AoF
Academy of Finance

Journal of Finance Issues

Volume 18 Issue 1 Spring 2019

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Intellectual Contributions made through the Academy of Finance Journals: 2003-2016

Monzurul Hoque and Thomas M. Krueger

Abstract

Intellectual contributions are a key measure of university faculty productivity. This study examines the intellectual contributions of members of the Academy of Finance shared with others through the organization's publications over the 2003-2016 period. Information presented ranges from journal-specific data such as pages to author-specific info such as institution and geographic location. The comprehensive investigation allows readers to gain an understanding of both the breadth and depth of the articles published in this house organ over time. We thereby demonstrate the contribution of the Academy of Finance to both the author's careers and finance's body of knowledge.

I. Purpose

The purpose of the paper is to present a detailed analysis of both the breath and depth of articles published in the Journal of Finance Issues and its predecessor Journal of Academy of Finance over the 2003-2016 period. This is the main publication organ of the Academy of Finance. The research on association related publications is quite common, most famous being the one on Journal of Finance, the publication organ of American Finance Association (Heck, Cooley, and Hubbard, 1986). Such analyses provide a comprehensive understanding of the research, its quality and coverage, participants, geographic dispersion, author concentration, among others.

Lately this line of analysis has received further impetus and importance due to proliferation of predatory journals as can be seen in Beall's (beallslist.weebly.com). Cabell's International, the well-regarded publisher of a longstanding journal directory, started Cabell's blacklist in 2017 for a fee. Authors are now checking this list before sending in for possible publication and administrators are checking the lists for identifying genuine intellectual contributions. Hence, providing a self-study of an in-depth analysis of intellectual contributions of a journal goes a long way beyond dissemination of information, it differentiates the value of the journal from predatory ones. Self-studies will present a de facto list of clearly legitimate journals, the converse list of predatory ones.

II. Introduction

In the first edition of the *Journal of the Academy of Finance*, the immediate predecessor to the *Journal of Finance Issues*, Ebied and Johnson (2003) share information regarding the origin of the Academy of Finance. In prior years, the organization's vehicle for sharing research among members was the *Midwest Review of Finance and Insurance*. In order to become a more widely recognized publication and reflect the ownership of the Academy of Finance, the *Midwest Review of Finance and Insurance* was retitled *the Journal of the Academy of Finance* in 2003. Over the

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years, the Journal of the Academy of Finance attracted authors from 40 states and 10 countries. In an attempt to share these researchers' findings with even more scholars, the journal was given its present title in 2012. When necessary to ease of reading, this report refers to articles in either the *Journal of the Academy of Finance* or *Journal of Finance Issues*, as being in *JFI*.

Fred Ebied and Don Johnson (2002) provide a comprehensive synopsis of the Academy of Finance's origins and early years. Five years later, Johnson and Philpot (2007) updated Ebied and Johnson's (2002) study and thereby share information regarding about the association's early years. Over the past decade, there has not been a thorough analysis of the Academy of Finance's activity. The lone exception is Krueger's (2017) analysis of authorship in the *Proceedings of the Academy of Finance*. One reason for the lack of effort to present information about the Academy of Finance may be the comprehensive website maintained by the association, which effectively serves as a repository of information. Furthermore, the Preface to each year's *Proceedings* issue provides an electronic update regarding association leadership and the specific meeting. This report shares additional insight to the Academy of Finance by reporting information about the organization's publication since the Ebied and Johnson (2002), covering the last 14 years.

III. Literature Review

Meetings-related research

Past research is either related to meetings or specific journals. Analysis for instance has been done of presentations at the annual meetings of the American Real Estate Society (Johnson, Roulac, and Followill (1996)), Academy of Finance (Ebeid and Johnson (1994) and Johnson and Philpot (2007)), Financial Management Association (i.e., Eggintan, Van Ness, and Van Ness (2013), and seven finance meetings simultaneously (Petry, 1981).

There is a history of questionnaires regarding the value of academic conferences leading back to Widing, Brown, and Luke (1989), who surveyed deans, department chairs, and faculty members. All agreed that conference participation played a role in the professional development of faculty. Authorship in national proceedings issues was ranked fourth in relative importance, while publication in regional proceedings was ranked tenth in relative importance. However, the importance of proceedings may have declined recently, as exemplified by Lewis and Kerr's (2012) proposed questionnaire regarding academic conferences. While the open-ended questions lend themselves to discussing the perceived value of conference proceedings, there is no specific question (across 41 items) in Lewis and Kerr's survey that directly asks for an assessment of conference-related publications.

Delivering and monitoring professional association meeting quality has become all the more important in an era of tight travel budget, leading Griffin, Malone, and Cooper (2005) to question whether association meetings are headed towards extinction. Given the lack of active recruiting at this spring meeting, the sustainability of the Academy of Finance is even more dependent upon the annual meetings' ability to service member needs to share research, incubate ideas for future research (see, for instance, Rittichainuwat, Beck and Lalopa (2000), Severt, Chan, and Breiter (2006), and Eke (2011)), and network with other finance faculty members (i.e., McCarthy et. al (2004)). While the meeting's proceedings is like "icing on a cake," it provides insight to the content and quality of the conference itself.

Easily the most relevant literature is an examination of the value of the *Proceedings of the Academy of Finance* publication, which has been produced annually since 2003. In fact, the *Proceedings* edition was created when the Academy switched the title of its publication from the *Midwest Journal of Finance and Insurance* to the *Journal of the Academy of Finance*. The primary function of the *Proceedings of the Academy of Finance* was identified as being a means to limit any implication that the *Journal of the Academy of Finance* was essentially a non-refereed, proceedings publication. Krueger's (2017) study examines key characteristics of the *Academy of Finance's Proceedings* over the 2003-2017 period. Authors have their choice of submitting either a complete paper or a two-page summary to the *Academy of Finance Proceedings* upon having their proposal for presentation at the annual spring meeting accepted. Over its first fifteen years, the *Academy of Finance Proceedings* has published 382 intellectual publications, with 108 of these being full papers. Participation has dropped in recent years, led by declines in the Investments and Finance Education tracks. Findings show that much of the decline has arisen from not retaining author interest from year to year and not effectively reaching out to other parts of the country or globe. The current report applies many of these same metrics to the journals of the Academy of Finance over the same time period.

Association-related publications

Much more analysis has been done regarding journals, with some of this being relevant for the current study. Information regarding the authorship, author's degree-granting institution, and employer for the first forty years of the *Journal of Finance* captured information on 1788 authors, from 116 doctoral degree-granting institutions, currently working at 444 different institutions (Heck, Cooley, and Hubbard, 1986). After twenty more years, expanding the sample from 1946-2006, Heck and Cooley, (2008)) report that *Journal of Finance* authorship was up to 3,276 authors. Expanding their focus, Heck and Cooley (2009) examined 26 finance journals, concluding that 17,601 authors had participated, while not judging the quality of any individual journal. Chung and Cox (2001), and more recently Alderson, Saporoschenko, and Nasseh (2009), find a similar listing of prominent journals and continued citation of many articles as was originally noted by Alexander and Mabry (1994) in the past century. Like Professor Heck and Cooley's initial manuscripts, however, this study focuses on a single finance publication.

Researchers over time (i.e., Petry (1988) Hudson (1996), Sutter and Kocher (2004)) have observed a trend towards co-authorship. Brown, Chang, and Chen (2011) note that the trend in co-authorship is upward and consistently higher for the top three finance journals. Specifically, over the 1990-2004 period, the percentage of co-authorship rose from 55 percent to 70 percent in non-top tier journals and from 63 percent to 75 percent in top tier journals. Brown, Chang, and Chen ascribe the difference to the belief that publishing in top journals requires more work. This research will examine whether the same trend is occurring across editions of the *Journal of Finance Issues*. We address the co-authorship issue by examining the number of items authored by individual authors and those co-authored on an adjusted basis. For instance, on a three-author paper, the each author would be credited with one third of an article on an adjusted basis.

University-based authorship analysis is examined by Dyl and Lilly (1985), Barry (1990), Fogarty and Ruhl (1997), and Jones and Roberts (2005). The latter authors plus Czinkota (2000) also address the larger issue of geographic dispersion of authors, both on a state and nation basis. Regionalizing the state issue, Fields and Swayne (1991), report a significant increase in the research produced by southern schools. An array of potential authorship characteristics worthy of study, including gender, years in academia, age, and present position, are presented by Polonsky and Whitelaw (2006). Svensson and Wood (2007) add ethnocentricity issues including the geographic locations of dual-authored manuscript. Unfortunately, many of these author-specific pieces of information are hard to obtain, leaving the current analysis with a study of authorship by university and geographic location.

Another way to assess journals is in terms of author concentration. For instance, Spake and Harmon (1998) examine the percentage of publication pages produced by the top 4 and top 8 contributing institutions. They find that the top four institutions contributed 19 percent of all articles, with 31 percent coming from the top eight institutions. They further analyze the percentage of authors producing over six to versus a single contribution. A similar analytic process will be applied in this study.

External validation of journal quality

Advances in desktop publishing, the ability to profit from publication fees and questionable ethics on the part of some editors has led to the practice commonly referred to as predatory publishing. Journal listing on a respected journal quality list has become a common means to verify journal quality, and thereby research quality. Krueger (2017) provides a thorough analysis of the issue and comparison of the Australian Business Deans Council's (ABDC) journal quality list, London-based Chartered Association of Business Schools' Academic Journal Guide (AJG), and Cabell's Directory of Publishing Opportunities in Finance. The latter has a white list of journals which are considered to be credible. The *Journal of Finance Issues* is included on this list.

Journal quality is frequently also based upon its impact. Impact, in turn, is commonly measured in terms of citation count. Krueger (2018) compares a variety of impact factors, including the values published by the Journal Citation Report (which is the commonly referred to impact factor), Scientific Journal Ranking (SJR) which includes "prestige" measurements, and Source Normalized Impact per Paper (SNIP) which adjusts for self-citation. Clarivate Analytics (2017) reports that it includes approximately one third of journals included in its SJR journal list, and the other listings are even more selective. Additional *Journal of Finance Issues* articles and citations will be necessary to break into these quality listings.

IV. Research Findings

Over the fourteen years from 2003-2016, a total of 296 articles were published in the journals of the Academy of Finance, as reported in the first line of Table I. Eighty-seven articles had a single author, which is approximately thirty percent of the total. The other articles were multi-author works, with a vast majority of these being two author works. A total of 333 institutions have employed these authors. As will be shown below, either the same author or authors from the same institution have published in JFI, resulting in JFI authorship arising from employees at 117 unique institutions. The last line of the first row of Table I report that intellectual contributions of the Academy of Finance's journals span 3460 pages.

Over these fourteen years, there have been 23 volumes published in Academy of Finance Journals. As shown in the second row of Table I, the typical volume had 12.9 articles, with about four of these being single-authored papers. On average there were 150.4 pages, as shown in the last row of the second column.

Median values are reported in the third row of Table I, in order, to present an indication of what the typical volume looked like over the past fourteen years. Ordering articles from the one with the most articles (which we can see from the maximum row was 21) to the least articles (which we can see from the minimum row was 5), the 12th volume—which would be in the center—had 14 articles. Following the same process but ordering the number of single authored articles from the most (i.e., 9) to the least (i.e., 3), we see that the typical journal had 3 single-authored articles. Likewise, going from the greatest number of co-authored articles in a single volume (i.e., 17) to the least (i.e., 3), the 12th ranked volume has 10 co-authored articles. The greatest institutional representation in a single volume was 27 institutions, while the least was 6 institutions, with a median value of 15 institutions. Volume length ranged from 51 to 255 pages, with a median of 162 pages. In summary, the median values are close to the mean, suggesting that there is no skewness.

However, the range has been quite large across time. For instance the number of articles has a range of 14, which exceeds the average. This observation suggests that the distribution tails are quite large. Or, stated in journal terms, that there has been a significant shift in the length of journal volumes over time. The standard deviation row highlights this variation. For instance, the mean number of single-authored articles is only 1.58 times (e.g., 3.8 ÷ 2.4) the standard deviation.

Figure I present the total number of pages for each of the 23 volumes making up the combined contribution of the *Journal of the Academy of Finance* and the *Journal of Finance Issues* to the finance literature. The number of pages reached an early low in the Fall of 2004, with only 133 pages. Only three years later the journal reached its all-time high of 255 pages. From this point to the spring of 2014, there was an appreciable eighty percent drop-off in volume page length. Since then page length has seemed to fluctuate on a seasonal basis, with an average of 62 pages in the spring edition and 84 pages in the fall edition.

The oddity of the decline is that several steps were taken to increase the appeal of the *Journal of Finance Issues*. Looking carefully, at Figure I, the reader will see that no volumes seem to have been produced in 2011. This is in fact not the truth. Instead, delays in article review, resubmission, and article production had pushed the calendar date over six months ahead of the journal publication date. Authors were in a position where they had to file annual evaluation reports with their superior well before publication dates. As you can see from Figure 1, Summer and Fall issues were replaced by Spring and Fall issues in 2014. This is undoubtedly a primary reason for the 111 page drop between the fall of 2007 and the summer of 2012. Therefore, in late 2011, a decision was made to publish the next volume with a 2012 date instead of a 2011 date. The next volume was actually produced in the summer of 2012.

The other challenge to the *Journal of Finance Issues* was the rapid rise of journals due to the advent of desktop publishing and growth in the number of predatory journals. As a publication of an academic association, the publication never was at risk of being considered a predatory journal. In fact, over a decade earlier, in 2003, the Academy of Finance had instituted its *Proceedings of the Academy of Finance* publication in order to limit any elusion to *Journal of Finance Issues* being purely a meetings paper publication. Nonetheless, to combat the ability of predatory journals to siphon potential journals from the *Journal of Finance Issues*, the editorial team switched to a more aggressive paper review schedule, which ideally condensed the period from the initial submission date to the publication date down to six months. (While the *Journal of Finance Issues* has experienced a decline in the review period, editors are focusing to reduce the period over which authors are revising their manuscripts, and hence this goal has yet to be reached.

A greater emphasis was also placed upon attracting articles from the outside. Two items in this vein, were the active decision to keep submission fees down and make JFI an open-access journal. Submission fees were kept to a level commensurate with the cost of attending the annual Academy of Finance meeting. Open access eliminates the cost to subsequent authors when citing *Journal of Finance Issues* articles citations and enhances the journal's citation rate. Despite the efforts of the JFI editorial board, the number of pages shrunk to its plateau of about 150 pages. This article is designed to help build interest and support for JFI.

