this section, alternative measures of name sentiment are provided in order to address the potential identification problem. A series of additional tests are conducted to further explore the effect of name sentiment.

4.5.1 Additional Fundamental News Controls

<Insert Table XVII here.>

In the final set of examinations, a robustness check is implemented to confirm whether the reaction of stock price return toward sentiment is driven by a fundamental change at the product market level, rather than the financial market.[59] The fundamental change and unbiased forecast from security analysts has a major impact on stock price. This confirms that the classic financial model can partially explain the financial market correctly. However, with all control variables, including indicators for future earning and discount rate, a similar effect for both firm-related sentiment and name-related sentiment is economically and statistically significant. I also use other measures of control for firm related sentiment: *Heat measure form Bloomberg* (Da, Engelberg, and Gao, 2015) and *Twitter Sentiment*. Result still holds.

4.5.2 Alternative Measures

The search volume of all searches using same term is categorized by Google Trends, and the algorithm used to generate the search volume is not available. To avoid potential noise in this identity measure, I manually incorporate some restraints in the search keywords (e.g. “Apple Fruit”). In addition, the abnormal firm name attention is also calculated following(Da, Engelbeg, Gao, 2011). The abnormal firm name attention is defined as the log of Google search density

[59] For a detailed discussion, please see Section 2 Part 2.

during the week minus the log of median Google search density during the previous eight weeks. The results with these two alternative measures are similar.

Another concern is that the change in search volume may not be caused by the news. For example, an increase in the number of consumers can also increase the search volume for a firm. Consumers search for information, such as product manuals, warranty policies or contact information. These unrelated information searches may affect the findings. Consequently, the search is further restrained to include only company news.

4.5.3 The Timing of Stock Price Reactions

<Insert Table XVIII here.>

<Insert Table XIX here.>

<Insert Table XX here.>

In this section, dynamic panel models are used to further address potential bias caused by the inconsistent LSDV due to serial correlation caused by lagged variables. Table XVIII, Table XIX and Table XX present the results of dynamic panel regressions. In column I of three tables, the potential correlation between firms' errors over time has been accounted for by clustering errors, but this cannot address the potential impact of unobserved heterogeneity on the conditional mean. Therefore, fixed effect and first difference estimators are used to address this endogeneity problem in Column II and Column III. In Column I with OLS estimators, the coefficients are upward biased due to the fact that the lagged dependent variables are positively correlated with the error. Next, in Column IV V and VI, IV method following Anderson-Hsiao (1982), and GMM method following Arellano-Bond (1991) and Blundell and Bond (1998) are used to construct the dynamic panel estimators. Table XVIII illustrates the positive relation between unexpected name attention and stock return volatility. The reversion effect is observed at T+1, and size of reversion is smaller than the size of impact at T.

I conclude that the attention effect on stock volatility is not permanent, and the arbitrageurs will step in to eliminate and mitigate mispricing. The stock volatility then returns to normal. The revision story also works for the unexpected attention related ticker symbol and unexpected attention related to the firm itself. Sentiment effect is then investigated in Table XIX and Table XX. The effect of name sentiment usually appears with a one week lag, but the effect of ticker sentiment is reflected in the stock price in the same week.

Next, the timing of the effect of the two opposite attitudes of sentiment is identified in Table XIX. It takes weeks for the positive effect to influence stock prices, but the price adjustment for negative name sentiment is instantaneous. This is consistent with the statistically insignificant effect of positive name sentiment on stock prices. In addition, the sign of the simultaneous term and lag term of company sentiment are opposite and sizes are similar in Column I, II, and III. These findings confirm the inconsistency introduced by violation of strict exogeneity of the repressors. In summary, the findings hold with dynamic panel data setting and a difference in the timing of the attention and sentiment effect is observed.

4.5.4 Illiquidity Firms

Baker and Wurgler (2007) documents that the companies with low capitalization, younger age, lower profitability, high volatility, non-dividend, higher growth and financial distress are more likely to be disproportionately sensitive to investor sentiment. I find the effects are more significant with stock illiquidity (measured by the relative effective spread). The illiquidity measure is created by take natural logarithm of annual relative effective spread, RESPRD, measured over firm i's fiscal year t. RESPRD is defined as the absolute value of the difference between the execution price and the midpoint of the prevailing bid-ask quote divided by the midpoint of the prevailing bid-ask quote.

4.5.5 Different Fixed Effect Models

In previous studies, scholars usually adopt an event study using name change. However, the results of these studies are typically challenged by other empiricists, as they faced the difficulty of addressing the omitted variables bias. The firms that engaged in rebranding may be systematically different from the underlying control group. The management teams in those firms are likely to conduct a reform at the same time (Carson and et al., 2016). To accurately locate the effect of the name sentiment, control variables and different types of fixed effect—calendar day fixed effect, industry fixed and name fixed effect— are included, with similar results.

4.5.6 Extreme Events

Another alternative explanation is that the name-term sentiment merely captures some extreme events for firms, e.g. ISIS terrorist attacks or restoration of relations between Cuba and the US. To address this concern, the returns are winsorized at 1%, 2% and 5% levels, and the results are very similar. I also endeavor to use other measures of control for firm related sentiment, namely, heat measure from Bloomberg (Da, Engelberg and Gao, 2014) and Twitter sentiment. These results still hold true.

4.6 Conclusion

During last a few decades, behavioral finance has been a popular research area for asset pricing, and both empirical and theoretical evidence has been well established. However, after abundant and competent research discovering new behavioral finance biases to account for asset pricing anomalies, some of these cognitive biases diminished or disappeared altogether with the development of the Internet and the decrease of information asymmetry. The introduction of the Internet in the last century provides a new channel for investors to improve their access to information about firms and about opinions from other investors. However, with attention and sentiment related to corporate name term dispersing throughout the Internet, I document in this paper a pricing anomaly and detect that the naming of corporations plays an important role in the stock market.

The investor name attention and sentiment associated with the firm names significantly impact stock prices. This study is the first to provide evidence showing that stock price persistently reacts to unexpected investor attention and sentiment changes for individual firms, which is consistent with the limited attention theory and sentiment theory of behavioral finance.

4.7 References

Abel, A.B., Eberly, J.C. and Panageas, S., 2007. Optimal inattention to the stock market. *The American economic review*, *97*(2), pp.244-249.

Allport, G.W., 1979. *The nature of prejudice*. Basic books.

Alter, A.L. and Oppenheimer, D.M., 2006. Predicting short-term stock fluctuations by using processing fluency. *Proceedings of the National Academy of Sciences*, *103*(24), pp.9369-9372.

Anand, A., Irvine, P., Puckett, A. and Venkataraman, K., 2013. Institutional trading and stock resiliency: Evidence from the 2007–2009 financial crisis. *Journal of financial Economics*, *108*(3), pp.773-797.

Anderson, T.W. and Hsiao, C., 1982. Formulation and estimation of dynamic models using panel data. *Journal of econometrics*, *18*(1), pp.47-82.

Antweiler, W. and Frank, M.Z., 2004. Is all that talk just noise? The information content of internet stock message boards. *The Journal of Finance*, *59*(3), pp.1259-1294.

Arellano, M. and Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, *58*(2), pp.277-297.

Ariel, R.A., 1987. A monthly effect in stock returns. Journal of Financial Economics, 18(1), pp.161-174.

Baker, M., Ruback, R.S. and Wurgler, J., 2004. *Behavioral corporate finance: A survey* (No. w10863). National Bureau of Economic Research.

Baker, M. and Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. *The Journal of Finance*, *61*(4), pp.1645-1680.

Baker, M. and Wurgler, J., 2007. Investor sentiment in the stock market.

Barber, B.M. and Odean, T., 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies*, *21*(2), pp.785-818.

Barberis, N., Shleifer, A. and Vishny, R., 1998. A model of investor sentiment. *Journal of financial economics*, *49*(3), pp.307-343.

Barberis, N. and Thaler, R., 2003. A survey of behavioral finance. *Handbook of the Economics of Finance*, *1*, pp.1053-1128.

Bertrand, M. and Mullainathan, S., 2004. Are Emily and Greg more employable than Lakisha and Jamal - A field experiment on labor market discrimination. *American Economic Review*, *94*(991), p.1013.

Ben-Rephael, A., Da, Z. and Israelsen, R.D., 2015. It Depends on Where You Search: A Comparison of Institutional and Retail Attention. *Available at SSRN 2692181*.

Blundell, R. and Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, *87*(1), pp.115-143.

Bodenhausen, G.V., 1988. Stereotypic biases in social decision making and memory: testing process models of stereotype use. *Journal of personality and social psychology*, *55*(5), p.726.

Boudoukh, J., Feldman, R., Kogan, S. and Richardson, M., 2013. *Which news moves stock prices? a textual analysis* (No. w18725). National Bureau of Economic Research.

Campbell, J.Y., Grossman, S.J. and Wang, J., 1992. *Trading volume and serial correlation in stock returns* (No. w4193). National Bureau of Economic Research.

Campbell, J.Y., 2000. Asset pricing at the millennium. *The Journal of Finance*, *55*(4), pp.1515-1567.

Campbell, J.Y., Lettau, M., Malkiel, B.G. and Xu, Y., 2001. Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk. *The Journal of Finance*, *56*(1), pp.1-43.

Carson, J.M., Cole, C.R. and Fier, S.G., 2016. Name Changes and Future Growth: Evidence from the Life Insurance Industry. *Journal of Insurance Issues*, pp.1-37.

Choi, N. and Sias, R.W., 2009. Institutional industry herding. *Journal of Financial Economics*, *94*(3), pp.469-491.

Cooper, M.J., Dimitrov, O. and Rau, P.R., 2001. A rose. com by any other name. *The journal of Finance*, *56*(6), pp.2371-2388.

Cooper, M.J., Gulen, H. and Rau, P.R., 2005. Changing names with style: Mutual fund name changes and their effects on fund flows. *The Journal of Finance*, *60*(6), pp.2825-2858.

Coval, J.D. and Shumway, T., 2001. Is sound just noise?. *The Journal of Finance*, *56*(5), pp.1887-1910.

Cutler, D.M., Poterba, J.M. and Summers, L.H., 1989. What moves stock prices?. *The Journal of Portfolio Management*, *15*(3), pp.4-12.

Da, Z., Engelberg, J. and Gao, P., 2011. In search of attention. *The Journal of Finance*, *66*(5), pp.1461-1499.

Da, Z., Engelberg, J. and Gao, P., 2015. The sum of all fears investor sentiment and asset prices. *Review of Financial Studies*, *28*(1), pp.1-32.

Daniel, K., Hirshleifer, D. and Subrahmanyam, A., 1998. Investor psychology and security market under-and overreactions. *the Journal of Finance*, *53*(6), pp.1839-1885.

Das, S.R. and Chen, M.Y., 2007. Yahoo! for Amazon: Sentiment extraction from small talk on the web. *Management Science*, *53*(9), pp.1375-1388.

De Long, J.B., Shleifer, A., Summers, L.H. and Waldmann, R.J., 1990. Noise trader risk in financial markets. *Journal of political Economy*, pp.703-738.

De Long, J.B., Shleifer, A., Summers, L.H. and Waldmann, R.J., 1990. Positive feedback investment strategies and destabilizing rational speculation. *the Journal of Finance*, *45*(2), pp.379-395.

Einav, L. and Yariv, L., 2006. What's in a surname? The effects of surname initials on academic success. *The Journal of Economic Perspectives*, *20*(1), pp.175-187.

Fama, E.F., 1965. The behavior of stock-market prices. *The journal of Business*, *38*(1), pp.34-105.

Fama, E.F., 1991. Efficient capital markets: II. *The Journal of finance*, *46*(5), pp.1575-1617.

French, K.R., 1980. Stock returns and the weekend effect. *Journal of financial economics*, *8*(1), pp.55-69.

Gao, Z., Ren, H. and Zhang, B., 2016. Googling Investor Sentiment around the World.

Goetzmann, W.N., Kim, D., Kumar, A. and Wang, Q., 2014. Weather-induced mood, institutional investors, and stock returns. *Review of Financial Studies*, p.hhu063.

Green, T.C. and Jame, R., 2013. Company name fluency, investor recognition, and firm value. *Journal of Financial Economics*, *109*(3), pp.813-834.

Griffin, J.M., Harris, J.H. and Topaloglu, S., 2003. The dynamics of institutional and individual trading. *The Journal of Finance*, *58*(6), pp.2285-2320.

Grullon, G., Kanatas, G. and Weston, J.P., 2004. Advertising, breadth of ownership, and liquidity. *Review of Financial Studies*, *17*(2), pp.439-461.

Hall, R., 1992. The strategic analysis of intangible resources. *Strategic management journal*, *13*(2), pp.135-144.

Han, B., 2008. Investor sentiment and option prices. *Review of Financial Studies*, *21*(1), pp.387-414.

Hartzmark, S.M., 2014. The worst, the best, ignoring all the rest: The rank effect and trading behavior. *Review of Financial Studies*, p.hhu079.

Hu, G., McLean, R.D., Pontiff, J. and Wang, Q., 2014. The year-end trading activities of institutional investors: Evidence from daily trades. *Review of Financial Studies*, *27*(5), pp.1593-1614.

Head, A., Smith, G. and Wilson, J., 2009. Would a stock by any other ticker smell as sweet?. *The Quarterly Review of Economics and Finance*, *49*(2), pp.551-561.

Huberman, G., 2001. Familiarity breeds investment. *Review of financial Studies*, *14*(3), pp.659-680.

Jacobs, H. and Hillert, A., 2014. *The power of primacy: Alphabetic bias, investor recognition, and market outcomes*. Working Paper.

Keim, D.B., 1983. Size-related anomalies and stock return seasonality: Further empirical evidence. *Journal of financial economics*, *12*(1), pp.13-32.

Keynes, J.M., 2006. *General theory of employment, interest and money*. Atlantic Publishers & Dist.

Kindleberger, C.P., 1978. *Economic response: comparative studies in trade, finance, and growth*. Harvard University Press.

Kiviet, J.F., 1995. On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. *Journal of econometrics*, *68*(1), pp.53-78.

Knewtson, H.S. and Sias, R.W., 2010. Why Susie owns Starbucks: The name letter effect in security selection. *Journal of Business Research*, *63*(12), pp.1324-1327.

Kreps, D.M., 1990. A Course in Mi croeconomic Thneory.

Kunda, Z., 1999. *Social cognition: Making sense of people*. MIT press.

Kumar, A., Niessen-Ruenzi, A. and Spalt, O.G., 2015. What's in a Name? Mutual Fund Flows When Managers Have Foreign-Sounding Names. *Review of Financial Studies*, p.hhv017.

Kumar, A., Niessen-Ruenzi, A. and Spalt, O.G., 2015. What's in a Name? Mutual Fund Flows When Managers Have Foreign-Sounding Names. *Review of Financial Studies*, p.hhv017.

Lee, C., Shleifer, A. and Thaler, R.H., 1991. Investor sentiment and the closed-end fund puzzle. *The Journal of Finance*, *46*(1), pp.75-109.

Lemmon, M. and Portniaguina, E., 2006. Consumer confidence and asset prices: Some empirical evidence. *Review of Financial Studies*, *19*(4), pp.1499-1529.

Livnat, J. and Mendenhall, R.R., 2006. Comparing the post–earnings announcement drift for surprises calculated from analyst and time series forecasts. *Journal of Accounting Research*, *44*(1), pp.177-205.

Madhavan, A. and Panchapagesan, V., 2000. Price discovery in auction markets: A look inside the black box. *Review of Financial Studies*, *13*(3), pp.627-658.

Malkiel, B.G. and Fama, E.F., 1970. Efficient capital markets: A review of theory and empirical work. *The journal of Finance*, *25*(2), pp.383-417.

Malkiel, B.G., 2003. The efficient market hypothesis and its critics. *The Journal of Economic Perspectives*, *17*(1), pp.59-82.

McGlone, M.S. and Tofighbakhsh, J., 2000. Birds of a feather flock conjointly (?): Rhyme as reason Pennington, N. and Hastie, R., 1988. Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *14*(3), p.521. in aphorisms. *Psychological Science*, *11*(5), pp.424-428.

Meyer, M., Milgrom, P. and Roberts, J., 1992. Organizational prospects, influence costs, and ownership changes. *Journal of Economics & Management Strategy*, *1*(1), pp.9-35.

Nickell, S., 1981. Biases in dynamic models with fixed effects.*Econometrica: Journal of the Econometric Society*, pp.1417-1426.

Ofek, E. and Richardson, M., 2003. Dotcom mania: The rise and fall of internet stock prices. *The Journal of Finance*, *58*(3), pp.1113-1137.

Pennington, N. and Hastie, R., 1986. Evidence evaluation in complex decision making. *Journal of Personality and Social Psychology*, *51*(2), p.242.

Pennington, N. and Hastie, R., 1988. Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *14*(3), p.521.

Rashes, M.S., 2001. Massively confused investors making conspicuously ignorant choices (mci–mcic). *The Journal of Finance*, *56*(5), pp.1911-1927.

Reber, R. and Schwarz, N., 1999. Effects of perceptual fluency on judgments of truth. *Consciousness and cognition*, *8*(3), pp.338-342.

Reber, R., Winkielman, P. and Schwarz, N., 1998. Effects of perceptual fluency on affective judgments. *Psychological science*, *9*(1), pp.45-48.

Shiller, R.J., 2000. Measuring bubble expectations and investor confidence. *The Journal of Psychology and Financial Markets*, *1*(1), pp.49-60.

Simon, H.A., 1978. Rationality as process and as product of thought. *The American economic review*, *68*(2), pp.1-16.

Singh, D., 2013. The brand personality component of brand goodwill: some antecedents and consequences. *Brand equity & advertising: Advertising's role in building strong brands*, p.83.

Tadelis, S., 1997. What's in a Name? Reputation as a Tradeable Asset.

Tetlock, P.C., 2007. Giving content to investor sentiment: The role of media in the stock market. *The Journal of Finance*, *62*(3), pp.1139-1168.

Tumarkin, R. and Whitelaw, R.F., 2001. News or noise? Internet postings and stock prices. *Financial Analysts Journal*, *57*(3), pp.41-51.

Yuan, Y., 2008. Attention and trading. *Unpublished Working Paper. University of Pennsylvania*.

Figure I

ISIS search popularity and Isis Pharmaceuticals, Inc. (ISIS) Price

This figure shows the effect of "ISIS" search volume densities for both Islamic State of Iraq and the Levant and Isis Pharmaceuticals, Inc. (ticker: ISIS) on stock price of Ionis Pharmaceuticals, Inc. (IONS). The primary vertical axis is the density of Google search volume (max: 100 and min: 0). The second vertical axis is the stock price measured by US Dollars ($). The Isis Pharmaceuticals, Inc changes its name to Ionis Pharmaceuticals, Inc. (ticker: IONS) on Dec 18, 2015 following the Paris terrorist attack on November 13, 2015. The Ionis Pharmaceuticals, Incs firm has no major changes with its fundamentals.

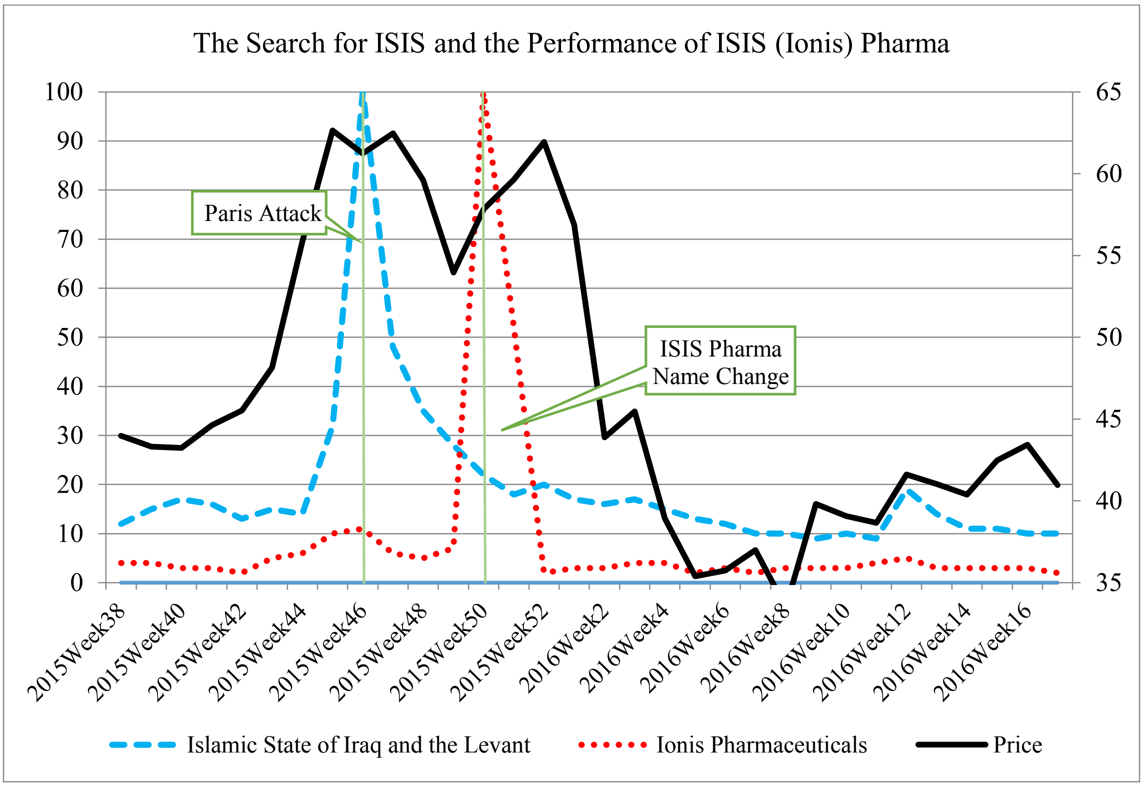


Figure II

CUBA search popularity and The Herzfeld Caribbean Basin Fund Inc. (CUBA) Fund Price

This figure shows the effect of "CUBA" search volumes for both the country of Cuba and the Herzfeld Caribbean Basin Fund Inc. (ticker: CUBA) on stock price of Cuba Fund. The primary vertical axis is the density of Google search volume (max: 100 and min: 0). The second vertical axis is the fund price measured by US Dollars ($). In December 2014, President Barack Obama, with his entire national security team announce a restoration of diplomatic rapprochement between the United States and Cuba, demonstrating political courage to change the course of history. The price of Herzfeld Caribbean Basin Fund Inc. with ticker "CUBA" reacts to the news, but it holds no actual Cuban companies.

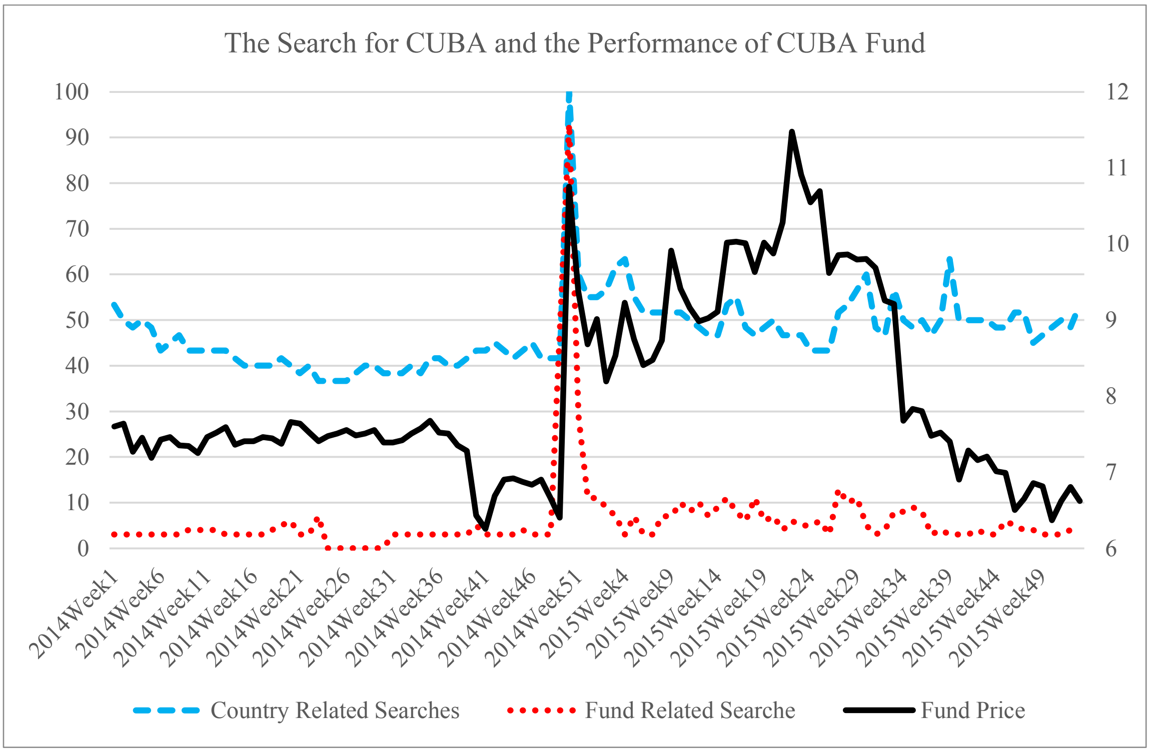


Figure III

The NAV and Price Change of Herzfeld Caribbean Basin Fund Inc. (CUBA) Fund

This figure shows the change of stock price and NAV of Herzfeld Caribbean Basin Fund Inc. (CUBA) Fund. In December 2014, the President of United States announces a restoration of diplomatic rapprochement between the United States and Cuba. The price of Herzfeld Caribbean Basin Fund Inc. with ticker "CUBA" reacts to the news, but it holds no actual Cuban companies and its NAV stay similar as before.