As one would expect there is a correlation between the number of pages and the number of intellectual contributions. Hence, Figure I and Figure II have similar patterns. In Figure II, one again sees the doubling of articles, followed by the decline to less than half its earlier low. The difference between these graphics arises from varying length of articles. We see this on the high side of intellectual contributions. Specifically, in the Fall 2007, the 21 intellectual contributions had an average page length of 12.1 pages. A year later, the 21 articles in Fall 2018 had an average page length of 10.6 pages. Perhaps the greatest variation between Figure I and Figure II occurs during more recent years, during which the number of articles is not seasonally driven, but stays in a narrow 5 to 7 article range.

As shown in Figure III, the number of authors also follows a similar trend, rising in the 2005 to 2010 period, and then falling off to a level, which in Spring 2016 was less than half of what it was earlier. The highest number of authors and pages written occur in the Fall 2007 edition. Thirty-nine researchers were able to add a JFI journal to their resume upon the publication of this volume. At the extremes, authorship exceeded thirty authors four times, and was less than ten twice. The latter two instances occurred during the 2014 and 2016 spring volumes.

Insight to authorship and co-authorship is presented in Figure IV, where the solid bar represents single authorship. In almost every volume, the frequency of co-authorship exceeds the frequency of single authorship. In the Fall 2014 volume, all of the articles were co-authored. By contrast, in the summer of 2012 volume 7 articles were single-authored, while a lesser 6 were co-authored. Nonetheless, over time the likelihood that a given article is single-authored has stayed relatively stationary. In the first eleven volumes, 28.3 percent (52 of 184) were single-authored, while the percentage of single-authored articles in the most recent eleven volumes is an almost identical 28.2 percent (26 of 92).

Author productivity is measured in two ways in Table II. The left set of columns counts all articles as a contribution of a given author, without regard to the number of co-authors or order in which the authors are listed. The other means by which author productivity is measured provides partial credit for co-authored articles. For instance, if there are two co-authors each receive half credit, if there are three authors each receives a third of the credit, and so forth. An example of the difference occurs in the top three rows, where George S. Swales is listed on the top left as having 16 different articles in JFI over the period being studied, by comparison. However, when he is only given partial credit for his co-authored articles (many of which were with C. Edward Chang and John S. Bowdidge), his ranking adjusted number falls below that of Thomas M. Krueger.

In total there are 26 authors with at least 5 articles during the sample period. Meanwhile, there were 26 authors with at least a 2.5 on the adjusted metric. The biggest jump in ranking from the total to adjusted columns occurs for Chu-Sheng Tai, who single-authored all five authored articles. Four authors can list five JFI journals on their resume, without their adjusted minimum reaching the 2.5 cut-off used in Table II.

Another important way to assess authorship is in terms of educational institution. As shown in Table III, Missouri State University leads the pack by a rather wide margin on this metric. This result is not necessarily surprising, given that this institutional employed three of the top five JFI authors (i.e., Swales, Chang, and Bowdidge). The total of 62 articles includes 15 articles from the period when Missouri State University was Southwest Missouri State University. Indiana University-South Bend, employer of two of the top six authors (i.e., Mehran and Kohli), comes in second.

Figure V illustrates the geographic location of authors, displaying both a concretion and a breadth of authorship. As one would expect in light of the high number of journals originating at Missouri State University over the years, 17.1 percent of all articles are by Missourians. In light of the fact that the annual meeting of the Academy of Finance is in Chicago, it is not surprising that the second largest percentage of articles are by authors in Illinois. Wisconsin, Michigan and Indiana constitute the other states in the top ten locations. In total, 55.7 percent of the publications have come from authors in these states.

Nonetheless, attesting to the *Journal of Finance Issue*'s breadth, articles have been published by authors from 38 states plus the District of Columbia. Furthermore, researchers outside the United States have authored 4.9 percent of the articles. Foremost among these nations are Canada and China.

Comparison of annual meeting-based *Proceedings of the Academy of Finance* and *Journal of Finance Issues* articles found that seventy-five *Journal of Finance Issues* articles, or 25.3percent of the total, first appeared as a research summary in the *Proceedings of the Academy of Finance*. Hence, it appears that both the *Proceedings* and *Journal of Finance Issues* are serving different clienteles. Another explanation of this low overlap may be that alternative purposes are being served by these research outlets, resulting in different submissions to each.

Table IV reports article authorship by region, including states within a region, and the percentage of authors coming from the specified region. As is plainly shown here, sixty percent of *Journal of Finance Issues* authors reside in the North Central portion of the United Sates. Another ten percent can be found in the mid-Atlantic region of the United States.

Before going on, some attention should be paid to the 532 total value in Figure V. Across the fourteen years being studied, there were a total of 532 authors were credited with a publication. However, several authors authored over one article, with George Swales being credited with 16. In total, 276 unique authors authored at least one *Journal of Finance Issues* article between 2002 and 2016.

Information regarding author institutional representation is shown in Figure VI. This graphic demonstrates that institutional representation is much more volatile over the 2007 to 2011 period than the author-based graphic (e.g., Figure III). For instances, while the number of authors dropped by only 5 percent from 2007 to 2008, the number of institutions represented decline by 36 percent. Nonetheless, the correlation between the number of authors listed and institutions represented in *Journal of Finance Issues* is a high 0.916.

In order to gain additional insight, the institutional representation, Figure VI also presents information regarding AACSB accreditation of author employers. Out of the 117 unique institutions of *Journal of Finance Issues* authors, 76 are at AACSB institutions. Approximately 65 percent of articles are written by authors at AACSB institutions.

V. Conclusion

Whether one is considering firms, individuals or academic organizations, in order to plan for the future, it is necessary to understand one's past. In order to provide members with a clear understanding of the performance of the journal published by the Academy of Finance, this analysis studies performance of the *Journal of the Academy of Finance* (2003-2010) and *Journal of Finance Issues* (2012-2016). Across these years, 276 researchers have had a hand in producing 296 articles. While some authors have produced multiple articles, only 25 researchers have authored or co-authored over five or more articles.

A majority of the research has been done by authors in Illinois and contiguous states, which makes sense in that the annual meeting of the Academy of Finance is held in Chicago. While most *Journal of Finance Issues* metrics surged in 2007, there has been a dramatic decline since 2012. Returning to earlier levels will require maintaining quality, reaching out to foreign authors, and promoting the journal wherever possible. One such effort is this documentation of the intellectual contribution of the journals of the Academy of Finance.

The Editorial Board continues to seek valued added opportunities for the authors in terms of creating alliances with other reputable journals. An initial alliance was established with the journal for five years where some selected JFI articles were published in Managerial Finance special issues. Two other alliances are currently being negotiated.

Examination of both recent participation and authorship trends is of obvious benefit to members of the Academy of Finance. Information provided here will help academic administrators and authors gain fresh insight to this type of intellectual contribution. Furthermore, readers who are members of other professional organizations can put their association's journal publication into perspective.

There are many ways to expand upon this research. The most obvious is to conduct the same sort of analysis for other finance journals. This benchmark could be compared to journals produced by another finance association or another field in or out of business. Surveying participants regarding their perception of the importance of various aspects of an association journal (i.e., acceptance rate, editorial style, publication fees, etc.) and assessment of how an association's journal is addressing these preferences would also be informative.

Table I. Key Characteristics of the *Journal of Academy of Finance*: 2003 - 2016					
	Articles	**Single Authors**	**Co-Authors**	**Institutions**	**Total Pages**
Total	296	87	209	333	3460
Mean	12.9	3.8	9.1	14.5	150.4
Median	14	3	10	15	162
Maximum	21	9	17	27	255
Minimum	5	0	3	6	51
Standard Deviation	6.1	2.4	4.4	6.2	64.9

Table II. Most Productive Authors			
Name of Author	**Total**	**Name of Author**	**Adjusted**
George S. Swales	16	Thomas M. Krueger	6.83
C. Edward Chang	14	George S. Swales	6.13
Thomas M. Krueger	12	Raj K. Kohli	5.99
John S. Bowdidge	11	C. Edward Chang	5.47
Jamshid Mehran	10	Chu-Sheng Tai	5
Raj K. Kohli	9	Jamshid Mehran	4.41
Kent P. Ragan	8	Tarek S Zaher	4.33
Kevin M. Bahr	8	Kevin M. Bahr	4.16
Askar Choudhury	7	John S. Bowdidge	4.14
G. N. Naidu	7	Eddie Ary	3.88
John Consler	7	Mark A. Wrolstad	3.83
Mark A. Wrolstad	7	Kent P. Ragan	3.65
Robert Balik	7	Askar Choudhury	3.5
Tarek S Zaher	7	G. N. Naidu	3.5
William E. Maas	7	Reza Rahgozar	3.5
Greg M. Lepak	6	Sharon K. Lee	3.5
Ralph A. Pope	6	Robert Balik	3.33
Reza Rahgozar	6	Ingyu Chiou	3.16
Arthur J. Young	5	John Consler	3.16
Asim Ghosh	5	Ralph A. Pope	3.16
Chu-Sheng Tai	5	William E. Maas	3.16
Eddie J. Ary	5	Jayen B. Patel	3
Ingyu Chiou	5	Greg M. Lepak	2.66

James Philpot	5	James Philpot	2.66
Raja Bouzouita	5	Monzurul Hoque	2.5
Susan J. Crain	5	Jamshed Y. Uppal	2.5
		Jeong W. Lee	2.5

Table III. Authors per Institutions

Institutions	**# of Authors on Paper**	**Institutions**	**# of Authors on Paper**
Missouri State University	63	Eastern Illinois University	8
Indiana University South Bend	23	Indiana State University	8
University of Wisconsin - La Crosse	19	North Carolina A&T State University	8
Illinois State University	18	San Francisco State University	8
Le Moyne College	17	Winona State University	8
University of Wisconsin - Stevens Point	13	DePaul University	7
Western Michigan University	13	James Madison University	7
Northern Michigan University	12	Gonzaga University	6
Western Illinois University	12	Howard University	6
University of Central Missouri	11	Indiana University of Pennsylvania	6
Ouachita Baptist University	10	St. Joseph's University	6
University of Wisconsin - River Falls	10	Truman State University	6
California State University - Sacramento	8	Memorial University of Newfoundland	5
		Saint Joseph's University	5

* Author count was adjusted so that there were no duplicate author in the same year; Institutions with <5 # of distinct authors overall is not shown *

Table IV. Authorship by Region		
Region	**States**	**Percentage of Authors**
East North Central	Illinois, Indiana, Michigan, Ohio, Wisconsin	39.0%
West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota	21.3%
Mid-Atlantic	New Jersey, New York, Pennsylvania	9.9%
South Atlantic	Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, District of Columbia	7.5%
Pacific	Alaska, California, Hawaii, Oregon, Washington	6.8%
Other Countries	Canada (6), China (6), Korea (4), and 9 others	4.8%
West South Central	Arkansas, Louisiana, Oklahoma, Texas	4.4%
East South Central	Alabama, Kentucky, Mississippi, Tennessee	2.9%
All other states		3.4%