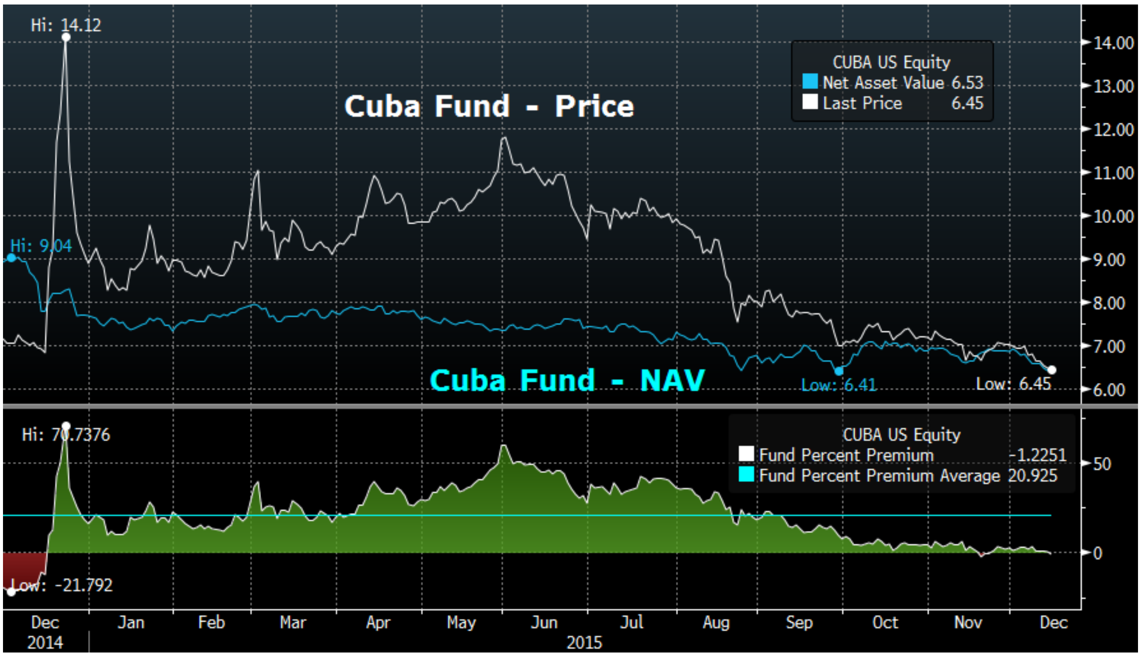


Table I

Summary Statistics

This table presents the summary statistics of all variables used in this paper. This sample contains the manually selected 147 firms with firm names unrelated to their business conduct. I also require these firms to have available information in CRSP and Compustat. All other variables are defined in the Appendix Table AI.

Variables	*N*	Mean	SD	25 Percentile	Median	75 Percentile
Panel A: Key Interested Variables						
Search Density for Company Name Terms (Assigned Firm Unrelated Category)	*46,570*	0.26821	0.234	0.050	0.240	0.430
Search Density for Company Itself: a	*46,570*	0.22251	0.244	0.020	0.120	0.370
Unexpected Name Sentiment: (e - d) - (h - g)	*20,078*	0.00037	0.077	-0.030	0.000	0.030
Unexpected Company Sentiment: d - g	*20,421*	-0.11723	0.154	-0.190	-0.100	-0.020
Unexpected Name Positive Sentiment: e - d	*20,121*	0.39241	0.209	0.230	0.370	0.560
Unexpected Name Negative Sentiment: h - g	*20,121*	0.06786	0.064	0.030	0.050	0.080
Change of Search Density for Company Related Positive News: d	*20,421*	0.12018	0.124	0.020	0.090	0.170
Change of Search Density for Company Related Negative News: g	*20,421*	0.23741	0.162	0.120	0.200	0.330
The Bloomberg Heat Measure	*26,123*	0.00268	0.016	0.001	0.001	0.003
The Bloomberg Sentiment Measure	*26,123*	0.18115	1.773	0	0	0.0935
# of 8-K Filings (Edgar)	*46,570*	0.26659	0.574	0	0	0
Panel B: Firm Fundamental Information						
Ln (Total Assets)	*46,253*	7.80574	1.838	6.495	7.450	9.002
Ln (MTB)	*46,143*	-0.01225	0.877	-0.500	0.066	0.578
Ln (Market Capitalization)	*46,143*	7.79521	1.784	6.537	7.581	8.862
Panel C: Analyst Forecast and Recommendation Information						
SUE Score (quarterly)	*42,024*	1.31016	6.585	-0.222	1.062	2.804
Surprise Mean (quarterly)	*44,393*	0.42354	0.778	0.142	0.312	0.582
Surprise STD (quarterly)	*42,639*	0.03838	0.086	0.009	0.018	0.041
Number of Recommendations	*44,811*	12.28364	8.477	6	11	17
Number Up	*44,811*	0.21086	0.528	0	0	0
Number Down	*44,811*	0.23613	0.584	0	0	0
Buy Percent	*44,811*	49.24074	27.826	28.570	50.000	69.570
Sell Percent	*44,811*	5.83510	10.715	0	0	9.090
Hold Percent	*44,811*	44.92414	24.826	27.780	46.150	61.540
Mean Recommendation	*44,811*	2.31077	0.524	2.000	2.290	2.670
Median Recommendation	*44,811*	2.41317	0.659	2.000	2.500	3.000
Standard Deviation	*44,811*	0.80184	0.299	0.710	0.850	0.970
Panel D: Performance Measures						
Stock Return Volatility Weekly	*45,011*	0.02185	0.019	0.011	0.017	0.027
Stock Returns Weekly	*45,019*	0.00344	0.064	-0.024	0.002	0.029

Table II
Summary Statistics

This table presents the summary statistics of all variables used in this paper. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. All other variables are defined in the Appendix Table AI.

Variables	*N*	Mean	SD	25 Percentile	Median	75 Percentile
Panel A: Key Interested Variables						
Searches Density for Company Itself: a	*962,057*	0.04428	0.146	0	0	0
Search Density for Company Name Terms: b	*974,359*	0.35524	0.258	0.110	0.360	0.560
Unexpected Name Attention: b – a	*962,057*	0.31014	0.316	0.070	0.330	0.540
Searches Density for Company Ticker Terms: c	*974,359*	0.19384	0.250	0	0.050	0.360
Unexpected Ticker Attention: c – a	*962,057*	0.14668	0.232	0	0.010	0.220
Change of [Search Density for Company Related Positive News: d]	*1,489,266*	0.00027	0.010	0	0	0
Change of [Search Density for Company Name Term Related Positive News: e]	*1,486,917*	0.00010	0.146	-0.050	0	0.050
Change of [Search Density for Company Ticker Term Related Positive News: f]	*505,134*	0.00002	0.073	-0.010	0	0.010
Unexpected Name Positive Sentiment: e – d	*1,486,917*	0.00010	0.146	-0.050	0	0.050
Unexpected Ticker Positive Sentiment: f – d	*505,134*	0.00002	0.073	-0.010	0	0.010
Change of [Search Density for Company Related Negative News: g]	*1,489,266*	0.00045	0.017	0	0	0
Change of [Search Density for Company Name Term Related Negative News: h]	*1,486,917*	0.00000	0.043	-0.010	0	0.010
Change of [Search Density for Company Ticker Term Related Negative News: i]	*505,134*	0.00004	0.130	-0.040	0	0.040
Unexpected Name Negative Sentiment: h – g	*1,486,917*	0.00000	0.043	-0.010	0	0.010
Unexpected Ticker Negative Sentiment: i – g	*505,134*	0.00004	0.130	-0.040	0	0.040
The Bloomberg Heat Measure	*744,080*	-25.059	5989.873	0	0	0.02
The Bloomberg Sentiment Measure	*744,080*	2.62092	17.806	0.33	1.08	2.25
# of 8-K Filings (Edgar)	*1,590,020*	0.43697	0.615	0	0	1
Panel B: Firm Fundamental Information						
Ln (Total Assets)	*1,265,738*	5.46	3.07	3.59	5.72	7.52
Ln (MTB)	*1,132,366*	-0.14	1.58	-0.95	-0.13	0.63
Ln (Market Capitalization)	*1,136,994*	5.29	2.65	3.49	5.30	7.14
Panel C: Analyst Forecast and Recommendation Information						
SUE Score (quarterly)	*167,910*	0.38	37.48	-0.82	0.55	2.14
Surprise Mean (quarterly)	*212,490*	-1662.62	343388.90	0.01	0.18	0.44
Surprise STD (quarterly)	*174,215*	179.73	23975.01	0.01	0.02	0.05
Number of Recommendations	*753,751*	7.03	6.67	2	5	10
Number Up	*753,751*	0.12	0.41	0	0	0
Number Down	*753,751*	0.15	0.49	0	0	0
Buy Percent	*753,751*	54.33	35.14	25	53.85	87.5
Sell Percent	*753,751*	6.47	16.70	0	0	4.17

Hold Percent	*753,751*	39.20	32.56	0	37.5	60.87
Mean Recommendation	*753,751*	2.28	0.67	1.91	2.25	2.75
Median Recommendation	*753,751*	2.33	0.75	2	2	3
Standard Deviation	*753,751*	0.61	0.43	0	0.71	0.9
Panel D: Performance Measures						
Stock Returns Weekly	*970,715*	0.00	0.06	-0.02	0.00	0.03
Stock Return Volatility Weekly	*970,618*	0.02	0.02	0.01	0.02	0.03
Trading Volume Weekly (mil)	*970,778*	10.50	46.80	1.02	2.76	8.21
Change of Stock Return Volatility Weekly	*968,096*	0.00	0.02	-0.01	0.00	0.01
% Change of Stock Return Volatility Weekly	*968,081*	0.26	0.97	-0.36	-0.01	0.55

Table III

Correlation Matrix

This table presents the correlation matrix of all variables used in this paper. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. All other variables are defined in the Appendix Table AI.

	Returns	Volatility	a	b	b - a	c	c - a
Stock Returns Weekly	1.000						
Stock Return Volatility Weekly	0.068	1.000					
Search Density for Company Itself: a	0.000	-0.021	1.000				
Search Density for Company Name Terms: b	-0.004	0.008	-0.145	1.000			
Unexpected Name Attention: b – a	-0.002	0.019	-0.723	0.789	1.000		
Search Density for Company Ticker Terms: c	0.002	-0.011	0.327	-0.279	-0.398	1.000	
Unexpected Ticker Attention: c – a	0.002	0.006	-0.442	-0.156	0.166	0.703	1.000
Change of [Search Density for Company Related Positive News: d]	-0.002	0.000	-0.001	0.002	0.002	0.001	0.001
Change of [Search Density for Company Name Term Related Positive News: e]	-0.004	0.003	0.003	0.025	0.016	0.004	0.002
Change of [Search Density for Company Ticker Term Related Positive News: f]	0.010	0.002	0.001	0.002	0.001	0.007	0.006
Unexpected Name Positive Sentiment: e – d	-0.004	0.003	0.003	0.025	0.016	0.004	0.002
Unexpected Ticker Positive Sentiment: f – d	0.010	0.002	0.001	0.002	0.001	0.007	0.006
Change of [Search Density for Company Related Negative News: g]	-0.001	0.004	-0.004	0.005	0.007	0.001	0.004
Change of [Search Density for Company Name Term Related Negative News: h]	-0.001	0.000	0.000	0.017	0.012	0.001	0.001
Change of [Search Density for Company Ticker Term Related Negative News: i]	-0.009	0.004	0.008	0.002	-0.004	0.016	0.009
Unexpected Name Negative Sentiment: h - g	-0.001	-0.001	0.000	0.017	0.012	0.001	0.001
Unexpected Ticker Negative Sentiment: i - g	-0.009	0.004	0.008	0.002	-0.004	0.016	0.009
The Bloomberg Sentiment Measure	0.021	-0.049	0.002	-0.001	-0.002	0.008	0.007

	d	e	f	e - d	f - d	g	h	i	h - g	i - g	Sentiment
d	1.000										
e	0.000	1.000									
f	0.000	0.006	1.000								
e - d	-0.006	1.000	0.006	1.000							
f - d	-0.010	0.006	1.000	0.006	1.000						
g	0.268	0.000	0.000	-0.001	-0.002	1.000					
h	0.000	0.105	0.012	0.105	0.012	0.000	1.000				
i	0.000	0.015	0.052	0.015	0.052	0.000	0.018	1.000			
h - g	-0.010	0.105	0.012	0.105	0.012	-0.036	0.999	0.018	1.000		
i - g	-0.003	0.015	0.052	0.015	0.052	-0.010	0.018	1.000	0.018	1.000	
The Bloomberg Sentiment Measure	-0.005	0.031	-0.002	0.031	-0.002	0.000	-0.001	-0.003	-0.001	-0.003	1.000

Table IV

Investor Attention and Stock Return Volatility

This table presents the relationship between Google search popularity and weekly stock return volatility. This sample contains the manually selected 147 firms with firm names unrelated to their business conduct. I also require these firms to have available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Volatility		
	(I)	(II)	(III)
Unexpected Name Attention:	0.0063**	0.0064**	0.0082*
b - a	(2.131)	(2.170)	(1.689)
Search Density for		-0.0015	-0.0021
Company Itself: a		(-0.741)	(-1.021)
Ln (Market Capitalization)			0.0004
			(0.327)
Ln (MTB)			-0.0030
			(-1.456)
Mean Recommendation			0.0026***
			(2.855)
Standard Deviation			-0.0000
of Recommendations			(-0.032)
Heats of			0.0406***
Institutional Investors			(3.440)
# of 8-K Filings			0.0038***
			(4.683)
Constant	0.0190***	0.0194***	-0.0072
	(8.847)	(8.628)	(-0.622)
Fixed	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)		
Cluster	Firm	Firm	Firm
R-squared	0.424	0.424	0.506
N	45,011	45,011	24,431

Table V

Investor Attention and Stock Return Volatility

This table presents the relationship between Google search popularity and weekly stock return volatility. This sample contains the manually selected 147 firms with firm names unrelated to their business conduct. I also require these firms have available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatility				
	(I)	(II)	(III)	(IV)	(V)
Unexpected Name Attention:	0.0073*	0.0143**	0.0154**	0.0142**	0.0155**
b - a	(1.875)	(2.285)	(2.262)	(2.303)	(2.276)
Lag		-0.0091**	-0.0061*	-0.0090**	-0.0058*
		(-2.148)	(-1.905)	(-2.129)	(-1.836)
Lag2			-0.0051		-0.0054
			(-1.572)		(-1.652)
Search Density for	-0.0016	-0.0021	-0.0020	-0.0015	-0.0014
the Company Itself	(-0.966)	(-0.867)	(-0.845)	(-0.663)	(-0.622)
Lag		0.0008	0.0014	0.0005	0.0012
		(0.310)	(0.413)	(0.188)	(0.354)
Lag2			-0.0008		-0.0010
			(-0.361)		(-0.450)
Return Std Deviation (t-1)	0.1431***	0.1451***	0.1448***	0.1293***	0.1290***
	(7.230)	(7.109)	(7.153)	(6.762)	(6.805)
Return Std Deviation (t-2)	0.0777***	0.0776***	0.0788***		
	(5.352)	(5.370)	(5.298)		
Return Std Deviation (t-3)	0.1014***	0.1015***	0.1014***		
	(6.704)	(6.619)	(6.602)		
Return Std Deviation (t-3, t-2)				0.1421***	0.1432***
				(6.131)	(6.073)
Return Std Deviation (t-6, t-4)				0.1476***	0.1476***
				(9.784)	(9.780)
Ln (Market Capitalization)	0.0004	0.0005	0.0005	0.0005	0.0005
	(0.458)	(0.538)	(0.561)	(0.608)	(0.640)
Ln (MTB)	-0.0022	-0.0023*	-0.0023*	-0.0020*	-0.0021*
	(-1.662)	(-1.696)	(-1.704)	(-1.686)	(-1.700)
Mean Recommendation	0.0018***	0.0018***	0.0018***	0.0015***	0.0015***
	(3.078)	(3.077)	(3.089)	(3.096)	(3.110)
Standard Deviation	-0.0000	0.0000	0.0000	0.0001	0.0002
of Recommendations	(-0.029)	(0.020)	(0.037)	(0.251)	(0.270)
Heats of	0.0403***	0.0400***	0.0399***	0.0399***	0.0397***
Institutional Investors	(3.540)	(3.538)	(3.533)	(3.556)	(3.551)
# of 8-K Filings	0.0039***	0.0038***	0.0038***	0.0038***	0.0038***
	(4.598)	(4.602)	(4.598)	(4.564)	(4.560)
Constant	-0.0104	-0.0105	-0.0105	-0.0114	-0.0114
	(-1.222)	(-1.236)	(-1.226)	(-1.475)	(-1.468)
Fixed	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)				
Cluster	Firm	Firm	Firm	Firm	Firm
R-squared	0.531	0.531	0.531	0.536	0.536
N	24,407	24,406	24,404	24,376	24,374

Table VI

Investor Attention and Stock Returns

This table presents the relationship between Google search popularity and weekly stock returns. This sample contains the manually selected 147 firms with firm names unrelated to their business conduct. I also require these firms have available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns		
	(I)	(II)	(III)
Unexpected Name Attention:	-0.0036*	-0.0034	-0.0069
b - a	(-1.710)	(-1.594)	(-1.433)
Search Density for		-0.0032	-0.0049
Company Itself: a		(-1.292)	(-1.254)
Ln (Market Capitalization)			0.0020
			(1.497)
Ln (MTB)			0.0065***
			(4.271)
Mean Recommendation			0.0009
			(1.083)
Standard Deviation			0.0007
of Recommendations			(0.555)
Sentiment of			0.0090
Institutional Investors			(0.417)
# of 8-K Filings			0.0021***
			(2.836)
Constant	0.0232***	0.0241***	0.0029
	(3.383)	(3.469)	(0.222)
Fixed	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)		
Cluster	Firm	Firm	Firm
R-squared	0.317	0.317	0.362
N	41,815	41,815	24,432

Table VII

Investor Attention and Stock Returns

This table presents the relationship between Google search popularity and weekly stock returns. This sample contains the manually selected 147 firms with firm names unrelated to their business conduct. I also require these firms have available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns				
	(I)	(II)	(III)	(V)	(VI)
Unexpected Name Attention:	-0.0068	0.0062	0.0087	0.0057	0.0082
b - a	(-1.413)	(0.741)	(0.948)	(0.685)	(0.898)
Lag		-0.0169**	-0.0109	-0.0165**	-0.0105
		(-2.132)	(-1.258)	(-2.067)	(-1.211)
Lag2			-0.0101		-0.0101
			(-1.258)		(-1.258)
Search Density for	-0.0049	0.0056	0.0057	0.0056	0.0056
Company Itself: a	(-1.217)	(0.843)	(0.820)	(0.835)	(0.814)
Lag		-0.0126	-0.0133	-0.0128	-0.0135
		(-1.556)	(-1.339)	(-1.582)	(-1.351)
Lag2			0.0010		0.0010
			(0.126)		(0.128)
Stock Return (t-1)	-0.0249***	-0.0253***	-0.0254***	-0.0259***	-0.0260***
	(-2.801)	(-2.832)	(-2.830)	(-2.872)	(-2.869)
Stock Return (t-2)	-0.0129*	-0.0132*	-0.0133*		
	(-1.682)	(-1.727)	(-1.734)		
Stock Return (t-3)	0.0015	0.0016	0.0012		
	(0.236)	(0.250)	(0.188)		
Stock Return (t-2, t-3)				-0.0062	-0.0065
				(-1.200)	(-1.236)
Stock Return (t-4, t-6)				-0.0083	-0.0083
				(-1.411)	(-1.400)
Ln (Market Capitalization)	0.0020	0.0023	0.0022	0.0023	0.0023
	(1.473)	(1.615)	(1.576)	(1.614)	(1.575)
Ln (MTB)	0.0068***	0.0066***	0.0066***	0.0069***	0.0068***
	(4.408)	(4.329)	(4.343)	(4.400)	(4.390)
Mean Recommendation	0.0009	0.0009	0.0009	0.0010	0.0010
	(1.047)	(1.061)	(1.058)	(1.154)	(1.149)
Standard Deviation	0.0007	0.0008	0.0008	0.0008	0.0008
of Recommendations	(0.525)	(0.571)	(0.609)	(0.580)	(0.616)
Sentiment of	0.0086	0.0082	0.0078	0.0087	0.0082
Institutional Investors	(0.403)	(0.384)	(0.362)	(0.404)	(0.382)
# of 8-K Filings	0.0020***	0.0020***	0.0020***	0.0020***	0.0019***
	(2.809)	(2.762)	(2.754)	(2.743)	(2.736)
Constant	0.0020	0.0016	0.0024	0.0009	0.0016
	(0.149)	(0.120)	(0.178)	(0.067)	(0.120)
Fixed	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)				
Cluster	Firm	Firm	Firm	Firm	Firm
R-squared	0.363	0.363	0.363	0.363	0.364
N	24,413	24,412	24,410	24,385	24,383

Table VIII

Investor Sentiment and Stock Returns

This table presents the relationship between Google search popularity and weekly stock returns. This sample contains the manually sleeted 147 firms with firm names unrelated to their business conduct. I also require these firms have available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Unexpected Name Sentiment	0.0049**	0.0047**	0.0102**			
Difference: (e - d) - (h - g)	(2.148)	(2.210)	(2.149)			
Unexpected Name Positive Sentiment:				-0.0017	-0.0011	-0.0022
e – d				(-0.577)	(-0.359)	(-0.415)
Unexpected Name Negative Senti-ment:				-0.0123**	-0.0112**	-0.0107*
h – g				(-2.187)	(-2.331)	(-1.776)
Unexpected Company Sentiment		0.0102**	0.0135*			
Difference: d - g		(2.099)	(1.780)			
Search Density for Company					0.0062*	0.0199
Related Positive News: d					(1.980)	(1.501)
Search Density for Company					-0.0039	-0.0072
Related Negative News: g					(-1.624)	(-1.336)
Ln (Market Capitalization)			0.0009			0.0012
			(0.430)			(0.566)
Ln (MTB)			0.0082***			0.0079***
			(4.050)			(3.829)
Mean Recommendation			0.0015			0.0016
			(1.109)			(1.172)
Standard Deviation			-0.0016			-0.0016
of Recommendations			(-0.617)			(-0.623)
Number of Recommendations						
Surprise Mean (Quarterly)						
Surprise STD Deviation (Quarterly)						
SUE Score (Quarterly)						
Buy Percent						
Sell Percent						
Number Up						
Number Down						
Sentiment of			0.0185			0.0171
Institutional Investors			(0.625)			(0.586)
# of 8-K Filings			0.0017**			0.0017**
			(2.125)			(2.118)
Constant	0.0289***	0.0219***	0.0061	0.0298***	0.0286***	0.0040
	(3.061)	(4.952)	(0.285)	(3.087)	(2.862)	(0.181)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)					
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.348	0.358	0.394	0.348	0.357	0.393
N	19,676	18,616	11,661	19,676	18,653	11,661

Table IX

Investor Sentiment and Weekly Stock Returns

This table presents the relationship between Google search popularity and weekly stock returns. This sample contains the manually sleeted 147 firms with firm names unrelated to their business conduct. I also require these firms have available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Unexpected Name Sentiment	0.0093*	0.0131*	0.0100**	0.0158*	0.0087	0.0133
Difference: (e - d) - (h - g)	(1.851)	(1.723)	(2.031)	(1.921)	(1.662)	(1.601)
Lag			0.0030	0.0076	0.0017	0.0043
			(0.676)	(1.067)	(0.383)	(0.600)
Lag2					-0.0032	-0.0085
					(-0.897)	(-1.360)
Unexpected Company Sentiment	0.0047**	0.0099**	0.0030	0.0104	0.0028	0.0097
Difference: d - g	(2.111)	(2.049)	(0.994)	(1.533)	(0.901)	(1.388)
Lag			0.0031	-0.0004	0.0025	-0.0016
			(0.909)	(-0.053)	(0.702)	(-0.223)
Lag2					0.0013	0.0026
					(0.524)	(0.499)
Stock Return (t-1)	-0.0113	0.0028	-0.0114	0.0027	-0.0112	0.0030
	(-1.025)	(0.200)	(-1.036)	(0.192)	(-1.026)	(0.216)
Stock Return (t-2)	-0.0006	-0.0070	-0.0007	-0.0069	-0.0002	-0.0069
	(-0.077)	(-0.654)	(-0.089)	(-0.648)	(-0.025)	(-0.648)
Stock Return (t-3)	0.0130	0.0107	0.0132	0.0106	0.0127	0.0099
	(1.398)	(0.901)	(1.412)	(0.898)	(1.361)	(0.833)
Ln (Market Capitalization)		0.0009		0.0009		0.0007
		(0.429)		(0.429)		(0.309)
Ln (MTB)		0.0081***		0.0081***		0.0082***
		(4.120)		(4.133)		(4.066)
Mean Recommendation		0.0015		0.0015		0.0015
		(1.110)		(1.106)		(1.118)
Standard Deviation		-0.0015		-0.0016		-0.0015
of Recommendations		(-0.615)		(-0.620)		(-0.591)
Sentiment of		0.0183		0.0176		0.0171
Institutional Investors		(0.616)		(0.595)		(0.576)
# of 8-K Filings		0.0016**		0.0016**		0.0016**
		(2.034)		(2.033)		(2.064)
Constant	0.0218***	0.0063	0.0219***	0.0064	0.0220***	0.0084
	(4.801)	(0.297)	(4.792)	(0.299)	(4.776)	(0.385)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)					
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.358	0.394	0.358	0.394	0.359	0.394
N	18,539	11,658	18,525	11,658	18,513	11,656