Figure I. Total Pages

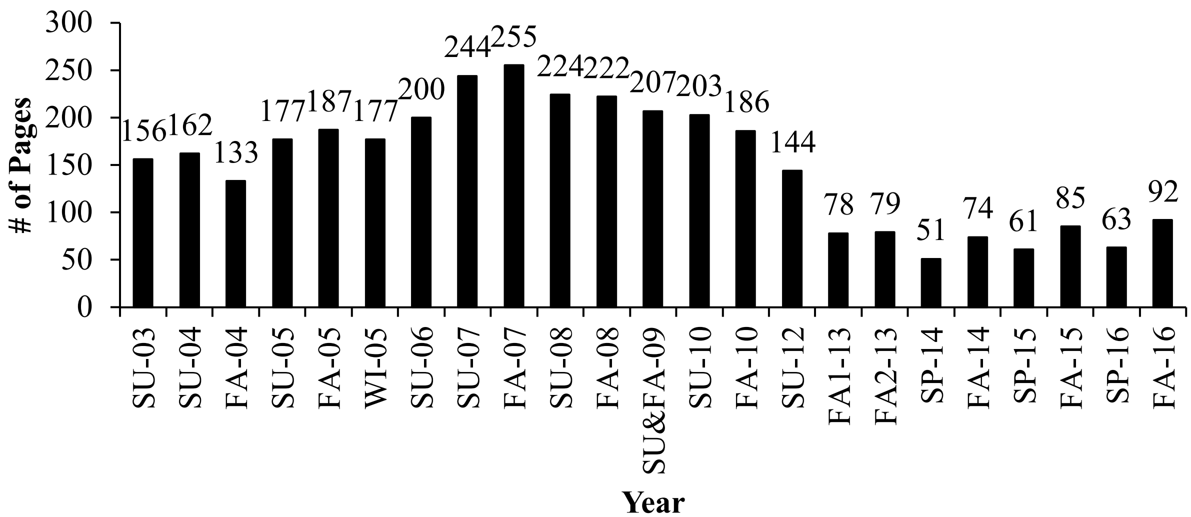


Figure II. Intellectual Contributions Across the Years

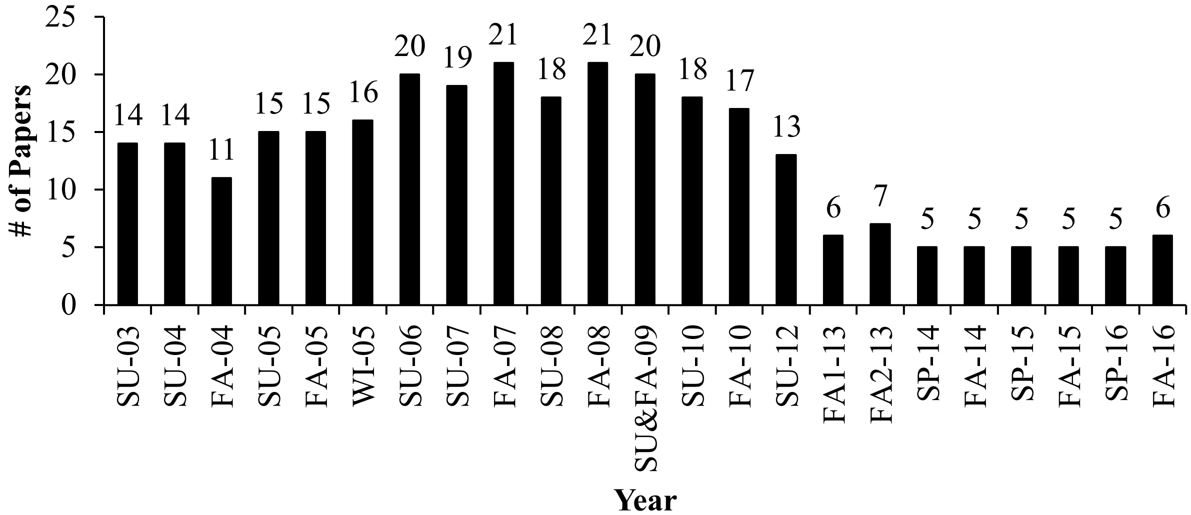


Figure III. Total Authors

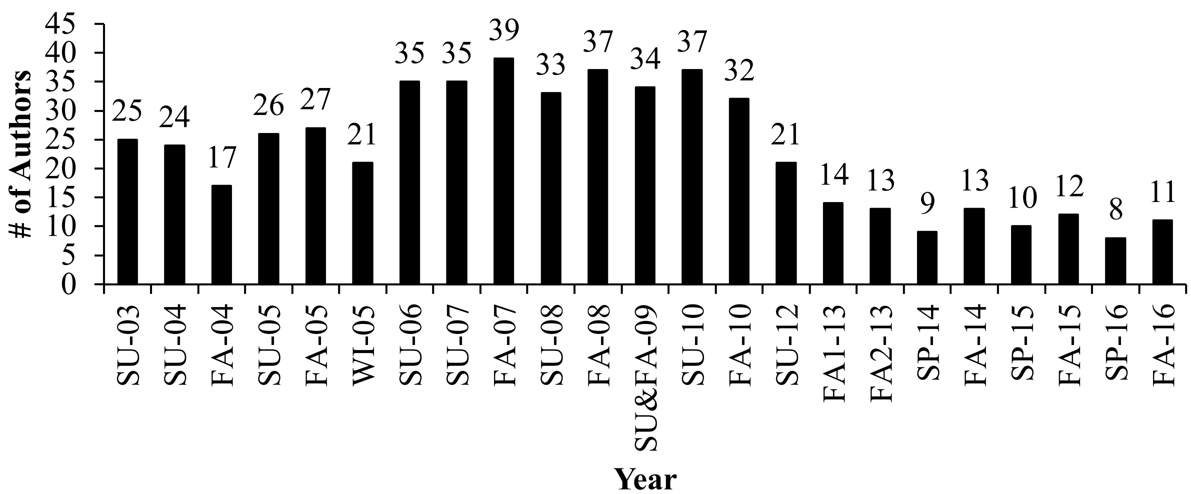


Figure IV. Author Distribution

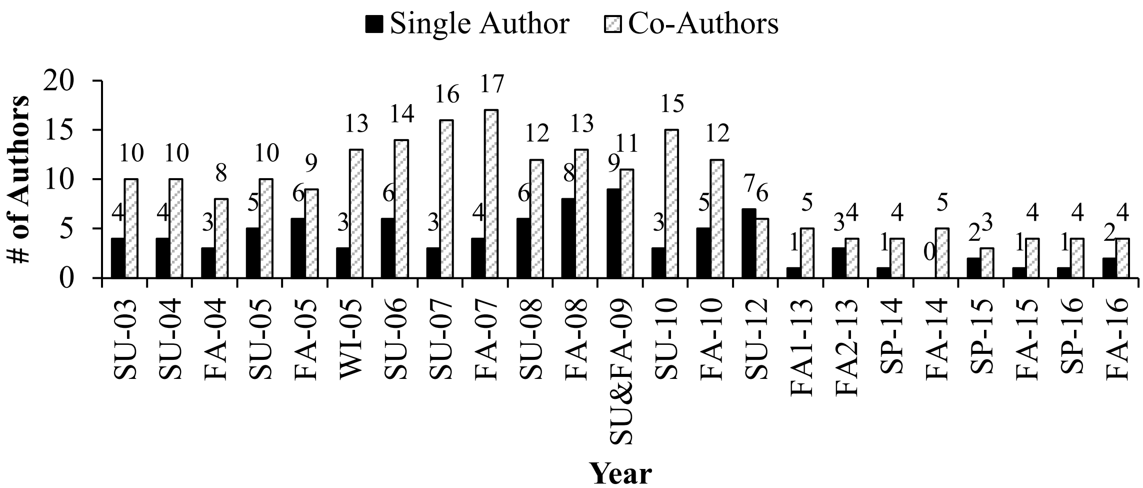
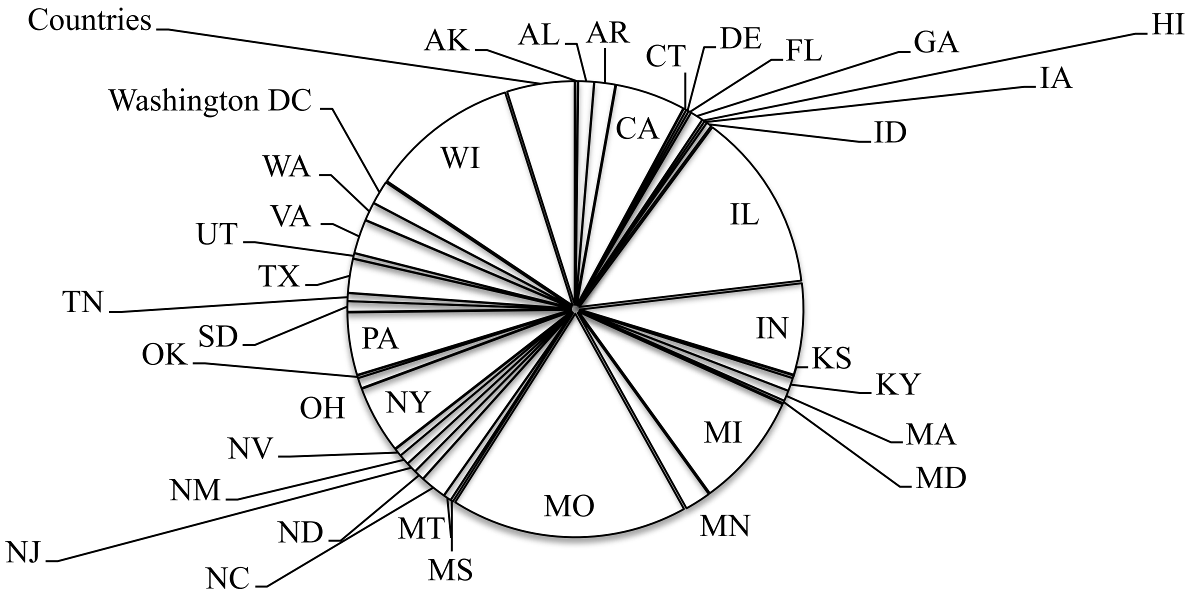


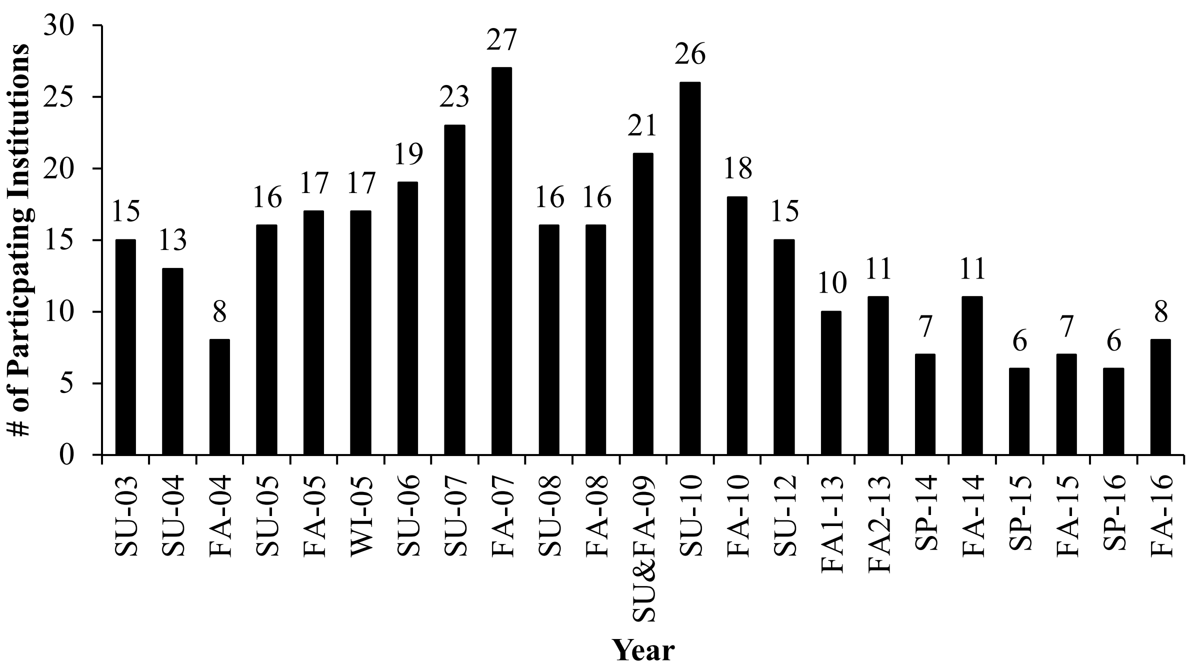
Figure V. Locations of Authors



State	Freq.	%	State	Freq.	%	*Other (Countries outside US)		
AK	1	0.2%	MS	1	0.2%	**Country**	**Freq.**	**%**
AL	6	1.1%	MT	3	0.6%	Barbados	1	0.2%
AR	8	1.5%	NC	10	1.9%	Canada	6	1.1%
CA	27	5.1%	ND	4	0.8%	China	6	1.1%
CT	1	0.2%	NJ	4	0.8%	England	2	0.4%
DE	1	0.2%	NM	4	0.8%	France	1	0.2%
FL	1	0.2%	NV	3	0.6%	India	1	0.2%
GA	5	0.9%	NY	26	4.9%	Iran	1	0.2%

HI	1	0.2%	OH	4	0.8%	Jamaica	1	0.2%
IA	1	0.2%	OK	1	0.2%	Korea	4	0.8%
ID	2	0.4%	PA	24	4.5%	Pakistan	1	0.2%
IL	69	13.0%	SD	4	0.8%	Saudi Arabia	1	0.2%
IN	35	6.6%	TN	3	0.6%	Taiwan	1	0.2%
KS	1	0.2%	TX	13	2.4%	**Total**	26	4.9%
KY	5	0.9%	UT	2	0.4%			
MA	4	0.8%	VA	13	2.4%			
MD	1	0.2%	WA	7	1.3%			
MI	44	8.3%	DC	9	1.7%			
MN	10	1.9%	WI	57	10.7%			
MO	91	17.1%	*Other	26	4.9%			
			Total	**532**				

Figure VI. Institutions



Total Participating Institutions	117	
AACSB Business Accredited	76	64.96%
AACSB Accounting Accredited	30	25.64%

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Is Small and Independent Board A Better Board? An Example of High-tech Firms

Nilakshi Borah

Abstract

This paper examines board structure and the effect of board size and composition on firm value for firms in high technology industries for the period 1995-2008. I find that high-tech firms, generally characterized by asymmetric information and growth opportunities, have board sizes 2.9% smaller and a proportion of insiders 1.7% higher than non high-tech firms. Using Tobin's *Q* as a measure of firm value, I document that Tobin's *Q* is increasing in board size for high-tech firms. This result is consistent with the argument that transaction costs, such as political pressure from regulators and institutional investors, as well as listing requirements set by the SEC and major stock exchanges, may impede board upsizing for high-tech firms. My findings indicate that a uniform "one size fits all" reform of corporate boards may impair board effectiveness in some types of firms.

I. Introduction

Agency theory argues that managers tend to choose projects that are not always in the best interest of shareholders (Jensen, 1986). The board of directors of a corporation, performing its functions of advising and monitoring top management, is one of the internal governance mechanisms to control agency conflicts between managers and shareholders. Numerous studies in the field of corporate governance explore the structure and efficiency of boards and suggest that the size of the board and the level of board independence affect the board's ability to perform its important functions. Various characteristics of firms or the context in which they operate may affect the board structure (Linck, Netter and Yang, 2008; Coles, Daniel, and Naveen, 2008). Given the high-growth, high-risk nature of tech-intensive industries, one might wonder whether the board structure in high-tech firm differs from the board structure in non high-tech firms. I answer this question by exploring the board structure and the effect of board structure on firm performance for firms in high-technology industries.

I answer this question for three reasons. First, though conventional wisdom suggests that smaller boards are more effective because large boards suffer coordination and free-rider problems (Jensen, 1993; Lipton and Lorsch, 1992), we still observe large boards. Apparently, no single board structure fits all firms optimally (Hermalin, 1994; Kole, 1997; Hermalin and Wallace, 2001). This study shows that the industry type could affect the size of the board.

Second, I respond to the on-going controversy among academics, practitioners and regulators on board independence. Independence boards can better curtail agency conflicts because outside directors are better monitors than inside directors. Along this line, Weisbach (1988) finds that CEO turnover is more sensitive to firm performance than it is in firms with less independent boards. Klein (2002) and Petra (2007) show that independent directors improve earnings quality.

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In practice, SEC requires firms to maintain board independence and Sarbanes-Oxley Act of 2002 requires that audit committees of boards have a majority of independent directors. Despite the widespread call for board reform, firms persist in having boards with a higher proportion of insiders. I show that technology-intensive industries, characterized by severe information asymmetry, may prefer a board with fewer outsiders. Taken together, results suggest that industry type affect the board composition including the size and the level of independence of a board.

Third, although prior studies document the relation between firm performance and board structure, studies on the relation between firm value and board independence generate mixed results. I investigate whether the relation between firm value and board composition can be explained by industry characteristics with regard to tech-intensity[1]. I find that increases in board size for high-tech firms result in increases in firm value, measured by Tobin's *Q*.

High-tech industries such as pharmaceuticals, computers, and electronics have emerged as leaders in the economy through their extreme competition and potential for future growth. Prior research has indicated that more than half of the total GDP in the wealthy economies of the world is based on high-tech industries (Kohers and Kohers, 2000). High-tech firms exhibit a high level of asymmetric information and growth opportunities (Francis and Schipper, 1999). These firm characteristics are associated with higher costs to verify the quality of projects for outsiders (Smith and Watts, 1992; Gaver and Gaver, 1993). The costs of information loss in having more outsiders may outweigh the benefits of having more outsiders to efficiently monitor management actions and give valuable advice; and therefore, high-tech firms should have smaller boards. Harris and Raviv (2008) argue that higher number of inside directors encourages CEOs to share information with outsiders, reducing the costs of information share. Therefore, boards in firms where information possessed only by insiders should have few outsiders. Taken together, I posit that smaller boards and a higher percentage of insiders are optimal for high-tech firms.