Table X

Investor Attention and Stock Return Volatility

This table presents the relationship between Google search popularity and weekly stock return volatility. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatility							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VIII)	(IX)
Raw Data								
Unexpected Name Attention:	0.0020***					0.0026***		0.0027***
b - a	(2.654)					(3.089)		(3.106)
Unexpected Ticker Attention:		0.0001					0.0002	-0.0005
c - a		(0.172)					(0.211)	(-0.585)
Search Density for			0.0032**			0.0053***	0.0032**	0.0053***
Company Itself: a			(2.194)			(3.057)	(2.197)	(3.067)
Search Density for				0.0025***				
Company Name Terms: b				(3.054)				
Search Density for					0.0008			
Company Ticker Terms: c					(1.181)			
Constant	0.0197***	0.0204***	0.0203***	0.0195***	0.0204***	0.0193***	0.0203***	0.0193***
	(41.283)	(54.174)	(54.596)	(37.269)	(52.686)	(36.281)	(52.751)	(36.482)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)							
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.387	0.387	0.387	0.387	0.386	0.387	0.387	0.387
N	958,320	958,320	958,320	970,618	970,618	958,320	958,320	958,320

Table XI

Change of Investor Attention and of Stock Return Volatility

This table presents the relationship between the changes of Google search popularity and weekly stock return volatility. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Change of Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sided test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Change of Weekly Stock Return Volatility							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VIII)	(IX)
First Difference of Variables								
Unexpected Name Attention:	0.0095***					0.0118***		0.0111***
b - a	(6.804)					(7.753)		(7.311)
Unexpected Ticker Attention:		0.0094***					0.0095***	0.0068***
c - a		(5.728)					(5.770)	(4.240)
Search Density for			0.0146***			0.0239***	0.0148***	0.0235***
Company Itself: a			(4.622)			(6.811)	(4.665)	(6.687)
Search Density for				0.0121***				
Company Name Terms: b				(8.039)				
Search Density for					0.0107***			
Company Ticker Terms: c					(7.460)			
Constant	-0.0023***	-0.0023***	-0.0023***	-0.0024***	-0.0024***	-0.0024***	-0.0023***	-0.0024***
	(-5.725)	(-5.687)	(-5.657)	(-5.920)	(-5.860)	(-5.833)	(-5.739)	(-5.882)
Fixed Effect	Year*Month*Week (Calendar)							
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.092	0.092	0.091	0.092	0.091	0.092	0.092	0.092
N	955,829	955,829	955,829	968,096	968,096	955,829	955,829	955,829

Table XII

Percentage Change of Investor Attention and Percentage Change of Weekly Stock Return Volatility

This table presents the relationship between the changing rates of Google search popularity and weekly stock return volatility. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Percentage Change of Weekly Stock Return Volatility*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Percentage Change of Weekly Stock Return Volatility							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VIII)	(IX)
Percentage Change of Variables								
Unexpected Name Attention:	0.2676***					0.3337***		0.3118***
b - a	(9.806)					(11.589)		(11.009)
Unexpected Ticker Attention:		0.2885***					0.2906***	0.2157***
c - a		(5.704)					(5.750)	(4.341)
Search Density for			0.4547***			0.7182***	0.4592***	0.7043***
Company Itself: a			(5.517)			(8.373)	(5.554)	(8.205)
Search Density for				0.3450***				
Company Name Terms: b				(12.071)				
Search Density for					0.3306***			
Company Ticker Terms: c					(7.759)			
Constant	0.1490***	0.1495***	0.1498***	0.1473***	0.1480***	0.1477***	0.1488***	0.1471***
	(6.715)	(6.736)	(6.750)	(6.680)	(6.715)	(6.652)	(6.706)	(6.626)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Effect				Year*Month*Week (Calendar)				
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.096	0.096	0.096	0.096	0.095	0.096	0.096	0.096
N	955,816	955,816	955,816	968,081	968,081	955,816	955,816	955,816

Table XIII

The effect of Investor Attention and Sentiment on Stock Return Volatility

This table presents the relationship between the changing rates of Google search popularity and weekly stock return volatility. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatility						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Unexpected Name Attention:	0.0057**	0.0057**	0.0057**	0.0054**	0.0058**	0.0054**	0.0054**
b - a	(2.386)	(2.386)	(2.386)	(2.034)	(2.389)	(2.037)	(2.036)
Unexpected Ticker Attention:	0.0008	0.0008	0.0008	0.0008	0.0009	0.0010	0.0010
c - a	(0.443)	(0.443)	(0.443)	(0.448)	(0.518)	(0.522)	(0.523)
Unexpected Name Positive Sentiment:				0.0008		0.0008	
e – d				(0.958)		(0.957)	
Unexpected Ticker Positive Sentiment:					0.0002	0.0002	
f – d					(0.147)	(0.146)	
Unexpected Name Negative Sentiment:				-0.0015		-0.0015	
h – g				(-0.753)		(-0.750)	
Unexpected Ticker Negative Sentiment:					-0.0004	-0.0004	
i – g					(-0.587)	(-0.580)	
Search Density for	0.0157*	0.0157*	0.0157*	0.0154*	0.0159*	0.0156*	0.0156*
Company Itself: a	(1.840)	(1.840)	(1.840)	(1.765)	(1.853)	(1.778)	(1.778)
Search Density for Company	0.0163***		0.0185***	0.0185***	0.0184***	0.0184***	0.0185***
Related Positive News: d	(3.684)		(4.434)	(4.405)	(4.433)	(4.402)	(4.435)
Search Density for Company							0.0008
Name Term Related Positive News: e							(0.957)
Search Density for Company							0.0002
Ticker Term Related Positive News: f							(0.143)
Search Density for Company		0.0045	0.0068***	0.0069***	0.0069***	0.0070***	0.0068***
Related Negative News: g		(1.635)	(2.689)	(2.727)	(2.698)	(2.736)	(2.686)
Search Density for Company							-0.0015
Name Term Related Negative News: h							(-0.746)
Search Density for Company							-0.0004
Ticker Term Related Negative News: i							(-0.581)
Heats of	-0.0001***	-0.0001***	-0.0001***	-0.0001***	0.0000	-0.0001***	-0.0001***
Institutional Investors	(-3.895)	(-3.894)	(-3.895)	(-3.935)	(.)	(-3.930)	(-3.930)
Constant	0.0172***	0.0172***	0.0172***	0.0172***	0.0172***	0.0172***	0.0172***
	(11.472)	(11.471)	(11.466)	(11.483)	(11.462)	(11.479)	(11.479)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)						

Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.491	0.491	0.491	0.491	0.491	0.491	0.491
N	92,778	92,778	92,778	92,778	92,778	92,778	92,778

Table XIV

The effect of Investor Attention and Sentiment on Trading Volume

This table presents the relationship between the changing rates of Google search popularity and weekly stock return volatility. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Trading Volume*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Trading Volume							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VIII)	(IX)
Raw Data								
Unexpected Name Attention:	5.4831***					7.6638***		7.1065***
b - a	(5.719)					(6.542)		(6.142)
Unexpected Ticker Attention:		7.1055***					7.1881***	5.4798**
c - a		(3.148)					(3.184)	(2.428)
Search Density for			17.6597***			23.6930***	17.7718***	23.3397***
Company Itself: a			(2.673)			(3.363)	(2.689)	(3.309)
Search Density for				8.0391***				
Company Name Terms: b				(6.474)				
Search Density for					9.4203***			
Company Ticker Terms: c					(4.195)			
Constant	-0.4145**	-0.4102**	-0.4104**	-0.4490**	-0.4414**	-0.4587**	-0.4352**	-0.4740**
	(-2.151)	(-2.134)	(-2.130)	(-2.345)	(-2.312)	(-2.372)	(-2.260)	(-2.454)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Effect				Year*Month*Week (Calendar)				
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
N	956,025	956,025	956,025	968,297	968,297	956,025	956,025	956,025

Table XV

The effect of Investor Attention and Sentiment on Trading Volume

This table presents the relationship between the changing rates of Google search popularity and weekly stock return volatility. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Trading Volume*. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Trading Volume						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Unexpected Name Attention:	0.0057**	0.0057**	0.0057**	0.0054**	0.0058**	0.0054**	0.0054**
b - a	(2.386)	(2.386)	(2.386)	(2.034)	(2.389)	(2.037)	(2.036)
Unexpected Ticker Attention:	0.0008	0.0008	0.0008	0.0008	0.0009	0.0010	0.0010
c - a	(0.443)	(0.443)	(0.443)	(0.448)	(0.518)	(0.522)	(0.523)
Unexpected Name Positive Sentiment:				0.0008		0.0008	
e – d				(0.958)		(0.957)	
Unexpected Ticker Positive Sentiment:					0.0002	0.0002	
f – d					(0.147)	(0.146)	
Unexpected Name Negative Sentiment:				-0.0015		-0.0015	
h – g				(-0.753)		(-0.750)	
Unexpected Ticker Negative Sentiment:					-0.0004	-0.0004	
i – g					(-0.587)	(-0.580)	
Search Density for	0.0157*	0.0157*	0.0157*	0.0154*	0.0159*	0.0156*	0.0156*
Company Itself: a	(1.840)	(1.840)	(1.840)	(1.765)	(1.853)	(1.778)	(1.778)
Search Density for Company	0.0163***		0.0185***	0.0185***	0.0184***	0.0184***	0.0185***
Related Positive News: d	(3.684)		(4.434)	(4.405)	(4.433)	(4.402)	(4.435)
Search Density for Company							0.0008
Name Term Related Positive News: e							(0.957)
Search Density for Company							0.0002
Ticker Term Related Positive News: f							(0.143)
Search Density for Company		0.0045	0.0068***	0.0069***	0.0069***	0.0070***	0.0068***
Related Negative News: g		(1.635)	(2.689)	(2.727)	(2.698)	(2.736)	(2.686)
Search Density for Company							-0.0015
Name Term Related Negative News: h							(-0.746)
Search Density for Company							-0.0004
Ticker Term Related Negative News: i							(-0.581)
Heats of	-0.0001***	-0.0001***	-0.0001***	-0.0001***	0.0000	-0.0001***	-0.0001***
Institutional Investors	(-3.895)	(-3.894)	(-3.895)	(-3.935)	(.)	(-3.930)	(-3.930)
Constant	0.0172***	0.0172***	0.0172***	0.0172***	0.0172***	0.0172***	0.0172***
	(11.472)	(11.471)	(11.466)	(11.483)	(11.462)	(11.479)	(11.479)

Fixed	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Effect				Year*Month*Week (Calendar)			
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.491	0.491	0.491	0.491	0.491	0.491	0.491
N	92,778	92,778	92,778	92,778	92,778	92,778	92,778

Table XVI

Investor Sentiment and Stock Returns

This table presents the relationship between the changing rates of Google search popularity and weekly stock returns. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Returns*. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Unexpected Name Positive Sentiment:	0.0012	0.0012				
e – d	(0.966)	(0.967)				
Unexpected Name Negative Sentiment:	-0.0093**	-0.0093**				
h – g	(-2.511)	(-2.503)				
Unexpected Ticker Positive Sentiment:				0.0067*	0.0082**	
f – d				(1.809)	(2.097)	
Unexpected Ticker Negative Sentiment:				-0.0032*	-0.0047**	
i – g				(-1.712)	(-2.230)	
Search Density for Company		0.0519***	0.0530***		0.0777***	0.0768***
Related Positive News: d		(4.858)	(4.867)		(6.806)	(6.728)
Search Density for Company			0.0012			
Name Term Related Positive News: e			(0.964)			
Search Density for Company						0.0082**
Ticker Term Related Positive News: f						(2.086)
Search Density for Company		-0.0434***	-0.0432***		-0.0334***	-0.0339***
Related Negative News: g		(-4.297)	(-4.187)		(-4.446)	(-4.503)
Search Density for Company			-0.0093**			
Name Term Related Negative News: h			(-2.498)			
Search Density for Company						-0.0047**
Ticker Term Related Negative News: i						(-2.232)
Sentiment of	0.0005***	0.0005***	0.0005***	0.0005***	0.0005***	0.0005***
Institutional Investors	(6.788)	(6.787)	(6.787)	(5.525)	(4.922)	(4.922)
Constant	0.0019	0.0019	0.0019	-0.0009	0.0012	0.0012
	(0.578)	(0.578)	(0.578)	(-0.186)	(0.247)	(0.247)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm
Effect			Year*Month*Week (Calendar)			
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.356	0.356	0.356	0.366	0.368	0.368
N	338,453	338,453	338,453	120,639	92,784	92,784

Table XVII

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatility		Weekly Stock Returns							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)
Unexpected Name Attention:	0.0069***	0.0064***								
b - a	(5.098)	(6.844)								
Unexpected Ticker Attention:	0.0044***	0.0076***								
c - a	(4.136)	(3.717)								
Unexpected Name Sentiment			0.0012**	0.0013						
Difference: (e - d) - (h - g)			(2.003)	(1.086)						
Unexpected Ticker Sentiment					0.0019*	0.0051***				
Difference: (f - d) - (i - g)					(1.934)	(2.616)				
Unexpected Name Positive Sentiment:							0.0010	0.0009		
e – d							(1.598)	(0.751)		
Unexpected Name Negative Sentiment:							-0.0032*	-0.0068*		
h – g							(-1.787)	(-1.785)		
Unexpected Ticker Positive Sentiment:									0.0082**	0.0081*
f – d									(2.097)	(1.918)
Unexpected Ticker Negative Sentiment:									-0.0047**	-0.0045**
i – g									(-2.230)	(-2.097)
Search Density for	0.0144***	0.0181***								
Company Itself: a	(6.225)	(5.178)								
Unexpected Company Sentiment			0.0259***	0.0500***	0.0251***	0.0501***				
Difference: d - g			(14.759)	(4.161)	(13.910)	(7.314)				
Search Density for Company							0.0324***	0.0403***	0.0777***	0.0596***
Related Positive News: d							(13.275)	(3.329)	(6.806)	(4.075)
Search Density for Company							-0.0264***	-0.0546***	-0.0334***	-0.0457***
Related Negative News: g							(-14.122)	(-4.687)	(-4.446)	(-5.326)
Ln (Market Capitalization)		-0.0013***		0.0004		0.0013		0.0004		0.0013
		(-3.060)		(0.954)		(1.625)		(0.959)		(1.624)
Ln (MTB)		-0.0027***		0.0075***		0.0067***		0.0075***		0.0067***
		(-5.426)		(16.357)		(8.241)		(16.352)		(8.240)