Using a sample of 14,131 firm-year observations over the period of 1995-2008, I find that high-tech firms have a board size 2.9% smaller and a proportion of insiders 1.7% higher than non high-tech firms. A closer look reveals that high-tech firms have a smaller number of both insiders and outsiders. For example, the coefficient estimates indicate that the number of insiders and the number of outsiders is 5.7% and 2.5% smaller for high-tech firms compared to non high-tech firms, respectively. These estimates are consistent with the findings of Denis and Sarin (1999) in that firms with greater growth opportunities have smaller boards with a smaller percentage of outsiders.

Next, I explore the relation firm value and board composition in high-tech industries. Any deviation from optimal board size may reduce firm value (see Coles et al., 2008). High-tech firms are likely to be younger firms and smaller in size relative to non high-tech firms. As firms grow, board size grows accordingly. However, transaction costs, such as political pressure from listing requirements set by the SEC and major national stock exchanges, as well as pressures from regulators and institutional investors, are likely to impede board upsizing. Therefore, high-tech firms tend to have smaller boards than optimal. Empirically, I should find increases in board size for high-tech firms result in increases in Tobin's *Q*.

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[1] Using a sample of 435 European firms, Andres and Rodriquez (2011) find that larger and less independent boards may enhance firm performance in high-tech industries.

Using Tobin's *Q* as a measure for firm value, I document that Tobin's *Q* is increasing with board size for high-tech firms. Moreover, adding insiders to the board has an even stronger positive effect on Tobin's Q than adding outsiders. Therefore, the previously documented negative relation between Tobin's *Q* and board size does not hold for high-tech firms. These results are consistent with the argument that, due to transaction costs, high-tech firms are likely to have smaller board sizes, measured by both insiders and outsiders, than the sizes that maximize firm value.

This paper complements and extends recent studies in several ways. First, I document that board size and composition in high-tech firms are significantly different from non high-tech firms in that high-tech firms have smaller boards with significantly fewer outside directors and significantly more insiders. These results are consistent with the argument that board size and composition vary across firms depending on the costs and benefits of the monitoring and advising roles of the boards (Denis and Sarin, 1999; Gillan, Hartzell, and Starks, 2003; Lehn, Patro, and Zhao, 2004; Boone, Field, Karpoff, and Raheja, 2007; Coles et al., 2008; Linck et al., 2008). Second, for high-tech firms, firm value is increasing with board size. Adding insiders has an even stronger positive effect on firm value than adding outsiders. This finding complements the results in Coles et al. (2008).[2]

My findings have important implications for policy makers regarding the reform of corporate boards. It appears that a generalized approach to board reform, such as specifying that all firms should have smaller and independent boards, may impair the effectiveness of boards for some firms. Advocates of smaller boards with larger numbers of outsiders appear to underestimate the information advantage of having a larger number of insiders on the board and the costs of having larger numbers of outsiders for firms with high growth opportunities and greater information asymmetry.

II. Literature review

A. Board size and high-tech firms

One of the main internal corporate governance mechanisms is board of directors and this mechanism has received vast attention from researchers. Literature documented two main roles of board of directors: monitoring and advising the management (see, for example, Adams and Ferreira, 2007). The monitoring role of boards can be compared to watchdog as directors monitor managers' action to ensure that manager is acting in the best interest of shareholders (Fama, 1980; Hermalin and Weisbach, 1998). In the advising role, boards take a more hands-off process by depending upon the expertise of its members to counsel management on the firm's strategic direction (Fama and Jensen, 1983).

The existing literature indicates that corporate board size is determined by the trade-off between the costs and benefits associated with the monitoring and advising roles of directors (Raheja, 2005; Adams and Ferreira, 2007; Boone et al., 2007; Coles et al., 2008; Linck et al., 2008, Harris and Raviv, 2008). The net benefits of monitoring increase with managers' opportunities to

[2] Coles et al. (2008) note that there is a positive relation between the proportion of insiders on the boards and firm value for firms with high R&D expenditures.

consume private benefits but decrease with the cost of monitoring. Managers on boards are better informed concerning the quality of projects, and outsiders must use managers' private information to monitor them. In noisy environments, managers may be reluctant to share information with outsiders because the more information outsiders have the more intensively they will monitor managers (Demsetz and Lehn, 1985; Gillan et al., 2003; Linck et al., 2008).

High-tech firms exhibit a high degree of asymmetric information between managers and shareholders (Benou, Gleason, and Madura, 2007). The technologies in high-tech firms are unique and not readily understandable to persons without highly specialized knowledge, thereby leading to greater levels of information asymmetry. High-tech firms also have more growth opportunities, and the cost of verifying the quality of the projects increases with the level of growth opportunities (Smith and Watts, 1992; Gaver and Gaver, 1993; Lehn et al., 2004). Therefore, the cost of monitoring is higher for high-tech firms relative to non high-tech firms. To the extent that the cost of monitoring of having a large board outweighs the benefits, high-tech firms should have smaller boards. Lastly, high-tech firms tend to operate in more volatile business environments with frequent technological changes and unstable market valuation. Managers need to manage their assets aggressively in order to keep pace with technological change. Therefore, high-tech firms desire corporate board structures that facilitate rapid decision-making. As the cost of altering corporate strategy is inversely related to board size,[3] high-tech firms should have smaller boards.

H_1. High-tech firms are associated with smaller boards than non high-tech firms.

B. Board composition and high-tech firms

Board composition has been at the core of numerous studies in the field of corporate governance. Scholars and regulators agree that a board is independent when the board has more outside directors. Fahlenbrach, Low, and Stulz (2010) note that in a large number of countries, laws or regulations require a fraction of the corporate board to be composed of independent outside directors based on the assumption that the interests of independent outside directors are better aligned with those of minority shareholders than the interests of inside directors. Outside directors are considered to be the crucial corporate governance mechanism for monitoring managers (Bhagat, Bolton and Romano, 2008). Prior studies show that having outside directors on the boards improves monitoring and advising functions of boards as outside directors on the board increases the independence of the board. Similarly, the major stock exchanges either mandate or highly recommend that the three principal monitoring committees (audit, compensation, and nominating) be entirely staffed with independent directors, while Section 301 of the Sarbanes-Oxley Act of 2002 (SOX) requires the same for the audit committee (Faleye, Hoitash, and Hoitash, 2011). Both the New York Stock Exchange (NYSE, since 1978) and NASDAQ (since 1989) require companies whose stock is traded on their exchanges to have at least two independent directors on their boards (Coles et al., 2008). Fama and Jensen (1983) argue that outside directors tend to be more effective monitors than inside directors as generally they are the key decision makers at other organizations who are concerned with their reputations in the managerial labor-market.

[3] Kole and Lehn (1999) report that board sizes of airline firms declined after industry deregulation in 1978, supporting this argument as deregulation leads to a more volatile business environment. Similarly, Frye and Smith (2003) find that regulated firms increase their board sizes more than unregulated firms following initial public offerings.

Evaluating the CEO and replacing him if his performance is poor is one of the main functions of board (Coles et al., 2008). Hermalin and Weisbach (1998) offer on board-specific model where they focus on two primary monitoring duties of the corporate boards: the hiring and the firing of the management. Weisbach (1988) reveal that CEO turnover is more sensitive to firm performance when boards are dominated by outside directors. He attributes this evidence to the fact that it can be costly for inside directors to challenge the CEO to whom their careers are tied. In UK, Cadbury Committee issued the Code of Best Practice in 1992 which recommends that boards of U.K. firms include at least three outside directors on their boards. Dahya, McConnell, and Travlos (2002) find that UK Firms that adopted the recommendations show a greater sensitivity of CEO turnover to performance than non-adopting firms. These studies consistenly point out that outside directors have an incentive to be effective monitors to signal to shareholders and labor markets their value as directors (Fama, 1980; Fama and Jensen, 1983).
Brickley, Coles, and Terry (1994) examine the impact of the board on the decision to adopt a poison pill. Brickley et al. (1994) find that the average stock market reaction to poison pills is positive when the board includes a majority of independent directors and negative when it does not. They conclude that outside directors serve the interests of shareholders based on this empirical finding. Cotter, Shivdasani, and Zenner (1997) analyze the role of the target firm's independent outside directors during takeover attempts by tender offer. Cotter et al. (1997) report that when a target's board includes a majority of outside independent directors, the target receives a return approximately 20 percentage points higher than that of a similar firm without a majority of outside independent directors on the board. Marciukaityte, Szewczyk, and Varma (2009) find that independent directors increase the likelihood of voluntary restatements and the stock performance following restatements recovers fast with the presence of independent boards. Uzun, Szewczyk, and Varma (2004) examine how different characteristics of the board of directors affect the occurrence of U.S. corporate fraud in the 1978-2001 period. They find that as the number of independent outside directors increases on a board, the likelihood of corporate wrongdoing decreases. In sum, these studies suggest that market view independent directors as an internal governance mechanism to overcome agency conflicts. Insiders on boards are better informed of the value of the potential projects. Therefore, larger numbers of insiders on the board can lead to more effective decision-making. Outsiders on the board need to use insiders' private information to monitor mangers' decisions. However, the more information outsiders have, the more intensively they will monitor managers. To insiders, the decision on whether to share information with outsiders depends on the trade-off between the benefits and costs associated with sharing information. To avoid intensive monitoring, they may choose not to share information, resulting in a higher cost of monitoring and advising (see Adams and Ferreira, 2007).

Raheja (2005) and Harris and Raviv (2008) model board structure as a trade-off between agency costs of greater insider information and coordination costs of greater outsider representation. A higher number of inside directors encourages insiders to share information with outsiders, who use information to give advice. The quality of the advice depends on the quality of information outsiders receive from insiders. In cases when insiders have important information relative to that of outsiders, a greater proportion of outside directors on the boards may reduce the private information of insiders to be shared with outsiders. This loss of information increases the coordination costs of the boards, which are likely to be more costly than the agency costs associated with a less independent board. Empirically, Lehn et al. (2004), Linck et al. (2008), and Boone et al. (2007) show that high-growth firms with greater information asymmetry have smaller boards with a high proportion of inside directors because the costs of information share is higher than the agency costs. Coles et al. (2008) find that the proportion of insiders is positively related to the firm's research and development expenditures. I propose, for firms with high information asymmetry, such as high-tech firms, it is optimal to have a higher fraction of insiders on the board because insiders' information brings more value to firms than could be achieved with an independent board.

H_2. High-tech firms are associated with a higher proportion of inside directors on the boards than non high-tech firms.

C. The effect of board size and composition on firm performance in high-tech firms

Previous studies document a negative relation between board size and firm performance. Yermack (1996) and Eisenberg, Sundgern, and Wells (1998) find that smaller boards are associated with higher firm performance. Using a sample of Malaysian and Singapore firms, Mak and Kusnadi (2005) find the inverse relationship between board size and firm value in both countries. However, studies on the relation between firm performance and board composition find mixed results. Rosenstein and Wyatt (1990) find that on average there is a statistically significant 0.2 percent increase in stock prices in response to the announcement of adding outside directors' to the board. Byrd and Hickman (1992) find that bidding firms in which at least 50 percent of the directors are independent outside directors exhibit significantly higher announcement-date abnormal returns than other bidders. This result indicates that the market identifies firms with independent outside directors as making better acquisitions (Hermalin and Weisbach, 2003). Weisbach (1988), Brickley et al. (1994), and Cotter et al. (1997) document that a higher level of board independence increases firm value in some circumstances. Hermalin and Weisbach (1991), Mehran (1995), Klein (1998), and Bhagat and Black (2001) find no relation between the proportion of outside directors on the board and firm value, as measured by Tobin's *Q*. Yermack (1996) and Agrawal and Knoeber (1996) report a significant negative relation between proportion of independent directors and Tobin's *Q*. Barnhart and Rosenstein (1998) document an inverted-U relation between Tobin's *Q* and proportion of independent directors, implying that Tobin's *Q* is lower for firms with either less or highly independent directors.

A fundamental issue in the studies of the effect of corporate board on firm value is whether the empirical findings are driven by the endogeneity of board structure and/or the causality problems. Studies argue that the attributes of boards are endogenously determined by firm characteristics in ways consistent with value maximization (Boone et al., 2007; Coles et al., 2008; Linck et al., 2008). When transaction costs of re-contracting are small, firms and managers contract optimally, and corporate governance mechanisms are set at or near the value-maximizing level, on average (Demsetz and Lehn, 1985; Coles, Lemmon, and Meschke, 2006). Hence, any observed relation between corporate board structure and firm value arises because the firm's environment is inadequately captured. Furthermore, Hermalin and Weisbach (1998) indicate that it is the poor performance leading to increases in board independence rather than board independence decreasing firm value. Therefore, empirically, one could find a negative association or no association at all between board independence and firm value even though board independence actually increases firm value.

When examining the relation of firm value and managerial ownership, Core and Larcker (2002) propose the transaction cost theory. They argue that it is inappropriate to implicitly assume that adjustment costs are so small that firms can continuously re-contract. Likewise, Coles et al. (2008) posit transaction cost impedes the adjustment of board size and composition towards their optimum in both firms with high R&D expenditures and firms with greater complexity. Applying the same reasoning to the case of firms in the high-tech industries, I argue that high-tech firms can only periodically re-optimize board size and composition when they deviate from the optimal level, and any deviations may result in a reduction in firm value.

Studies find that there is an inverted-U relation between board size and Tobin's *Q* (Lipton and Lorsch, 1992; Coles et al., 2008). Applying their study to high-tech industries, I assume that there is an inverted-U relation between Tobin's *Q* and board size. On the one hand, in a case involving sub-optimal board size that is below optimal, increasing board size leads to higher firm value. On the other hand, when sub-optimal board size is above the optimal level, increasing board size leads to lower firm value. Empirically, Coles et al. (2008) find that firms cannot adjust their board structure quickly enough to be optimal, and Tobin's *Q* increases with the proportion of insiders on boards for high R&D-intensive firms.

Because of the transaction costs, board size deviates from its optimal. If deviations from optimal board sizes are random, that is, board sizes can be either smaller or larger than the optimal, I would detect no relation, a positive relation, or a negative relation between Tobin's *Q* and board size. Suppose that deviations from optimal board sizes are not random, however. More specifically, if high-tech firms tend to have smaller boards than optimal, I would observe only the part of the inverted-U relation that is to the left side of the optimum. Empirically, I should find a positive relation between Tobin's *Q* and board size for high-tech firms.