Mean Recommendation		0.0002		0.0001		0.0048***		0.0002		0.0048***
		(0.337)		(0.173)		(2.860)		(0.180)		(2.861)
Standard Deviation		-0.0012***		-0.0003		-0.0002		-0.0003		-0.0002
of Recommendations		(-3.747)		(-0.626)		(-0.187)		(-0.624)		(-0.188)
Number of Recommendations		-0.0001**		-0.0003***		-0.0002**		-0.0003***		-0.0002**
		(-2.063)		(-8.121)		(-2.461)		(-8.135)		(-2.458)
Surprise Mean (Quarterly)		-0.0000***		0.0000		0.0000		0.0000		0.0000
		(-3.230)		(0.282)		(0.035)		(0.284)		(0.034)
Surprise STD Deviation		-0.0000		-0.0000***		-0.0017		-0.0000***		-0.0017
(Quarterly)		(-0.555)		(-3.546)		(-1.203)		(-3.547)		(-1.203)
SUE Score (Quarterly)		-0.0000		0.0000*		0.0001***		0.0000*		0.0001***
		(-1.594)		(1.798)		(3.655)		(1.798)		(3.654)
Buy Percent		-0.0000**		-0.0000		0.0000		-0.0000		0.0000
		(-2.381)		(-1.038)		(1.635)		(-1.031)		(1.636)
Sell Percent		0.0001***		0.0000		-0.0000		0.0000		-0.0000
		(4.246)		(1.190)		(-0.825)		(1.180)		(-0.825)
Number Up		0.0006***		0.0023***		0.0020***		0.0023***		0.0020***
		(10.498)		(14.632)		(7.089)		(14.633)		(7.087)
Number Down		0.0006***		-0.0019***		-0.0019***		-0.0019***		-0.0019***
		(8.036)		(-12.976)		(-6.680)		(-12.972)		(-6.678)
Sentiment of		0.0448***		0.0306***		0.0162		0.0306***		0.0162
Institutional Investors		(18.225)		(5.427)		(1.635)		(5.430)		(1.636)
# of 8-K Filings		0.0042***		0.0009***		0.0010***		0.0009***		0.0010***
		(34.252)		(4.745)		(3.484)		(4.751)		(3.480)
Constant	0.0181***	0.0320***	0.0219***	0.0009	0.0162***	-0.0230**	0.0219***	0.0009	0.0012	-0.0231**
	(56.414)	(7.823)	(16.156)	(0.180)	(6.420)	(-2.506)	(16.161)	(0.179)	(0.247)	(-2.511)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)									
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.388	0.500	0.314	0.366	0.334	0.379	0.314	0.366	0.368	0.379
N	956,033	430,927	680,756	318,249	172,906	87,827	680,756	318,249	92,784	87,827

Table XVIII

Investor Attention and Stock Volatility - Dynamic Panel Regressions

This table presents the dynamic relationship between the investor attention and weekly stock returns. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility*. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatility					
	(I)	(II)	(III)	(IV)	(V)	(VI)
Unexpected Name	0.0117***	0.0089***	0.0095***	0.0095***	0.0164***	0.0127***
Attention: b - a	(7.923)	(5.321)	(6.912)	(6.046)	(9.599)	(8.557)
Lag	-0.0122***	-0.0074***	-0.0040***	-0.0029***	-0.0020**	-0.0063***
	(-8.360)	(-5.813)	(-6.333)	(-4.457)	(-1.996)	(-7.850)
Unexpected Ticker	0.0061***	0.0047***	0.0053***	0.0048***	0.0093***	0.0154***
Attention: c - a	(4.315)	(3.514)	(3.564)	(3.304)	(5.635)	(8.830)
Lag	-0.0070***	-0.0056***	-0.0021***	-0.0010*	-0.0017*	0.0037***
	(-4.980)	(-4.792)	(-3.009)	(-1.796)	(-1.645)	(2.898)
Search Density for	0.0224***	0.0184***	0.0209***	0.0203***	0.0325***	0.0323***
the Company Itself	(7.248)	(6.021)	(5.515)	(5.386)	(8.665)	(8.136)
Lag	-0.0242***	-0.0154***	-0.0091***	-0.0063***	-0.0038**	-0.0057***
	(-8.019)	(-6.558)	(-4.951)	(-4.039)	(-2.071)	(-2.606)
Return Std Deviation	0.5143***	0.2555***	0.5119***	0.4076***	0.1117***	0.1498***
(t-1)	(79.286)	(36.715)	(50.271)	(48.771)	(10.992)	(18.212)
Constant	0.0111***	0.0072***	0.0000	0.0017***	0.0129***	0.0128***
	(50.874)	(18.850)	(1.018)	(7.958)	(19.056)	(18.630)
Panel Model	No	Fixed Effect	First Difference	Anderson-Hsiao Estimator	Arellano-Bond Estimator	Blundell-Bond Estimator
Fixed Effect	No	Firm Calendar	No Calendar	Firm Calendar	Firm Calendar	Firm Calendar
Cluster	Firm	Firm	Firm	Firm	Robust	Robust
R-squared	0.249	0.424	0.767	0.739		
N	955,063	955,063	951,808	948,553	951,808	955,063

Table XIX

Investor Sentiment and Stock Returns - Dynamic Panel Regressions

This table presents the dynamic relationship between the investor sentiment and weekly stock returns. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Returns*. All regressions include a constant. The firm fundamental controls variables include *Ln (Market Capitalization)*, *Ln (MTB)*, *Mean Recommendation*, *Standard Deviation of Recommendations*, *Sentiment of Institutional Investors*, and *number of 8-K Filings*. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Unexpected Name Sentiment	0.0019	0.0008	-0.0005	0.0017	-0.0002	-0.0028	
Difference: (e - d) - (h - g)	(0.778)	(0.333)	(-0.157)	(0.418)	(-0.060)	(-0.949)	
Lag	0.0067**	0.0014	0.0008	0.0088**	0.0059**	0.0062**	0.0059**
	(2.387)	(0.600)	(0.262)	(2.096)	(1.970)	(2.017)	(2.232)
Unexpected Ticker Sentiment	0.0102***	0.0052**	0.0044**	0.0100***	0.0120***	0.0152***	
Difference: (f - d) - (i - g)	(3.853)	(2.517)	(2.214)	(3.409)	(4.051)	(5.041)	
Lag	0.0022	-0.0006	0.0017	0.0030	0.0036	0.0058*	-0.0021
	(0.797)	(-0.283)	(0.810)	(0.992)	(1.173)	(1.819)	(-0.858)
Unexpected Company Sentiment	0.0467***	0.0412***	0.1097***	-0.0621***	-0.0638*	-0.7445	
Difference: d - g	(8.820)	(3.007)	(3.496)	(-10.371)	(-1.838)	(-0.278)	
Lag	-0.0376***	0.0205*	0.2618***	0.0592***	-0.0722	0.0735	0.0467***
	(-6.829)	(1.691)	(11.384)	(9.922)	(-0.546)	(0.027)	(11.952)
Return (t-1)	-0.0403***	-0.0286***	-0.5105***	-0.0980***	-0.0644***	-0.0607***	-0.0442***
	(-8.970)	(-5.997)	(-174.953)	(-11.593)	(-14.052)	(-14.547)	(-9.831)
Constant	0.0064***	0.0087	0.0003***	0.0002***	0.0918	0.0158	0.0007
	(5.547)	(1.046)	(7.976)	(5.032)	(1.194)	(1.534)	(0.116)
Firm Fundamental Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel Model	No	Fixed Effect	First Difference	Anderson-Hsiao Estimator	Arellano-Bond Estimator	Blundell-Bond Estimator	Prediction Regression
Fixed Effect	No	Firm Calendar	No Calendar	Firm Calendar	Firm Calendar	Firm Calendar	
Cluster	Firm	Firm	Firm	Firm	Robust	Robust	Firm
R-squared	0.004	0.374	0.546	0.096			
N	91,435	91,435	88,482	88,420	88,482	88,482	88,482

Table XX

Investor Sentiment and Stock Returns - Dynamic Panel Regressions

This table presents the dynamic relationship between the investor sentiment and weekly stock returns. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Returns*. All regressions include a constant. All standard errors are clustered at the firm level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Returns						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Unexpected Name Positive Sentiment:	0.0015**	0.0014**	0.0012*	0.0006	0.0008	0.0007	
e – d	(2.014)	(2.192)	(1.757)	(0.700)	(0.980)	(0.806)	
Lag	0.0006	0.0011	0.0013**	-0.0001	0.0004	0.0011	-0.0009
	(0.828)	(1.605)	(1.967)	(-0.115)	(0.473)	(1.208)	(-1.164)
Unexpected Name Negative Sentiment:	-0.0042**	-0.0036*	-0.0035*	-0.0045*	-0.0044*	-0.0049**	
h – g	(-2.014)	(-1.957)	(-1.821)	(-1.935)	(-1.915)	(-2.036)	
Lag	-0.0020	0.0010	-0.0007	-0.0009	-0.0011	-0.0026	0.0001
	(-0.959)	(0.544)	(-0.387)	(-0.392)	(-0.535)	(-1.159)	(0.042)
Search Density for Company	-0.0066***	0.0610***	0.0941***	0.0349***	0.0324***	0.1208	
Related Positive News: d	(-4.693)	(29.090)	(16.017)	(4.655)	(3.785)	(0.456)	
Lag	0.0072***	-0.0318***	0.0546*	0.1116***	0.0977***	0.2479	0.1515***
	(5.821)	(-8.761)	(1.771)	(7.131)	(6.314)	(0.821)	(2.959)
Search Density for Company	0.0131***	-0.0334***	-0.0593***	-0.0211**	-0.0215**	-0.0178	
Related Negative News: g	(9.613)	(-5.310)	(-15.590)	(-2.207)	(-2.455)	(-0.068)	
Lag	-0.0136***	0.0088	-0.0593	-0.1183***	-0.1083***	-0.1648	-0.1526***
	(-10.597)	(0.983)	(-1.592)	(-7.770)	(-10.237)	(-0.698)	(-3.101)
Stock Return (t-1)	-0.0280***	-0.0256***	-0.5097***	-0.0674***	-0.0936***	-0.0498***	-0.3900***
	(-15.489)	(-12.923)	(-407.950)	(-19.183)	(-40.666)	(-24.173)	(-212.125)
Constant	0.0026***	0.0233***	-0.0000***	0.0000	0.0028***	0.0026***	-0.0000***
	(43.679)	(26.953)	(-7.033)	(0.862)	(37.525)	(37.952)	(-3.160)
Panel Model	No	Fixed Effect	First Difference	Anderson-Hsiao Estimator	Arellano-Bond Estimator	Blundell-Bond Estimator	Prediction Regression
Fixed Effect	No	Firm Calendar	No Calendar	Firm Calendar	Firm Calendar	Firm Calendar	
Cluster	Firm	Firm	Firm	Firm	Robust	Robust	Firm
R-squared	0.001	0.315	0.495	0.066			
N	678,230	678,230	675,823	675,051	675,823	678,230	675,884

4.8 Appendix

4.8-A.1 Variable Definitions

Table 4-A1
Definitions of Variables

Name	Description
Panel A: Key Interested Variables	
Searches Density for Company Itself: a	The Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. Detailed see Appendix B.
Search Density for Company Name Terms: b	The Google search volume density of the corporate name terms, standardized to (-1, +1).
Unexpected Name Attention: b - a	The Google search volume density difference of corporate name terms and the firm itself.
Searches Density for Company Ticker Terms: c	The Google search volume density of the corporate ticker terms, standardized to (-1, +1).
Unexpected Ticker Attention: c - a	The Google search volume density difference of the corporate ticker terms and the firm itself.
Change of [Search Density for Company Related Positive News: d]	The Google search volume density of the companies plus positive words (e.g. success, grow, expend, up, increase, and beat), standardized to (-1, +1).
Change of [Search Density for Company Name Term Related Positive News: e]	The Google search volume density of the corporate name terms plus positive words (e.g. good, well, better, and decent), standardized to (-1, +1).
Change of [Search Density for Company Ticker Term Related Positive News: f]	The Google search volume density of corporate ticker plus positive words (e.g. success, grow, expend, up, increase, and beat), standardized to (-1, +1), standardized to (-1, +1).
Unexpected Name Positive Sentiment: e - d	The Google search volume density difference of <company name terms+positive words> and the firm's positive news.
Unexpected Ticker Positive Sentiment: f - d	The Google search volume density difference of <ticker terms+positive words> and the firm's positive news.
Change of [Search Density for Company Related Negative News: g]	The Google search volume density of the companies plus negative words (e.g. fail, drop, loose, down, low, fall, fraud, and miss), standardized to (-1, +1).
Change of [Search Density for Company Name Term Related Negative News: h]	The Google search volume density of the corporate name terms plus negative words (e.g. bad, corrupt, and worse), standardized to (-1, +1).
Change of [Search Density for Company Ticker Term Related Negative News: i]	The Google search volume density of corporate ticker plus negative words (e.g. fail, drop, loose, down, low, fall, fraud, and miss), standardized to (-1, +1).
Unexpected Name Negative Sentiment: h - g	The Google search volume density difference of <company name terms+positive words> and the firm's negative news.
Unexpected Ticker Negative Sentiment: i - g	The Google search volume density difference of <ticker terms+nagetive words> and the firm's negative news.
The Bloomberg Heat Measure	Following Ben-Rephael, Da and Israelsen (2016), I create this measure using Bloomberg data (including News Heat - Daily Average Story Flow, News Heats - Average Readership, and News Publication - Daily Number of Stories), standardized to (0, +1).
The Bloomberg Sentiment Measure	Sentiment Measure by Bloomberg (including News Sentiment - Daily Average, News Sentiment Daily Historical Minimum and News Sentiment Daily Historical Maximum), standardized to (-1, +1).
News Heat - Daily Average Story Flow	Average value of News Heat - Story Flow (Realtime) (RQ368, NEWS_HEAT_STORY_FLOW_RT) for the parent company. Field updates at 12 midnight local time for the parent company's time zone.
News Sentiment - Daily Average	Average value of news sentiment for the parent company on a particular day. The measure is between -1, indicating most negative sentiment, to 1, indicating most positive sentiment, with 0 indicating either neutral sentiment or balanced negative and positive sentiment.

News Publication - Daily Number of Stories	Number of stories published on the most recent day. Field updates at 12 midnight local time for the parent company's time zone.
News Heats - Daily Max Readership	Maximum value of News Heat - User Activity (Realtime) (RQ369, NEWS_HEAT_USER_ACTIVITY_RT) for the day. Field updates at 12 midnight local time for the parent company's time zone.
News Heats - Average Readership	Average value of News Heat - User Activity (Realtime) (RQ369, NEWS_HEAT_USER_ACTIVITY_RT) for the day. Field updates at 12 midnight local time for the parent company's time zone.
News Heats - Max Story Flow	Maximum value of News Heat - Story Flow (Realtime) (RQ368, NEWS_HEAT_STORY_FLOW_RT) for the parent company. Field updates at 12 midnight local time for the parent company's time zone.
News Sentiment Daily Historical Minimum	Minimum value of news sentiment for the parent company on a particular day. The measure is between -1, indicating most negative sentiment, to 1, indicating most positive sentiment, with 0 indicating either neutral sentiment or balanced negative and positive sentiment.
News Sentiment Daily Historical Maximum	Maximum value of news sentiment for the parent company on a particular day. The measure is between -1, indicating most negative sentiment, to 1, indicating most positive sentiment, with 0 indicating either neutral sentiment or balanced negative and positive sentiment.
Twitter Sentiment Daily Average	Average value of Twitter sentiment for the parent company on a particular day. Negative sentiment indicates factors that are normally associated with the fall of a company's stock price. Positive sentiment indicates factors that are normally associated with the rise of a company's stock price. The measure is between -1, indicating most negative sentiment, to 1, indicating most positive sentiment, with 0 indicating either neutral sentiment or balanced negative and positive sentiment.
Twitter Sentiment Daily Minimum	Minimum value of Twitter sentiment for the parent company on a particular day. Negative sentiment indicates factors that are normally associated with the fall of a company's stock price. Positive sentiment indicates factors that are normally associated with the rise of a company's stock price. The measure is between -1, indicating most negative sentiment, to 1, indicating most positive sentiment, with 0 indicating either neutral sentiment or balanced negative and positive sentiment.
Twitter Sentiment Daily Maximum	Maximum value of Twitter sentiment for the parent company on a particular day. Negative sentiment indicates factors that are normally associated with the fall of a company's stock price. Positive sentiment indicates factors that are normally associated with the rise of a company's stock price. The measure is between -1, indicating most negative sentiment, to 1, indicating most positive sentiment, with 0 indicating either neutral sentiment or balanced negative and positive sentiment.
# of 8-K Filings	Number of 8-K filings by firm, provided by Edgar database. 8-K Current Reports record major events that shareholders should know about. Usually, 8-K is a report of unscheduled material events or corporate changes at a company that could be of importance to the shareholders or the Securities and Exchange Commission.
Edgar Heats	“EDGAR” is the daily number of unique requests for firm filings on the SEC EDGAR server (Loughran and McDonald, 2015).
Panel B: Firm Fundamental Information	
Total Assets ($ mil)	Total assets of a company at a point in time in millions of dollars.
Ln (Total Assets)	Natural log value of the total assets.
MTB	The market value of common equity plus the book value of total liabilities divided by the book value of total assets. [(prcc_f*csho + dltt + dlc) /at].
Ln (MTB)	Natural log value of the market to book ratio.
Market Capitalization ($ mil)	The market value the firm. [prcc_f*csho].
Ln (Market Capitalization)	Natural log value of the market capitalization.
Panel C: Analyst Forecast and Recommendation Information	
SUE Score (quarterly)	SUE is the absolute value of the surprise in analyst forecast and analyst recommendation change. It is standardized unanticipated earnings score, calculated using the ratio of the absolute surprise to estimate dispersion, to measure the distance between the two values in terms of standard deviation of the estimates [(Actual EPS - Surprise mean EPS)/Standard Deviation.

Surprise Mean (quarterly)	The arithmetic average of estimates of the absolute difference between the latest interim EPS and the last estimate EPS for the period.
Surprise, Percent	The difference, expressed as a percent, between the actual (reported) earnings and the I/B/E/S Surprise mean EPS estimate for a company, for the fiscal period indicated. [(Actual EPS - Surprise Mean EPS)/Surprise Mean EPS*100].
Surprise STD Deviation (quarterly)	The standard deviation of all estimates that make up the interim surprise mean (SURMN) for the quarter just reported.
Number of Recommendations	The number of analysts covering the company for the fiscal period, using the most recent information.
Number Up	A measure of optimistic sentiment calculated using the number of upward revisions since the last monthly production.
Number Down	A measure of optimistic sentiment calculated using the number of downward revisions since the last monthly production.
Buy Percent	The percentage of BUY or STRONG BUY recommendations.
Sell Percent	The percentage of UNDER PERFORM or SELL recommendations.
Hold Percent	The percentage of HOLD recommendations.
Mean Recommendation	The arithmetic average of all outstanding consensus recommendation for a particular fiscal period. Analyst recommendations are rated on a 1 to 5 scale. 1 is equivalent to a strong buy rating, 3 a hold rating, and 5 a sell rating.
Median Recommendation	The median number of all outstanding consensus recommendation for a particular fiscal period.
Standard Deviation	The statistical measure of dispersion of consensus recommendation for the fiscal period indicated
Panel D: Performance Measures	
Stock Returns Weekly	The weekly stock return calculated using CRSP daily stock returns.
Stock Return Volatility Weekly	The weekly stock return volatility calculated using CRSP daily stock return.
Trading Volume Weekly (mil)	The weekly trading volume calculated using CRSP daily trading volume.

4.8-A.2 Fama-MacBeth Regression

Pooled regression is used to investigate the impact of unrelated name attention on stock return. This may underestimate the standard errors because weekly returns for the sample stocks may be cross-sectionally correlated. A Fama-MacBeth (1973) cross-sectional regression is designed to solve this problem.

I have rerun the regressions regarding all main findings with Fama-MacBeth (1973) setup and results are listed below. With more accurate and less biased estimation of the standard errors using Fama-MacBeth (1973) cross-sectional regression, I find similar significant results illustrated in Table 4-A2-1, Table 4-A2-2 and Table 4-A2-3.

Table 4-A2-1

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level, time leveland double cluster at firm and time level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatilities			
	(I)	(II)	(III)	(IV)
Unexpected Name Attention:	0.0069***	0.0089***	0.0064***	0.0070***
b - a	(5.098)	(4.611)	(6.844)	(7.227)
Unexpected Ticker Attention:	0.0044***	0.0054***	0.0076***	0.0096***
c - a	(4.136)	(6.155)	(3.717)	(6.337)
Search Density for	0.0144***	0.0161***	0.0181***	0.0159***
Company Itself: a	(6.225)	(7.460)	(5.178)	(6.369)
Ln (Market Capitalization)			-0.0013***	-0.0039***
			(-3.060)	(-58.914)
Ln (MTB)			-0.0027***	-0.0009***
			(-5.426)	(-5.376)
Mean Recommendation			0.0002	0.0038***
			(0.337)	(11.813)
Standard Deviation			-0.0012***	-0.0014***
of Recommendations			(-3.747)	(-6.194)
Number of Recommendations			-0.0001**	0.0002***
			(-2.063)	(15.927)
Surprise Mean (Quarterly)			-0.0000***	-0.0004***
			(-3.230)	(-11.444)
Surprise STD Deviation			-0.0000	0.0053***
(Quarterly)			(-0.555)	(14.833)
SUE Score (Quarterly)			-0.0000	-0.0000
			(-1.594)	(-0.621)
Buy Percent			-0.0000**	0.0001***
			(-2.381)	(16.872)
Sell Percent			0.0001***	0.0000***
			(4.246)	(3.789)
Number Up			0.0006***	0.0010***
			(10.498)	(15.761)
Number Down			0.0006***	0.0009***
			(8.036)	(13.258)
Sentiment of			0.0448***	1.3088***
Institutional Investors			(18.225)	(33.127)
# of 8-K Filings			0.0042***	0.0026***
			(34.252)	(25.301)
Constant	0.0181***	0.0220***	0.0320***	0.0342***
	(56.414)	(46.934)	(7.823)	(31.334)
Model	Fixed Effect	Fama-MacBeth	Fixed Effect	Fama-MacBeth
Cluster	Firm	NA	Firm	NA
R-squared	0.388	0.005	0.500	0.230
N	956033	956033	430927	430927

Table 4-A2-2

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level, time leveland double cluster at firm and time level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return			
	(I)	(II)	(III)	(IV)
Unexpected Name Sentiments	0.0012**	0.0012	0.0013	0.0022*
Difference: (e - d) - (h - g)	(2.003)	(1.616)	(1.086)	(1.711)
Unexpected Company Sentiments	0.0259***	0.0004	0.0500***	-0.0342
Difference: d - g	(14.759)	(0.186)	(4.161)	(-1.019)
Ln (Market Capitalization)			0.0004	0.0005**
			(0.954)	(2.309)
Ln (MTB)			0.0075***	0.0018***
			(16.357)	(5.925)
Mean Recommendation			0.0001	-0.0012
			(0.173)	(-1.129)
Standard Deviation			-0.0003	-0.0005
of Recommendations			(-0.626)	(-1.028)
Number of Recommendations			-0.0003***	-0.0002***
			(-8.121)	(-6.567)
Surprise Mean (Quarterly)			0.0000	0.0002**
			(0.282)	(2.093)
Surprise STD Deviation			-0.0000***	-0.0001
(Quarterly)			(-3.546)	(-0.081)
SUE Score (Quarterly)			0.0000*	0.0002***
			(1.798)	(5.813)
Buy Percent			-0.0000	-0.0000
			(-1.038)	(-0.207)
Sell Percent			0.0000	0.0000
			(1.190)	(0.903)
Number Up			0.0023***	0.0026***
			(14.632)	(11.159)
Number Down			-0.0019***	-0.0021***
			(-12.976)	(-7.930)
Sentiment of			0.0306***	0.3434***
Institutional Investors			(5.427)	(4.745)
# of 8-K Filings			0.0009***	0.0007***
			(4.745)	(3.449)
Constant	0.0219***	0.0026**	0.0009	0.0036
	(16.156)	(2.019)	(0.180)	(0.936)
Model	Fixed Effect	Fama-MacBeth	Fixed Effect	Fama-MacBeth
Cluster	Firm	NA	Firm	NA
R-squared	0.314	0.001	0.366	0.078
N	680756	680756	318249	318249

Table 4-A2-3

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level, time leveland double cluster at firm and time level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return			
	(I)	(II)	(III)	(IV)
Unexpected Ticker Sentiments	0.0019*	0.0043***	0.0051***	0.0044**
Difference: (f - d) - (i - g)	(1.934)	(3.390)	(2.616)	(2.080)
Unexpected Company Sentiments	0.0251***	0.0009	0.0501***	0.0014
Difference: d - g	(13.910)	(0.359)	(7.314)	(1.105)
Ln (Market Capitalization)			0.0013	0.0004
			(1.625)	(1.474)
Ln (MTB)			0.0067***	0.0016***
			(8.241)	(4.589)
Mean Recommendation			0.0048***	0.0008
			(2.860)	(0.379)
Standard Deviation			-0.0002	0.0011
of Recommendations			(-0.187)	(0.837)
Number of Recommendations			-0.0002**	-0.0002***
			(-2.461)	(-3.383)
Surprise Mean (Quarterly)			0.0000	-0.0002
			(0.035)	(-0.645)
Surprise STD Deviation			-0.0017	0.0002
(Quarterly)			(-1.203)	(0.079)
SUE Score (Quarterly)			0.0001***	0.0002***
			(3.655)	(4.160)
Buy Percent			0.0000	0.0000
			(1.635)	(0.389)
Sell Percent			-0.0000	-0.0000
			(-0.825)	(-0.725)
Number Up			0.0020***	0.0021***
			(7.089)	(5.974)
Number Down			-0.0019***	-0.0021***
			(-6.680)	(-5.593)
Sentiment of			0.0162	0.2150**
Institutional Investors			(1.635)	(2.255)
# of 8-K Filings			0.0010***	0.0010***
			(3.484)	(2.638)
Constant	0.0162***	0.0028**	-0.0230**	-0.0024
	(6.420)	(2.158)	(-2.506)	(-0.356)
Model	Fixed Effect	Fama-MacBeth	Fixed Ef-fect	Fama-Mac-Beth
Cluster	Time	NA	Firm	NA
R-squared	0.334	0.004	0.379	0.147
N	172906	172906	87827	87827

4.8-A.3 Cluster the Standard Errors at the Time Dimension.