The question now turns to why high-tech firms tend to have smaller boards than optimal. First, boards grow slowly in response to the increasing net benefits of monitoring and advising functions by board members (Lehn et al., 2004). High-tech firms are likely to be younger firms and smaller in size relative to non high-tech firms. In my sample, the mean (median) log of total assets is 7.25 (6.99) for high-tech firms, while it is 7.61 (7.43) for non high-tech firms, with the difference statistically significant at the 1% level. Second, transaction costs of adding board members potentially impede upsizing. A good example of transaction costs would be political pressure from a variety of sources, including listing requirements promulgated by the SEC and major stock exchanges, the press, regulators, institutional investors, business groups such as the Conference Board and Business Roundtable, and even academia (Coles et al., 2008). For instance, Wu (2004) attributes the reduction in board size in the 1990s to institutional pressure. Lipton and Lorsch (1992) and Jensen (1993) argue that smaller boards are likely to dominate larger boards because of the coordination and director free-rider problems associated with larger boards. Another example of transaction cost would be the dollar cost associated with adding a board member. Yermack (2004) finds that directors' wealth increases approximately 11 cents per each $1,000 increase in firm value and about $285,000 for a 1 standard deviation change in firm value. Taken altogether, the various constraints are likely to prevent board structure of high-tech firms from adjusting to its optimal. This argument leads to the following hypothesis.

H_3. Tobin's Q is positively related to board size for high-tech firms.

Board reform proposed by regulators has increased independent director representation on board. Due to the substantial transaction cost, firms are reluctant to let go of directors. To increase the board independence, firms choose to add more outside directors rather than firing existing inside directors (Dahya et al., 2002; Linck et al., 2005). Consequently, the percentage of independent directors is likely to be less than its optimum. As firms in high-tech industries are associated with greater information asymmetry, adding more outside directors are more likely to lead to unbalanced power between insiders and outsiders, resulting in poor information-sharing for directors to perform both monitoring and advising functions. Moreover, the insiders are likely to be engineers or experts in their field in high-tech firms, thus, they can provide CEOs with more valuable insights on firm strategic planning. As such, I propose, although it is optimal for high-tech firms to have more insiders on the boards than non high-tech firms, this is less likely to be the case. Hence, adding more insiders to the board should increase firm value.

H_4. Tobin's Q is positively related to the number of insiders on the boards for high-tech firms.

III. Sample selection and data

A. Sample selection

My initial sample includes all firms in Compustat during the sample period 1995-2008. This sample is merged with Risk Metrics and Equilar to obtain board of director data. CEO characteristics, such as age, stock incentives, and year of tenure, are from Execucomp. Stock return data is from CRSP (Center for Research on Security Prices). All the observations with missing value for key variables are excluded. The full sample, including both high-tech firms and non high-tech firms, includes 14,131 firm-year observations.[4] When examining the relation between Tobin's *Q* and board structure for high-tech firms, I restrict the sample by including only high-tech firms, resulting in a sub-sample of 2,828 firm-year observations.

B. High-tech industries

Following Francis and Schipper (1999), I classify high-tech firms as firms having significant unrecorded intangible assets. Specifically, high-tech firms operate in such industries as pharmaceuticals, computer and electronics manufacturing, telecommunications, and software. Table I reports the three-digit SIC codes and names of the industries for high-tech firms.

[4] Excluding financial firms (SIC Codes 6000 to 6999) and utilities firms (SIC Codes 4000 to 4999) does not alter my results.

Table I: Classification of High-tech Industries

High-Technology Industries	
283	Drugs
357	Computer and Office Equipment
360	Electrical Machinery and Equipment, Excluding Computers
361	Electrical Transmissions and Distribution Equipment
362	Electrical Industrial Apparatus
363	Household Appliances
364	Electrical Lighting and Wiring Equipment
365	Household Audio, Video Equipment, Audio Receiving
366	Communication Equipment
367	Electronic Components, Semiconductors
368	Computer Hardware (Including Mini, Micro, Mainframes, Terminals, Discs, Tape Drivers, Scanners, Graphics Systems, Peripherals, and Equipment)
481	Telephone Communications
737	Computer Programming, Software, Data Processing
873	Research, Development, Testing Services

C. Variable construction

Board structure is measured by size and composition. Board size is measured by the number of directors (including both insiders and outsiders), and board composition is measured by the proportion of insiders on the board. Following the existing literature, I classify all directors who are employees of the firm as inside directors, and outsiders are board size minus insiders (Borokhovich, Parrino, and Trapani, 1996; Huson, Parrino, and Starks, 2001; Lehn et al., 2004; Coles et al., 2008; Linck et al., 2008). The proportion of insiders is the number of insiders scaled by the board size.

Firm value is measured by Tobin's *Q*, which is computed as book assets minus book equity plus market value of equity, all scaled by book assets. Hermalin and Weisbach (1998) suggest that board independence decreases with the CEO's bargaining power. To the extent that the CEO's bargaining power increases through operating performance and CEO tenure, board independence should decrease with operating performance and CEO tenure. Raheja (2005) argues that the number of outsiders increases as the CEO's influence increases. I use CEO age to proxy for the CEO's influence (Hermalin and Weisbach, 1998, Linck et al., 2008). Studies indicate that costs of monitoring increase with growth opportunities and the level of asymmetric information. Growth opportunities are proxied by intangible assets. Fama and Jensen (1983) indicate that firms with high stock return volatility are more likely to have private information unknown to outsiders. Accordingly, I use the standard deviation of monthly stock returns over the past three years to proxy for the level of asymmetric information. The benefits of advising increase with the complexity of firms in that highly complex firms benefit more from outsiders with a range of expertise (Coles et al., 2008; Linck et al., 2008). I use firm age and leverage to measure the complexity of firms' operating environment (Fama and Jensen, 1983; Booth and Deli, 1999; Boone et al., 2007; Coles et al., 2008; Linck et al., 2008). The benefits of monitoring increase with the level of private benefits available to managers (Raheja, 2005; Adams and Ferreira, 2007), and therefore I use free cash flow to proxy for private benefits (Jensen, 1986). Appendix A provides more detailed definitions of the variables.

D. Descriptive statistics

Table II presents descriptive statistics for all sample firms on key variables. Results are comparable with those reported in the existing literature, with some small differences due to different sample periods and sample selection methods. The mean (median) number of board members is 9.4 (9), compared to the observation of 10-12 in other studies (Bhagat and Black, 2001; Huson et al., 2001; Yermack, 1996; Coles et al., 2008). The mean (median) proportion of insiders on the board is 32.31% (30%), which is consistent with Linck et al. (2008) who observed an average insider fraction of 34.3%. Both the mean and the median number of insiders on the board are 3, and the mean (median) number of outsiders is 6.4 (6).

Table II: Descriptive Statistics

	Mean	Standard Deviation	Percentiles				
			Min	p25	Median	p75	Max
Board characteristics							
Board size	9.4388	2.5321	3.0000	8.0000	9.0000	11.0000	39.0000
Percentage of insiders	0.3231	0.1724	0.0000	0.1818	0.3000	0.4286	1.0000
Insiders	3.0203	1.8653	0.0000	2.0000	3.0000	4.0000	31.0000
Outsiders	6.4468	2.3947	0.0000	5.0000	6.0000	8.0000	23.0000
CEO characteristics							
CEO tenure	8.4134	7.3478	0.0000	3.0000	6.0000	11.0000	58.0000
CEO age	55.9914	7.3410	34.0000	51.0000	56.0000	61.0000	92.0000
CEO PPS	1.4139	12.5741	0.0000	0.0871	0.2425	0.6829	709.8297
Firm characteristics							
Tobin's *Q*	2.0220	1.5628	0.4037	1.2108	1.5616	2.2311	39.1199
Intangible assets	0.6898	0.2335	0.0297	0.5386	0.7525	0.8750	1.0000
R&D expenditure	0.0487	0.3725	0.0000	0.0000	0.0000	0.0305	29.7258
Capital expenditure	0.0837	0.1443	-0.0429	0.0242	0.0438	0.0863	4.2829
Leverage	0.2375	0.1763	0.0000	0.0949	0.2325	0.3488	1.7433
Firm age	34.3900	19.9251	1.0000	18.0000	29.0000	43.0000	85.0000
Firm risk	0.3854	0.1967	0.0842	0.2492	0.3392	0.4683	2.2125
ROA	0.1424	0.0967	-1.1705	0.0937	0.1363	0.1889	0.9651
Free cash flow	0.0832	0.0782	-1.3302	0.0488	0.0824	0.1181	0.6024

The mean (median) years for CEO tenure is 8.4 (6), consistent with Linck et al. (2008). The mean (median) CEO age is 55.99 (56), which is consistent with Faleye (2007), Fee and Hadlock (2004), and Linck et al (2008). All three studies report a mean CEO age of 55. CEO pay performance sensitivity (PPS) is measured as the dollar change in CEO wealth for a percentage change in firm value, divided by 100,000. On average, a CEO has a PPS of 1.42. The mean (median) value of Tobin's *Q* is 2.02 (1.56), which is very close to the observation in Linck et al. (2008), who report that Tobin's *Q* has a mean value of 2.29 and median value of 1.47. The mean (median) firm age is 34.39 (29), which is less than the same measures for the sample firms used by Lehn et al. (2004), and greater than the same measures for the sample firms used by Boone et al. (2007).

IV. Univariate analysis

Panel A of table III presents the differences in board, CEO, and firm characteristics between high-tech firms and non high-tech firms. The average board size is 8.49 for high-tech firms and 9.68 for non high-tech firms. On average, high-tech firms have board size significantly smaller than non high-tecg firms by 1.19, a difference significant at the 1% level. The difference in board size is the result of the lower number of both insiders and outsiders on the board of high-tech firms relative to non high-tech firms. High-tech firms have a slightly higher proportion of insiders than non high-tech firms (32.81% versus 32.25%) and the difference is significant at the 10% level. Taken together, these results are consistent with hypothesis 1 and 2 that high-tech firms have higher monitoring costs and therefore, require smaller boards with a higher proportion of insiders.

CEOs in high-tech firms have longer years in tenure, suggesting that CEOs have stronger bargaining power. High-tech firms spend significantly more on intangible assets and research and development as percentages of total sales than non high-tech firms. For example, the proportion of intangible assets of total assets is 14.36% higher for high-tech firms than for non high-tech firms. On average, high-tech firms invest 17.97% of total assets in R&D compared to 1.57% for non high-tech firms, difference significant at the 1% level. Higher intangible assets and R&D expenditures indicate a higher level of asymmetric information and growth opportunities, thereby suggesting high-tech firms require smaller and less independent boards.

Table III: Univariate Results: Panel A

	Mean			Median		
	[I] High-tech firms	[II] Other firms	[I]-[II] (t-statistics)	[I] High-tech firms	[II] other firms	[I]-[II] (Z-value)
Board size	8.4894	9.6777	-1.1883***	8.0000	9.0000	-1.0000***
			(-22.70)			(24.57)
Percentage of insiders	0.3281	0.3225	0.0056*	0.3000	0.2857	0.0143*
			(1.83)			(1.63)
Outsiders	5.7740	6.6104	-0.8363***	5.0000	7.0000	-2.000***
			(-16.74)			(17.98)
Insiders	2.7341	3.0979	-0.3638***	2.0000	3.0000	-1.000***
			(-9.29)			(9.28)
CEO tenure	8.7815	8.3088	0.4727***	6.0000	6.0000	0.0000***
			(3.06)			(2.80)
CEO age	54.0916	56.4603	-2.3687***	54.0000	56.0000	-2.0000***
			(-15.47)			(-14.99)
Intangible assets	0.8050	0.6614	0.1436***	0.8421	0.7198	0.1224***
			(30.17)			(-28.22)
R&D expenditures	0.1797	0.0157	0.1640***	0.0954	0.0000	0.0954***
			(21.36)			(64.39)
Firm risk	0.5194	0.3518	0.1677***	0.4710	0.3201	0.1509***
			(43.19)			(35.42)
Firm age	28.3052	35.9381	-7.6329***	24.0000	37.0000	7.0000***
			(-18.43)			(-18.98)

Panel B presents the relation between Tobin's *Q* and board structures for high-tech firms. High-tech firms are sorted based on whether they have a board size above the sample median (large board) or below the sample median (small board), whether they have a proportion of insiders above the sample median (high insider proportion) or below the sample median (low insider proportion), whether they have a number of insiders above the sample median (high number of insiders) or below the sample median (low number of insiders), and whether they have a number of outsiders above the sample median (high number of outsiders) or below the sample median (low number of insiders). On average, firms with large boards have a Tobin's *Q* of 2.9, while firms with small boards have Tobin's *Q* of 2.75, the difference between these two values is statistically significant at the 10% level. Tobin's *Q* is higher for firms with a higher proportion of insiders on the boards (3.01) compared with those with a lower proportion of insiders (2.67). The difference is statistically significant at the 1% level. Tobin's *Q* is higher for firms with a higher number of insiders than those with lower number of insiders, and for firms with a lower number of outsiders than those with a higher number of outsiders. In both cases, the differences are statistically significant at the 1% level. Similar results can be obtained when the median value of Tobin's *Q* is examined. The results from Panel B are consistent with the hypotheses that Tobin's *Q* is positively related to firm size and the number of insiders on the board for high-tech firms.

Table III: Univariate Results: Panel B

Mean		[I]-[II] (t-statistics)	Median		[I]-[II] (Z-value)
[I] Small board	[II] Large board		[I] Small board	[II] Large board	
2.7528	2.9009	-0.1480* (-1.63)	2.0697	2.1310	-0.0613 (-0.60)
[I] Low insider proportion	[II] High insider proportion		[I] Low insider proportion	[II] High insider proportion	
2.6693	3.0082	-0.3389*** (-3.75)	2.0357	2.1868	-0.1511*** (-3.14)
[I] Low number of insiders	[II] High number of insiders		[I] Low number of insiders	[II] High number of insiders	
2.6662	3.0384	-0.3722*** (-4.11)	1.9993	3.5719	-1.5726*** (-5.32)
[I] Low number of outsiders	[II] High number of outsiders		[I] Low number of outsiders	[II] High number of outsiders	
2.9840	2.6833	0.3007*** (3.32)	2.1468	2.0667	0.0801** (2.02)

V. Multivariate analysis

The multivariate specifications are estimated using both ordinary least squares (OLS) regressions and median regression for each regression model to eliminate potential biases from the skewness of the variables (Gompers, Ishii, and Metrick, 2003; Coles et al., 2008). Specifically, the median regression uses the least absolute deviation criterion, rather than least squares, with respect to deviations from the median to obtain coefficient estimates. A fixed effect model might not be appropriate in this study because board structure is relatively persistent, and the lack of within variation of the year-to-year firm-level observations may bias the results of the regression. Firms in the same industries face similar market conditions, and the regression residuals are likely to be cross-sectionally correlated. To account for the biases from the contemporaneous correlation in the regression residuals across firms, I include both year and industry dummy variables, which are classified by two-digit standard industrial classification (SIC). For the OLS regressions, the standard errors are adjusted by clustering observations within firms and the covariance matrix is estimated using White's (1980) estimator. This methodology allows me to use panel data yet still control for the time series correlation in the time series observations for each firm.

A. Board size of high-tech firms

Panel A of table IV reports the results from regressing the log of board size on the high-tech dummy as well as control variables[5] to test hypothesis H_1. The regressions include all the observations in the full sample. High-tech firms have higher asymmetric information and growth rate than non high-tech firms, and the associated higher monitoring costs should lead to smaller boards. I use a high-tech dummy, which takes a value of one if a firm belongs to a high-tech industry and zero otherwise, to capture the effect of being a high-tech firm on board size. Both OLS (model 1) and median regression (model 2) have estimated coefficients of the high-tech dummy significantly negative (at the 1% level). The parameter estimates suggest that the average board size is about 2.9% smaller for high-tech firms than for non high-tech firms, strongly supporting hypothesis H_1.

Table IV: Do High-tech Firms Have Smaller Boards? Panel A

	Model 1 OLS regression	Model 2 Median regression
	Log (board size)	Log (board size)
High-tech	-0.0289**	-0.0288***
	(-2.03)	(-3.15)
Log (CEO tenure)	-0.0167**	-0.0203***
	(-2.46)	(-5.81)
Log (CEO age)	0.0888**	0.0682***
	(2.23)	(3.21)
Risk	-0.4336***	-0.4551***
	(-13.60)	(-23.64)
ROA	0.0278	0.0007
	(0.36)	(0.85)
ROA_1	-0.1905***	-0.0020***
	(-4.84)	(-3.84)
Intangible assets	0.0160	0.0169
	(0.69)	(1.35)
Leverage	0.1621***	0.1598***
	(5.69)	(10.46)
Firm age	0.0035***	0.0036***
	(13.63)	(30.48)
Free cash flow	0.0208	-0.0055
	(0.22)	(-0.06)
Intercept	1.8799***	1.9834***
	(11.87)	(25.49)
Industry and year dummies	YES	YES
N	14,131	14,131
R^2 (Pseudo-R^2)	26.24%	14.74%

[5] I use a log (board size) to adjust the skewness of the data and to be consistent with current studies (Coles et al., 2008). I find similar results when board size is used instead.

Table IV: Do High-tech Firms Have Smaller Boards? Panel B

	Model 1 Log(insiders)	Model 2 Log(insiders)	Model 3 Log(outsiders)	Model 4 Log(outsiders)
High-tech	-0.0573***	-0.0552**	-0.0246*	-0.0141*
	(-2.73)	(-2.36)	(-1.84)	(-2.04)
Log (CEO tenure)	0.0469***	0.0401***	-0.0497***	-0.0487***
	(4.53)	(2.74)	(-6.19)	(-9.60)
Log (CEO age)	0.1266**	0.1154**	0.0485	0.0540***
	(2.23)	(2.06)	(0.98)	(2.84)
Risk	-0.1848***	-0.1273***	-0.4412***	-0.4567***
	(-4.04)	(-2.70)	(-11.73)	(-17.66)
ROA	0.2287**	0.1860	-0.0434	-0.0162
	(1.98)	(1.45)	(-0.52)	(-0.19)
ROA_1	-0.0121	0.0348	-0.2141***	-0.2941***
	(-0.20)	(0.53)	(-4.62)	(-4.76)
Intangible assets	0.0519	0.0095	-0.0309	-0.0172
	(1.40)	(0.65)	(-1.09)	(-1.13)
Leverage	0.0220	-0.0021	0.1554***	0.1590***
	(0.47)	(-0.08)	(4.53)	(8.68)
Firm age	-0.0020***	-0.0022***	0.0056***	0.0052***
	(-4.55)	(-2.84)	(17.83)	(28.10)
Free cash flow	-0.2107	-0.1170	0.0799	0.0347
	(-1.58)	(-1.03)	(0.79)	(0.37)
Intercept	0.5279**	0.6244***	1.9607***	1.9743***
	(2.36)	(2.78)	(10.06)	(24.49)
Industry and year dummies	YES	YES	YES	YES
N	14131	14131	14131	14131
R^2 (Pseudo-R^2)	15.58%	8.62%	0.2746	16.94%

The signs of coefficient estimate of control variables are consistent with existing literature. The relation between CEO tenure and board size is significantly negative (Coles et al., 2008). Both CEO age and firm age are positively and significantly related to board size (Denis and Sarin, 1999; Baker and Gompers, 2003; Coles et al., 2008). The standard deviation of stock returns is negatively and significantly related to board size (Coles et al, 2008; Linck et al., 2008). Investment opportunities, measured by intangible assets, appear to have no effect on board size (Coles et al., 2008; Linck et al., 2008).

I further examine what drives the smaller board sizes for high-tech firms relative to non high-tech firms. Specifically, I estimate regression models similar to those in panel A with dependent variables being log (insiders) and log (outsiders). Results are reported in panel B. The average smaller board size for high-tech firms reflects the fact that high-tech firms have both fewer insiders and fewer outsiders than non high-tech firms. The coefficient estimates indicate that the number of insiders is 5.7% smaller for high-tech firms compared to non high-tech firms, and the number of outsiders is 2.4% smaller for high-tech firms than for non high-tech firms.

B. Board composition of high-tech firms

The results in table V strongly support hypothesis H_2. The significantly positive coefficient estimates on the high-tech dummy in both OLS and median regressions indicate that high-tech firms are associated with a higher proportion of insiders on the boards. More specifically, the average (median) proportion of insiders for high-tech firms is 1.7% (2.6%) higher than for non high-tech firms. Consistent with the bargaining power hypothesis in Hermalin and Weisbach (1998), the proportion of insiders increases with CEO tenure and profitability, but is only weakly positively related to CEO age. Consistent with the argument that firms with high monitoring costs have less independent boards, the proportion of insiders increases with risk and intangible assets. As in Coles et al. (2008), I find that the standard deviation of stock returns is positively related to the proportion of insiders, supporting the monitoring cost hypothesis (Adams and Ferreira, 2007; Raheja, 2005). Firm age, a proxy for firm complexity, is negatively and significantly related to the proportion of insiders, supporting the argument that complex firms have high advising benefits and require more independent boards (Raheja, 2005; Coles et al., 2008).

Table V: Do High-tech Firms Have Larger Proportions of Insiders on the Board?

	Model 1 Percentage of insiders	Model 2 Percentage of insiders
High-tech	0.0173**	0.0258***
	(2.04)	(4.85)
Log (CEO tenure)	0.0245***	0.0282***
	(6.18)	(6.83)
Log (CEO age)	0.0247	0.0273*
	(1.07)	(1.83)
Risk	0.0524***	0.0629***
	(2.99)	(4.70)
ROA	0.0706*	0.1154**
	(1.71)	(2.34)
ROA_1	0.0474*	0.0701**
	(1.93)	(2.35)
Intangible assets	0.0224	0.0148*
	(1.58)	(1.67)
Leverage	-0.0281	-0.0559***
	(-1.59)	(-4.39)
Firm age	-0.0018***	-0.0018***
	(-11.71)	(-20.22)
Free cash flow	-0.0750	-0.1380***
	(-1.55)	(-2.81)
Intercept	0.1003	0.0765
	(1.11)	(1.34)
Industry and year dummies	YES	YES
N	14131	14131
R^2 (Pseudo-R^2)	20.01%	11.27%

C. Tobin's Q and board structure

Next, I explore the relation between board size and Tobin's *Q*. Based on the literature on the determinants of Tobin's *Q*, I control CEO pay performance sensitivity, stock return volatility, current and past profitability, intangible assets, capital structure, and firm age in the regression model (Morck, Shleifer, Vishny, 1988; McConnell and Servaes, 1990; Yermack, 1996; Himmelberg, Hubbard, and Palia, 1999; Demsetz and Villalonga, 2001; Coles et al., 2008). Results are reported in table VI. The coefficient on board size is significantly positive in both the OLS regression (model 1) and the median regression (model 2). The parameter estimate in model (1) suggests that adding one board member increase Tobin's *Q* by 20% (0.5537/ (exp $^{(1)}$)×100%).

Note that I also control for the proportion of insiders in the regression models, and therefore the positive relation between board size and Tobin's *Q* is not the confounding effect of the proportion of insiders. These results are consistent with hypothesis H_3 that increasing board size leads to higher Tobin's *Q* for high-tech firms. The high transaction costs of adding board members prevent high-tech firms from upsizing board size to its optimal.

Table VI: The Relation between Tobin's *Q* and Board Size for High-tech Firms

	Model 1 Tobin's *Q*	Model 2 Tobin's *Q*
Log (board size)	0.5537*	0.2466***
	(1.85)	(3.10)
Percentage of insiders	-0.1997	0.1634
	(-0.45)	(1.00
CEO PPS	0.0154***	0.0182***
	(8.07)	(6.40)
Risk	1.1933***	0.9264***
	(3.35)	(9.72)
ROA	5.4586***	5.7253***
	(5.89)	(18.57)
ROA_1	-1.3369	0.4282
	(-1.56)	(1.07)
Intangible assets	1.9964***	1.2137***
	(3.87)	(9.77)
Leverage	-1.5126**	-1.2443***
	(-2.38)	(-8.08)
Firm age	-0.0113**	-0.0020
	(-2.43)	(-1.35)
Intercept	-1.2028	-0.3991
	(-1.29)	(-1.38)
Industry and year dummies	YES	YES
N	2828	2828
R^2 (Pseudo-R^2)	21.28%	14.25%

Coefficient on other control variables is generally significant in the expected direction. CEO pay performance sensitivity is positively related to Tobin's *Q* (Mehran, 1995; Core and Larker, 2002). Consistent with Yermack (2004) and Coles et al. (2008), current level of profitability, proxied by return on assets, has positive associations with Tobin's *Q*. Intangible assets, the measure for investment opportunities, have a significantly positive effect on Tobin's *Q*.

Table VII separately examines the effect of adding insiders and outsiders on Tobin's *Q*, controlling for the proportion of insiders. Note that when the proportion of insiders is held constant, any increase in the number of insiders (outsiders) requires a corresponding increase in the number of outsiders (insiders). The significant positive coefficient on log (insiders) in model (1) and (2) indicates that adding inside directors improve firm value, supporting H_4. The number of inside directors on board is less than its optimum for high-tech firms, and they will be better off by adding more inside directors. Furthermore, it appears that increasing the number of outsiders can also increase Tobin's *Q*, as indicated by the positive and significant coefficient on log (outsiders) in model (3) and (4). Taken as a whole, the results indicate that increasing board size, both by adding insiders and outsiders, increases firm value for high-tech firms.

Table VII: A Separate Examination of the Effect of Adding Insiders and Outsiders on Tobin's *Q* for High-tech Firms

	Tobin's *Q*	Tobin's *Q*	Tobin's *Q*	Tobin's *Q*
Log(insiders)	0.6480*	0.3069**		
	(1.93)	(2.24)		
Log(outsiders)			0.6734**	0.3009***
			(2.01)	(3.19)
Percentage of insiders	-1.5712**	-0.4925**	0.7640	0.6395**
	(-1.98)	(-2.09)	(1.12)	(2.09)
CEO PPS	0.0154***	0.0183***	0.0153***	0.0184***
	(8.01)	(6.75)	(8.06)	(9.43)
Risk	1.1422***	0.8722***	1.1848***	0.8848***
	(3.27)	(6.90)	(3.36)	(5.10)
ROA	5.4610***	5.7001***	5.4575***	5.6817***
	(5.89)	(12.10)	(5.88)	(11.82)
ROA_1	-1.3631	0.3771	-1.3557	0.3892
	(-1.60)	(1.02)	(-1.59)	(0.90)
Intangible assets	1.9732***	1.1778***	2.0126***	1.1938***
	(3.85)	(5.88)	(3.91)	(5.79)
Leverage	-1.4738**	-1.2522***	-1.5008**	-1.2625***
	(-2.36)	(-9.79)	(-2.37)	(-8.68)
Firm age	-0.0102**	-0.0015	-0.0114**	-0.0020
	(-2.29)	(-1.25)	(-2.47)	(-1.44)
Intercept	-0.3740	-0.2805	-1.6067	-0.8260***
	(-0.58)	(-1.35)	(-1.55)	(-2.78)
Industry and year dummies	YES	YES	YES	YES
N	2828	2828	2828	2828
R^2 (Pseudo-R^2)	21.25%	14.25%	21.31%	14.27%

VI. Robustness

A. Exploring endogeneity

The analysis above indicates that firm value increases with board size and the number of both insiders and outsiders for high-tech firms. However, I might interpret these findings in two ways: larger boards lead to better firm performance for high-tech firms, or firm value requires an adjustment of board structure by adding board members. If firms expand their boards after good performance or downsize their boards after poor performance, the contemporaneous relation between firm value and board size is subject to the concern that changes in firm value result in changes in board size. To address the causality issue, I regress Tobin's *Q* on lagged board size and board composition with other control variables (Hermalin and Weisbach, 1991). The results remain unchanged (results are not tabulated and available upon request).

The above analysis assumes that the corporate structure is exogenous. Previous studies, however, indicate that board variables could be endogenous (Demsetz and Lehn, 1985; Hermalin and Weisbach, 1998; Bizjak, Brickley, and Coles, 1993; Bhagat and Black, 1999; Denis and Sarin, 1999; Coles, Lemmon and Meschke, 2006). Any observed relation between board structure and firm value may be attributable to I inadequately capture the contracting environment and my model specifications suffer omitted variable bias. To proxy for firm contracting environment, I include a one-year lagged value of Tobin's *Q* as a control variable in the regression models. The coefficient estimates on board size and the number of insiders and outsiders are smaller but remain significant. The robustness of the results is more consistent with the notion that Tobin's *Q* is increasing in board size (results are not tabulated and available upon request).

Finally, I address the endogeneity issue using three-stage least squares (3SLS) regressions. The dependent variables are Tobin's *Q*, logarithm of board size, and the proportion of insiders (see Bhagat and Black, 2001; Coles et al., 2008). The results are consistent with my hypotheses[6].