It seems that clustering at the firm level may not help to obtain the right estimates. Both the dependent (unexpected attention) and independent variables (returns) should have low autocorrelation within a firm. This section contains a robustness check of clustering by time.

I rerun the test with standard errors clustered by time and double cluster by both time and firm. The results are shown in the following tables and I can draw the similar conclusion.

Table 4-A3-1

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level, time leveland double cluster at firm and time level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return Volatilities					
	(I)	(II)	(III)	(III)	(IV)	(V)
Unexpected Name Attention:	0.0069***	0.0069***	0.0069***	0.0064***	0.0064***	0.0064***
b - a	(5.098)	(5.105)	(5.350)	(6.844)	(7.752)	(8.638)
Unexpected Ticker Attention:	0.0044***	0.0044***	0.0044***	0.0076***	0.0076***	0.0076***
c - a	(4.136)	(5.713)	(5.806)	(3.717)	(6.149)	(6.350)
Search Density for	0.0144***	0.0144***	0.0144***	0.0181***	0.0181***	0.0181***
Company Itself: a	(6.225)	(6.383)	(6.533)	(5.178)	(6.622)	(6.929)
Ln (Market Capitalization)				-0.0013***	-0.0013***	-0.0013***
				(-3.060)	(-5.778)	(-9.531)
Ln (MTB)				-0.0027***	-0.0027***	-0.0027***
				(-5.426)	(-6.838)	(-17.275)
Mean Recommendation				0.0002	0.0002	0.0002
				(0.337)	(0.824)	(0.862)
Standard Deviation				-0.0012***	-0.0012***	-0.0012***
of Recommendations				(-3.747)	(-8.162)	(-9.373)
Number of				-0.0001**	-0.0001***	-0.0001***
Recommendations				(-2.063)	(-3.696)	(-6.366)
Surprise Mean (Quarterly)				-0.0000***	-0.0000	-0.0000
				(-3.230)	(-0.800)	(-0.807)
Surprise STD Deviation				-0.0000	-0.0000	-0.0000
(Quarterly)				(-0.555)	(-0.134)	(-0.135)
SUE Score (Quarterly)				-0.0000	-0.0000***	-0.0000***
				(-1.594)	(-3.670)	(-4.425)
Buy Percent				-0.0000**	-0.0000***	-0.0000***
				(-2.381)	(-4.209)	(-6.052)
Sell Percent				0.0001***	0.0001***	0.0001***
				(4.246)	(7.833)	(11.075)
Number Up				0.0006***	0.0006***	0.0006***
				(10.498)	(8.914)	(13.545)
Number Down				0.0006***	0.0006***	0.0006***
				(8.036)	(7.971)	(11.627)
Sentiment of				0.0448***	0.0448	0.0448***
Institutional Investors				(18.225)	(1.298)	(18.742)
# of 8-K Filings				0.0042***	0.0042***	0.0042***
				(34.252)	(31.656)	(71.585)
Constant	0.0181***	0.0181***	0.0181***	0.0320***	0.0320***	0.0320***
	(56.414)	(543.780)	(59.141)	(7.823)	(18.403)	(19.183)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)					
Cluster	Firm	Time	Firm+Time	Firm	Time	Firm+Time
R-squared	0.388	0.388	0.388	0.500	0.500	0.500
N	956033	956033	956033	430927	430927	430927

Table 4-A3-2

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level, time leveland double cluster at firm and time level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return					
	(I)	(II)	(III)	(III)	(IV)	(V)
Unexpected Name Sentiments	0.0012**	0.0012*	0.0012**	0.0013	0.0013	0.0013
Difference: (e - d) - (h - g)	(2.003)	(1.963)	(2.054)	(1.086)	(1.034)	(1.074)
Unexpected Company Sentiments	0.0259***	0.0259	0.0259	0.0500***	0.0500	0.0500
Difference: d - g	(14.759)	(1.496)	(1.505)	(4.161)	(0.753)	(0.750)
Ln (Market Capitalization)				0.0004	0.0004	0.0004
				(0.954)	(0.496)	(0.807)
Ln (MTB)				0.0075***	0.0075***	0.0075***
				(16.357)	(7.725)	(15.160)
Mean Recommendation				0.0001	0.0001	0.0001
				(0.173)	(0.132)	(0.152)
Standard Deviation				-0.0003	-0.0003	-0.0003
of Recommendations				(-0.626)	(-0.500)	(-0.550)
Number of Recommendations				-0.0003***	-0.0003***	-0.0003***
				(-8.121)	(-3.768)	(-7.893)
Surprise Mean (Quarterly)				0.0000	0.0000	0.0000
				(0.282)	(0.047)	(0.049)
Surprise STD Deviation				-0.0000***	-0.0000	-0.0000
(Quarterly)				(-3.546)	(-1.071)	(-1.041)
SUE Score (Quarterly)				0.0000*	0.0000***	0.0000***
				(1.798)	(3.837)	(3.878)
Buy Percent				-0.0000	-0.0000	-0.0000
				(-1.038)	(-0.652)	(-0.938)
Sell Percent				0.0000	0.0000	0.0000
				(1.190)	(0.744)	(1.054)
Number Up				0.0023***	0.0023***	0.0023***
				(14.632)	(9.757)	(14.684)
Number Down				-0.0019***	-0.0019***	-0.0019***
				(-12.976)	(-8.118)	(-12.602)
Sentiment of				0.0306***	0.0306*	0.0306***
Institutional Investors				(5.427)	(1.960)	(5.520)
# of 8-K Filings				0.0009***	0.0009***	0.0009***
				(4.745)	(4.111)	(4.987)
Constant	0.0219***	0.0219***	0.0219***	0.0009	0.0009	0.0009
	(16.156)	(168.378)	(16.180)	(0.180)	(0.132)	(0.157)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm
Effect			Year*Month*Week (Calendar)			
Cluster	Firm	Time	Firm+Time	Firm	Time	Firm+Time
R-squared	0.314	0.314	0.314	0.366	0.366	0.366
N	680756	680756	680756	318249	318249	318249

Table 4-A3-3

Robustness Tests

This table presents the robustness test using all potential control variables to avoid omitted variable bias. This sample contains all S&P 1500 firms with available information in CRSP and Compustat. The dependent variables are the *Weekly Stock Return Volatility* and *Weekly Stock Returns*. The results presented in this table are consistent with previous test. *Unexpected Name Attention (b – a)* is the Google search volume density difference of corporate name terms and the firm itself. *Unexpected Ticker Attention (c – a)* is the Google search volume density difference of the corporate ticker terms and the firm itself. *Search Density for Company Itself (a)* is the Google search volume density of a specific firms, standardized to (-1, +1). Follow Da, Engelberg, and Gao (2011), I use Google Trends data as a direct measure of retail investor attention of firms. All regressions include a constant. All standard errors are clustered at the firm level, time leveland double cluster at firm and time level. Robust t-statistics adjusted for heterogeneity for two sides test are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. All other variables are defined in the Appendix Table AI.

	Weekly Stock Return					
	(I)	(II)	(III)	(III)	(IV)	(V)
Unexpected Ticker Sentiments	0.0019*	0.0019*	0.0019*	0.0051***	0.0051**	0.0051**
Difference: (f - d) - (i - g)	(1.934)	(1.857)	(1.940)	(2.616)	(2.495)	(2.436)
Unexpected Company Sentiments	0.0251***	0.0251	0.0251	0.0501***	0.0501	0.0501
Difference: d - g	(13.910)	(1.460)	(1.459)	(7.314)	(0.757)	(0.754)
Ln (Market Capitalization)				0.0013	0.0013	0.0013
				(1.625)	(1.090)	(1.385)
Ln (MTB)				0.0067***	0.0067***	0.0067***
				(8.241)	(4.910)	(7.360)
Mean Recommendation				0.0048***	0.0048**	0.0048***
				(2.860)	(2.337)	(2.643)
Standard Deviation				-0.0002	-0.0002	-0.0002
of Recommendations				(-0.187)	(-0.180)	(-0.181)
Number of Recommendations				-0.0002**	-0.0002*	-0.0002**
				(-2.461)	(-1.767)	(-2.470)
Surprise Mean (Quarterly)				0.0000	0.0000	0.0000
				(0.035)	(0.025)	(0.031)
Surprise STD Deviation				-0.0017	-0.0017	-0.0017
(Quarterly)				(-1.203)	(-0.955)	(-1.049)
SUE Score (Quarterly)				0.0001***	0.0001***	0.0001***
				(3.655)	(3.735)	(4.121)
Buy Percent				0.0000	0.0000	0.0000
				(1.635)	(1.140)	(1.500)
Sell Percent				-0.0000	-0.0000	-0.0000
				(-0.825)	(-0.632)	(-0.721)
Number Up				0.0020***	0.0020***	0.0020***
				(7.089)	(5.888)	(7.089)
Number Down				-0.0019***	-0.0019***	-0.0019***
				(-6.680)	(-5.567)	(-6.885)
Sentiment of				0.0162	0.0162	0.0162*
Institutional Investors				(1.635)	(1.205)	(1.675)
# of 8-K Filings				0.0010***	0.0010***	0.0010***
				(3.484)	(2.648)	(2.972)
Constant	0.0162***	0.0162***	0.0162***	-0.0230**	-0.0230*	-0.0230**
	(6.420)	(141.712)	(6.432)	(-2.506)	(-1.947)	(-2.050)
Fixed	Firm	Firm	Firm	Firm	Firm	Firm
Effect	Year*Month*Week (Calendar)					
Cluster	Firm	Time	Firm+Time	Firm	Time	Firm+Time
R-squared	0.334	0.334	0.334	0.379	0.379	0.379
N	172906	172906	172906	87827	87827	87827

Chapter 5

Conclusion

This dissertation is a detailed research on two issues in corporate governance and one issue in behavioral finance. The research in this thesis extends findings in corporate finance and behavioral finance.

In first chapter, I investigate on the aging phenomenon among independent director age. The director age has increased substantially over time, rising 8 percent from 2002 to 2014. I have answered the key research question that whether director age limit is the optimal solution to concerns that elder directors exacerbate agency conflicts. Using 8-K filings of all listed firms from 1994 to 2014, I show that shareholders welcome amendments to corporate charters that increase independent director mandatory retirement age. However, regressions of firm performance on director age in a sample of S&P 1500 firms show that the effect of independent director age on firm performance is non-uniform. My results in this chapter make an important contribution to the literature on independent directors, which lacks the evidence on the effect of director age on board decision-making and firm performance. I suggest age has costs and benefits. Mandatory retirement policies may preclude firms from retaining talented individuals.

The second chapter investigates the value of CEO succession planning. I find firms with succession plans around CEO turnover events have lower volatility, are able to appoint successors in a timelier manner and have better performance following turnover events. This chapter fills the important gap in the literature that there have been very few efforts to directly identify the existence of CEO succession planning in S&P 1500 firms and to comprehensively examine the effect of CEO succession planning on all S&P 1500 firms. Overall, my results provide direct evidence that CEO succession planning is an important part of a board's monitoring function and creates value for firms during CEO turnover.

In the third chapter, I document the impact of investor attention and sentiment, raised by non-related news but sharing the same name-term of corporation, on stock performances. Using a unique measure to track the investor attention - weekly unexpected Internet search volume density, I find the increase of unrelated name-term attention escalates the return volatility and facilitates the trading activities of linked securities. By further differentiating the unexpected attention into positive and negative sentiment, I find investors react to sentiment regarding the firm itself, but more irrationally to the unexpected negative name sentiment. Arbitrageurs appear to be limited in their ability to eliminate these deviations from fundamentals, but I observe some revisions afterwards. Last, these findings prove the limited attention theory and sentiment theory.