Table VIII: Effect of Board Structure on Tobin's *Q*: 3SLS Regressions

	Tobin's *Q*	Log (board size)	Percentage of insiders
Log (board size)	2.1775***		0.1616***
	(3.55)		(5.59)
Percentage of insiders	-7.6642**	-0.2329	
	(-2.57)	(-0.24)	
Risk	1.4706***	-0.1052***	0.0314
	(4.95)	(-3.49)	(1.36)
ROA	0.0548***	0.0086***	-0.0016
	(8.90)	(3.35)	(-1.15)
ROA_1	-0.0138**	-0.0029***	-0.0003
	(-2.24)	(-3.57)	(-0.71)
Intangible assets	2.8949***	0.0022	0.1279***
	(5.92)	(0.02)	(3.91)
Firm age	-0.0054	0.0023*	0.0009***
	(-1.02)	(1.78)	(2.92)
Tobin's *Q*		-0.0476**	-0.0127
		(-2.06)	(-1.36)
Free cash flow		-0.6403***	0.2832***
		(-3.49)	(2.87)
Log (CEO tenure)		-0.0059	-0.0198***
		(-0.26)	(-4.14)
Log (CEO age)		0.0358	0.0267
		(0.88)	(1.42)
Leverage	-1.7087***		-0.0233
	(-5.89)		(-0.90)
Firm Size		0.0917***	
		(7.91)	
CEO PPS	0.0129***		
	(6.08)		
Industry and year dummies	YES	YES	YES
N	2828	2828	2828

B. Are the assumptions for my hypotheses sound?

My hypotheses are developed based on the assumption that high-tech firms tend to have smaller boards and fewer insiders than their optimum. To test whether this is indeed the case, we estimate the regression with board size, board size squared, the interaction between board size and

[6] I extend the data of this table until 2013 and find similar results. Results are not tabulated but available upon request.

the high-tech dummy, the interaction between board size squared and the high-tech dummy, the proportion of insiders, and other control variables. The estimated coefficients on both interaction terms are significantly different from zero, indicating that board size has different effects on Tobin's *Q* for high-tech firms versus non high-tech firms. Furthermore, the tangible point is 9.4 and therefore, the optimal board size that maximizes firm value is 10. With the premise that board size and Tobin's Q have an inverted U-relation, there should be a positive relation between board size and Tobin's *Q* as long as board size is less 10. More than 75% of my sample firms have board sizes of less than 10. Therefore, the assumption that high-tech firms tend to have smaller boards than optimal appears to be valid in my sample.

Similarly, I replace board size with the number of insiders and the number of outsiders in the regressions. Results indicate that a large portion of my sample firms have less than optimal numbers of insiders and outsiders. These results provide further support for the hypotheses.

VII. Conclusions

There has been an active debate in the corporate governance literature about the optimal size and composition of a board. Prior literature finds evidence that smaller boards are associated with higher firm performance. However, studies on the relation between firm value and board composition find mixed results. Past studies look at all firms and industries in aggregate, and little research has been done to examine whether board structure vary by firm and industry characteristics. Some firms under specific industries may have characteristics that can result a non-conventional board structure.

This paper examines board structure and the effect of board size and composition on firm value for firms in the high technology industries. I argue that information asymmetry is severe in high-tech industries. Managers of high-tech firms may be unwilling to share information with outsiders because the outsiders will use the information to intensively monitor managers, resulting in higher costs of information share. Furthermore, managers in high-tech firms are likely to be experts in their field, leading to lower benefits of having a large board with outside expertise to provide advice. Therefore, high-tech firms are likely to have smaller boards with higher insider representation. Lipton and Lorsch (1992) suggest that there is an inverted-U relation between board size and firm value. The transaction costs of adding directors to the board impede board upsizing. Hence, high-tech firms tend to have smaller boards than optimal. Increases in board size should increase firm value.

I document a smaller board with a higher proportion of insiders for high-tech firms using a sample of 14,131 firm-year observations over the period of 1995-2008. The smaller board size appears to be driven by both smaller numbers of insiders and smaller numbers of outsiders. Using Tobin's *Q* as a measure for firm value, I document that Tobin's *Q* is increasing in board size for high-tech firms. While both adding insiders and outsiders increases firm value, the positive effect of adding insiders is stronger than that of adding outsiders. My results are robust to alternative model specifications that control for endogeneity and causality.

The findings in this study have important implications for any discussion on board reform. Board size and independence are shaped by firm-specific and managerial characteristics. Any attempt to impose regulations to ensure that all boards are small with a high level of independence may be ineffective in some cases. No single prescription for optimal board size will serve all firms and their stakeholders equally well.

VIII. Appendix A: Variable Definitions

The appendix defines the key variables employed in this study. Accounting data is taken from Compustat and are defined by their corresponding data item number in Compustat. Board data is from RiskMetrics and Equilar. CEO data is from Execucomp. Stock return data is from CRSP (Center for Research on Security Prices).

Tobin's Q= (data6+data199×data22-data60)/data6
Board size=Number of directors
Insiders=Number of employee directors
Outsiders=Board size-number of insiders
The proportion of insiders=Insiders/board size
CEO tenure = the number of years the CEO has been CEO
CEO PPS (CEO pay performance sensitivity) = the dollar change in total CEO wealth for a percentage change in firm value, divided by 1,000,000
Intangible assets=one minus the ratio of net property, plant, and equipment to book value of assets.
R& D expenditure =Max(0, data46)/data12
Capital expenditure =data128/data12
Leverage = (data0+data34)/data6
Firm age=the number of years since the first trading date on CRSP
Firm risk= standard deviation of monthly stock returns for previous 36 months
ROA= data13/data6
Free cash flow= (data308-data19-data21)/data6

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How Close is the Implied Volatility Derived from Black Scholes for Individual Stocks to VIX

Joseph Cheng and Jack Hui

Abstract

The implied volatility derived from Black Scholes model represents total volatility which includes both systematic and unsystematic components. The purpose of this paper is to examine the accuracy of the implied volatility derived by Black Scholes (after excluding the unsystematic component) with reference to VIX, which is a widely used proxy for market (systematic) volatility. We utilize CAPM to extract the volatility linked to systematic component for the 30 individual stocks within Dow Jones and compare them to VIX. The systematic volatility for these stocks adjusted for beta turn out to be rather close to the VIX, which implied that CAPM is an effective approach for separating market risk from total risk.

I. Introduction

The two most well-known classical models in finance are CAPM and the Black Scholes. It would be interesting to evaluate these two models by examining how well they can explain real world data. In this paper, we will apply both models to estimate market volatility and see how close this estimate is to the observed volatility as revealed by the VIX. Since the release of Black and Scholes (1973), different kinds of modification on the valuation of option have been proposed by researchers who are enthused as well as those who are critical to Black and Scholes model. One key contribution of the Black and Scholes model is that it can be used for estimating the implied volatility. Volatility is the key to understand and analyze stock price fluctuations. Therefore, it is a common practice for academicians and practitioners to develop models for deriving the implied volatility of individual stocks. For most models, as in Black and Scholes (1973), the calculation for implied volatility requires information on the actual option price, risk free rate, strike price and time-to-maturity as inputs. The implied volatility derived represents total volatility which comprise both systematic and unsystematic components.

In light of CAPM theory and the Black Scholes model, we propose a method to extract

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total risk for each individual stocks into systematic and unsystematic risk; 4) by using the result from 3), we calculate a ratio of unsystematic risk over the total risk and adjust the Black Scholes implied total volatility by multiplying 1 minus the ratio to extract the market volatility. Finally, the estimated market volatility from all 30 stocks are averaged and compared to the actual VIX.

The paper is structured as follows: Section 2 briefly introduces different related existing literature. The hypothesis development and model are included in Section 3. Empirical experiment is conducted and the result is shown in Section 4. The last section will provide the conclusion.

II. Literature Review

There is intense debate in existing literature on option valuation and the individual stock's implied volatility since the release of the classical Black Scholes Model (Black and Scholes, 1973). As a vital factor to understand the stock market and predict stock return, Corrado and Miller (2006), tried to examine the factors affecting the implied volatility. David and Veronesi (2002) and Guidolin and Timmerman (2003) identified that implied volatility changes over time because investors are uncertain about the fundamental economic factors. Gemmill and Kamiyama (2000) suggested that the lagged implied volatility in another market is one of the drivers of the changes in the implied volatility at a specific market. Goyal and Saretto (2007) confirmed and extended the above studies using cross-sectional implied volatilities.

After recognizing the factors of the dynamics of implied volatility, a stream of studies emerged for developing multiple methods to predict the implied volatility. Merton (1980) suggested that the diffusive risk measured by the implied volatility can be identified by quadratic variation of realized stock returns. Dumas et al. (1998), Goncalves and Guidolin (2006) and Fengler et al (2007) tried to predict the implied volatility surface of S&P500 index options across moneyness and expiration dates. Konstantinidi et al. (2008) employed six different models and suggested that there are statistical and economic significance in the predictability of European and U.S indices on the evolution of implied volatility. The results are consistent in both point and interval forecasts. Bernales and Guidolin (2014) conducted a similar research by using a two-stage model to investigate whether there is dynamic and cross-sectional correlation between stock options' and implied volatility surface for index options. In a different direction, Banerjee et. al (2007) investigated the predicting power implied volatility of index option for portfolio returns. Yan (2010) estimated the slope of the implied volatility smile as a proxy to measure the stock jump size, and to quantify the jump risk and predict stock returns.

III. Models Explanation

In this section, we will point out the difficulties in deriving the implied volatility which is comparable to the expected market volatility. An inaccurate estimate on the total implied volatility would make the comparison not meaningful. Conventional models are helpful in pricing options given an assumed level of volatility. However, doing the reversal of using the observed price to impute the implied volatility utilizing these models may lead to the first shortcomings - the observed price might not be an efficient price. Specifically, substituting the quoted option prices into the models to calculate the implied volatility can pose several problems. First, the actual option price might be inaccurate if the option is thinly traded in the CBOE. For any individual stock, there are many types of options with many different strike prices. In addition, there are weekly and quarterly options, index options etc. Choices of different strike prices for investors are so diverse that many of the options are thinly traded. Because of the low volume, the options have rather wide spreads between ask and bid. Under this circumstance, using the observed price of low volume options to estimate the implied volatility can lead to inaccurate result.

In addition, another difficulty we face in deriving volatility comparable to expected market volatility. For example, the stochastic volatility and ARCH model used by Fouque et. al (2000), the Constant Elasticity Model suggested by Davydov and Linetsky (2001) and the jump-diffusion models used by Duffie et. al (2000) may not be easily applied on pricing the path-dependent options such as perpetual American options and lookback options by incorporating the implied volatility smile. In terms of the enormously complicated calculations, Longstaff and Schwartz's (2001) simulation-based model is extremely time-consuming to implement and can only be applied to three-factor affine specification.

Thus, in light with the above difficulties, it is important for us to use options with high volume and a less complicated method to yield accurate estimates for implied volatilities. In the paper, we utilize Black Scholes model to evaluate sample of highly traded options from 30 stocks within DJIA. Also, we utilize CAPM to extract the portion of risk that are unsystematic.

In the following part of this section, we will thoroughly explain how the volatility is derived from (1) Black and Scholes' approach; from (2) CAPM and regression analysis, and how to derive VIX.

Firstly, we use call option valuation as an example. According to the Black and Scholes' (1973), the price of call option is as follow:

$$C_{s,t} = S_t N(d_1) - K e^{-rt} N(d_2) \qquad (1)$$

where

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(R_f + \frac{S_t^2}{2}\right)t}{\sigma_s\sqrt{t}}$$

and

$$d_2 = d_1 - \sigma_s\sqrt{t}$$

$C_{s,t}$ refers to the call option price of stock s at time t; S_t refers to the stock price at time t; K refers to the exercise price at time t; $N(d_1)$ and $N(d_2)$ are the probability density functions; R_f or r refer to the annualized risk free rate measured by the daily U.S. Treasury bill rate. σ_s represents the annualized implied volatility of individual stocks. It can be derived by plugging into the model the actual option price and other variables.

The following illustrates the method for separating the variation linked to market from the variation linked to unsystematic risk in detail using CAPM. According to CAPM, the regression model is as follow:

$$R_s = R_f + \beta_s(R_m - R_f) + \varepsilon \qquad (2)$$

where R_s is the return of individual stock; β_s is the beta of stock; $R_m - R_f$ is the market premium and ε is the error term. We re-write the equation as follow:

$$R_s - R_f = \beta_s(R_m - R_f) + \varepsilon \qquad (3)$$

By utilizing the CAPM, we regress the market premium ($R_m - R_f$) on excess return of stock ($R_s - R_f$) in order to estimate β_s. Each variable should be prorated according to the length of the sample period. The variance of stock return in CAPM is written as:

$$\sigma_s^2 = (\beta_s)^2(\sigma_m)^2 + \sigma_u^2 \qquad (4)$$

where σ_s is the annualized standard deviation of stock return or the volatility of stock; σ_m is the annualized standard deviation S&P market return; σ_u represents the unsystematic risk as measured by the annualized non-market related volatility. This method suggests the concept that risk of individual stock equals to the sum of systematic and unsystematic risk. The unsystematic risk is extracted from the results of the regression (3), which is the variance of residuals. This figure can be altered by using different time periods of data (for example, 30-day or 60-day stock return etc.). It is necessary to annualize σ_u^2 and σ_m^2 to keep all variables in the equation (4) consistent. If we use daily stock and market returns in the regression (3), we should annualize σ_u^2 and σ_m^2 by multiplying 260 (given that there are 260 trading days per year). After deriving the σ_s^2 from equation (4), we square root the results to obtain the annualized volatility of individual stocks.

The following illustrates the derivation of Volatility Index (VIX). VIX is provided by CBOE to represent the 30-day expected volatility for the S&P index based on a set of S&P 500 index options. It is derived from near-the-money call and put index options with more than 23 days but less than 37 days to expiration. The calculation is as follow:

$$VIX = \left[\frac{2}{t}\sum_i \frac{\Delta K_i}{K_i^2} e^{rt} Q(K_i) - \frac{1}{t}\left(\frac{F}{K_0} - 1\right)^2\right]^{0.5} x\ 100 \quad (5)$$

where F is the forward index level derived from the price of index option; K_0 is the first strike price below F; K_i is the strike price of the i[th] out-of-the-money option, a call is out-of-the-money if $K_i > K_0$, a put is out-of-the-money if $K_i < K_0$; ΔK_i is calculated as $(K_{i+1} + K_{i-1})/2$; $Q(K_i)$ is the mid-point of the bid-ask spread for each option with K_i. The market volatility is an annualized figure which can be obtained by dividing VIX by 100.

IV. Empirical estimate of volatility

In this section, we first derive the total volatility from the Black and Scholes Model for the 30 stocks. Afterward, the implied volatility derived from Black and Scholes is separated into systematic and unsystematic portion. As VIX is the benchmark for expected market volatility, it should not reflect the unsystematic risk. Therefore, the unsystematic component should be subtracted from total volatility. Only the systematic component for the implied volatility of 30 stocks are used for comparison.

Table 1

Symbols descriptions and source of data

R_s	The daily percentage change of Return Index of individual stocks in the sample	DataStream
R_m	The daily percentage change of Return Index of S&P 500 Composite	DataStream
R_f	The annualized 30-day U.S. Treasury Bill rate	DataStream
VIX	The annualized volatility index derived from S&P 500 index option	CBOE
σ_m	The annualized volatility derived from VIX/100	CBOE
K	Strike price for the individual stock options	CBOE
S_t	The stock price on the evaluation date; 18 July 2017	CBOE
$C_{s,t}$	Actual option price of stock in time t used for deriving the implied volatility in the Black and Scholes (1973) model	CBOE

We use the options of the 30 stocks listed in the Dow Jones Industrial Average Index (DJIA) which have relatively high trading volume as our sample. Since the sample are drawn from individual options that are highly traded, the estimates should be more accurate.

For our first study, we choose a common expiration date in 2017 for all 30 stock options which is 18th August. As VIX is based on a 30 day window for volatility, the time point for our empirical evaluation occurs 30 days before the common expiration date, which is 18th July. Thus, we estimate the volatility as of 18th July for all 30 stocks using both Black Scholes and CAPM and compare the derived estimates to the VIX on the same date.

To utilize equation (4) for deriving volatility for both systematic and unsystematic, we need to estimate the β_s and σ_u^2 as of 18th July. To estimate these figures, we regress equation (3) on 18th July with a sample period of 30 days from 18th June to 18th July. All R_s, R_f and R_m are prorated to daily basis. The regression (3) for the 30 stocks yields estimate for β_s and σ_u^2, which are summarized on Table (2).

Table 2

Summary of the CAPM regression results –
Beta for individual stocks, daily and unsystematic risk from 18 June to 18 July 2017.

TIC	Name	β_s	Daily σ_u^2	Annualized σ_u^2
AAPL	Apple Inc.	1.64173	3.40E-05	8.84E-03
AXP	American Express Co.	0.691724	2.82E-05	7.33E-03
BA	Boeing Co.	0.815754	4.80E-05	1.25E-02
CAT	Caterpillar Inc.	0.95219	1.09E-04	2.82E-02
CSCO	Cisco Systems Inc.	1.2885	1.95E-05	5.06E-03
CVX	Chevron Corp.	0.339425	6.68E-05	1.74E-02
DD	E I du Pont De Nemours and Co.	1.08666	1.06E-04	2.75E-02
DIS	Walt Disney Co.	1.07868	5.94E-05	1.54E-02
GE	General Electric Co.	1.10983	1.23E-04	3.19E-02
GS	Goldman Sachs Group Inc.	0.565026	1.41E-04	3.67E-02
HD	Home Depot Inc.	0.613699	7.91E-05	2.06E-02
IBM	International Business Machines Corp.	0.454618	3.12E-05	8.12E-03
INTC	Intel Corp.	1.79561	6.24E-05	1.62E-02
JNJ	Johnson & Johnson	0.409476	4.38E-05	1.14E-02
JPM	Coca-Cola Co.	0.456906	9.08E-05	2.36E-02
KO	JPMorgan Chase & Co.	0.621831	1.52E-05	3.95E-03
MCD	McDonald's Corp.	0.571233	4.24E-05	1.10E-02
MMM	3M Co.	0.88765	1.29E-05	3.36E-03
MRK	Merck & Co Inc.	0.587117	5.74E-05	1.49E-02
MSFT	Microsoft Corp.	1.73813	4.85E-05	1.26E-02
NKE	Nike Inc.	1.18995	6.62E-04	1.72E-01
PFE	Pfizer Inc.	0.49314	3.08E-05	8.00E-03
PG	Procter & Gamble Co.	0.597309	2.61E-05	6.80E-03
TRV	Travelers Companies Inc.	0.248992	3.12E-05	8.11E-03

UNH	UnitedHealth Group Inc.	0.562679	2.59E-05	6.73E-03
UTX	United Technologies Corp.	0.70218	1.15E-05	2.98E-03
V	Visa Inc.	1.1765	4.26E-05	1.11E-02
VZ	Verizon Communications Inc.	1.17726	5.72E-05	1.49E-02
WMT	Wal-Mart	0.29086	9.18E-05	2.39E-02
XOM	Exxon Mobil Corp.	0.510307	4.99E-05	1.30E-02

Variance of S&P annualized return: 0.00712
Mean of β_s: 0.8218322

We then utilized the estimated values of β_s, unsystematic risk σ_u^2 from the regression (3) for the 30 stocks as summarized in Table (2), and the standard deviation of S&P daily return (σ_m), which is 0.084, to calculate the total volatility of individual stock using equation (4). Since both σ_m^2 and σ_u^2 in Table (2) are in daily terms, we annualized them by multiplying 260 as there are 260 trading days in a year. For estimating implied volatility, we utilized the standard Black Scholes approach where the observed option price is used to estimate the standard deviation of annual return. Results from both approaches are shown in Table (3).

Total variance and volatility Equation (4) and Black Scholes approach

Ticker	σ_s^2 from Equation (4)	σ_s from Equation (4)	σ_s^2 from Black and Scholes	σ_s from Black and Scholes
AAPL	0.02804	0.16744	0.05611	0.236879
AXP	0.01074	0.10364	0.03430	0.185214
BA	0.01722	0.13123	0.04029	0.200714
CAT	0.03467	0.18620	0.03935	0.198363
CSCO	0.01688	0.12994	0.03611	0.190019
CVX	0.01819	0.13488	0.02374	0.15409
DD	0.03595	0.18961	0.03225	0.179582
DIS	0.02373	0.15405	0.04597	0.214416
GE	0.04068	0.20170	0.03575	0.18908
GS	0.03901	0.19750	0.04452	0.211003
HD	0.02325	0.15249	0.04063	0.201567
IBM	0.00959	0.09793	0.04112	0.202788
INTC	0.03918	0.19793	0.03566	0.188832
JNJ	0.01257	0.11212	0.01369	0.117014
JPM	0.02510	0.15843	0.02650	0.162802
KO	0.00670	0.08185	0.01750	0.132297
MCD	0.01336	0.11557	0.03106	0.176252

MMM	0.00897	0.09470	0.02660	0.163103
MRK	0.01738	0.13185	0.03304	0.181773
MSFT	0.03412	0.18472	0.04598	0.21444
NKE	0.18208	0.42671	0.02582	0.16068
PFE	0.00973	0.09866	0.01246	0.111644
PG	0.00934	0.09663	0.01095	0.104662
TRV	0.00855	0.09246	0.03160	0.177754
UNH	0.00899	0.09479	0.02033	0.142578
UTX	0.00649	0.08058	0.01868	0.13669
V	0.02093	0.14467	0.03272	0.180874
VZ	0.02475	0.15733	0.03063	0.175008
WMT	0.02447	0.15642	0.00964	0.098175
XOM	0.01482	0.12173	0.01705	0.130573
Mean		0.14646		0.1706289

Afterward, in order to isolate the unsystematic risk from total volatility, we use the result from Equation (4) to calculate the ratio $\frac{\sigma_u^2}{\sigma_s^2}$, denoted as h, which is the portion of variance linked to unsystematic risk. Then the σ_s^2 derived from Black and Scholes (BS) approach is multiplied by $(1 - \text{h})$ and square-rooted to obtain the pure systematic risk. The result is shown in Table (4).

Table 4. Systematic risk derived from Black Scholes' result

Systematic risk derived from Black Scholes' result			
Ticker	h= $\left(\frac{\sigma_u^2}{\sigma_s^2}\right)$	Systematic variance from Black and Scholes = (1-h)	Systematic standard deviation from Black and Scholes
AAPL	0.31531	0.03842	0.19601
AXP	0.68271	0.01088	0.10433
BA	0.72477	0.01109	0.10530
CAT	0.81374	0.00733	0.08561
CSCO	0.29965	0.02529	0.15902
CVX	0.95489	0.00107	0.03273
DD	0.76606	0.00754	0.08686
DIS	0.65078	0.01606	0.12671
GE	0.78437	0.00771	0.08780
GS	0.94170	0.00260	0.05095
HD	0.88464	0.00469	0.06846

IBM	0.84651	0.00631	0.07945
INTC	0.41383	0.02090	0.14457
JNJ	0.90500	0.00130	0.03607
JPM	0.94076	0.00157	0.03963
KO	0.58890	0.00720	0.08483
MCD	0.82598	0.00541	0.07352
MMM	0.37424	0.01665	0.12902
MRK	0.85877	0.00467	0.06831
MSFT	0.36940	0.02900	0.17029
NKE	0.94461	0.00143	0.03782
PFE	0.82204	0.00222	0.04710
PG	0.72782	0.00298	0.05460
TRV	0.94835	0.00163	0.04040
UNH	0.74905	0.00510	0.07142
UTX	0.45920	0.01010	0.10052
V	0.52898	0.01541	0.12414
VZ	0.60121	0.01221	0.11052
WMT	0.97537	0.00024	0.01541
XOM	0.87482	0.00213	0.04620
Mean			0.08592

According to the result in Table (4), the mean value for implied systematic volatility derived from Black Scholes and CAPM is 0.08592. Given that the average β_s for the 30 stocks is 0.8218 when regressed against the S&P return, we adjust the VIX by multiplying it by 0.8218 since the value of β_s are derived from regressing individual stock return against the S&P return whose beta is implicitly assumed to be 1. The VIX adjusted for beta is 0.08506, which is extremely close to the above Black and Scholes estimate of 0.8218. In addition to this 2017 study, we repeated this procedure for two recent samples in 2019. This provides a good contrast given that the volatility in 2019 is much greater than that in 2017. The result for all three samples are summarized in Table 5 below.

Table 5

Comparison of VIX to Estimated Volatilities for all Three Sample Periods.

Sample Period	18 June 2017 to 18 July 2017.	10th July2019 to 9th Aug 2019	7th Aug 2019 to 6th Sept 2019

VIX (adjusted for beta)	0.08506	0.1605	0.1518
Volatility Estimated by BS and CAPM	0.08592	0.153	0.1596
Difference in percentage	1.01%	-4.67%	5.14%

The last row in Table 5 displays the difference between VIX and the volatility as estimated by CAPM and BS, which is Volatility Estimated by BS and CAPM minus VIX divided by VIX. As seen, the maximum difference is only about 5.14%, which suggests that the accuracy of estimates derived from using Black Scholes combining with CAPM is relatively high. Note that the volatility in Summer 2019 is almost twice as high as in Summer 2017. This is due to the erratic fluctuation of the market caused by the ups and downs of news about the trade war and other world events in 2019. It is interesting to note that the BS and CAPM method seems to work quite well in approximating VIX during both high and low volatility periods.

V. Conclusion

Utilizing both the Black Scholes model and CAPM, we developed an approach of deriving systematic risk from total implied volatility of individual stocks and hence estimate the market expected volatility. We think that simply using the implied volatility from Black Scholes to estimate market expected volatility is biased as there are systematic and unsystematic risk within. Therefore, we use CAPM theory to estimate the portion of systematic volatility in total volatility for individual stocks and use it to derive the implied systematic volatility. Since our estimated implied systematic volatility is rather close to VIX, which is regarded as a proxy for expected market volatility, we conclude that CAPM can be used with Black Scholes to yield both expected systematic and unsystematic risk.

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Large Commercial Banks: Dodd-Frank Effect Versus Trump Effect

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Abstract

Large commercial banks have been financially impacted by both: (i) the Dodd-Frank Effect, which is the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 and (ii) the Trump Effect, which is the presidential election of Donald Trump in 2016. It is well-known that the Dodd-Frank Act targeted large commercial banks with additional regulatory compliance costs such as the Dodd-Frank Act Stress Test (DFAST), the Durbin Amendment, the Volcker Rule, the Lincoln Amendment, and the creation of the Consumer Financial Protection Bureau. While the goal of the Dodd-Frank Act is to prevent another 2008 financial crisis, it imposes huge regulatory compliance costs on large commercial banks. The American Action Forum reported the compliance cost at more than $36 billion and 73 million paperwork hours. The Government Accountability Office (GAO) originally calculated compliance costs at $2.9 billion for the first five years, but the estimated cost published in the Federal Register was raised to $10.4 billion. Consequently, while seeking and securing the presidency, Donald Trump promised large commercial banks there would be regulatory rollbacks of the Obama-era legislation. In addition to examining the Dodd-Frank Effect and Trump Effect separately, we will examine the Combined Effect. This paper will add valuable knowledge to government policy makers on how the regulation and deregulation impacts commercial banks, and in a more general sense, how regulatory changes (and even perceived changes) impact firm value.

I. Introduction

In 2008 the U.S. entered into the Great Recession. According to the U.S. Department of Treasury (2012), from January 2008 to June 2009 American households experienced a $19 trillion decline in net worth and lost 8.8 million jobs cumulatively. American households saw the stock market decline 57 percent in value from October 2007 to March 2009 and the housing market decline 30 percent from mid-2006 to mid-2009. Corporate America suffered equally. The federal government took over housing giants Fannie Mae and Freddie Mac. The Federal Reserve provided a $152 billion bailout for the insurance giant AIG while the federal government provided a $700 billion bailout (TARP – Troubled Asset Relief Program) for large commercial banks.

To prevent a repeat of the 2008 Great Recession as described above, the Congress and President Obama passed the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, which included multiple provisions to protect American households and the U.S. economy. The provisions include: (i) Dodd-Frank Act Stress Test (DFAST), (ii) Durbin Amendment, (iii) Volcker Rule, (iv) Lincoln Amendment, and (v) the creation of Consumer Financial Protection Bureau. DFAST determines whether large commercial banks have enough capital to absorb potential losses if there were another downturn in the economy. The Durbin Amendment required the Federal Reserve to regulate debit card transaction fees that retailers pay commercial banks. The Volcker Rule, named after former Federal Reserve Chairman Paul Volcker, restricts large

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commercial banks from engaging in certain kinds of speculative trading. The Lincoln Amendment prevents large FDIC-insured commercial banks from acting as a swap-dealer. The Consumer Financial Protection Bureau, a government agency, helps ensure large commercial banks treat American households fairly. In all, the Dodd-Frank Act contained 2,300 pages of regulations and required 400 rules, estimated at an additional 5,000+ pages, to be written.

The regulatory compliance costs of the Dodd-Frank Act ranged from $10.4 billion, according to the Government Accountability Office, to $36 billion according to the American Action Forum. Given the tremendous regulatory compliance costs, Republican presidential nominee, Donald Trump, provided a shining light for large commercial banks as Trump promised regulatory rollbacks of the Dodd-Frank Act.

This research uses an event study methodology to examine the financial impact the Dodd-Frank Effect (Regulatory Compliance Costs) and the Trump Effect (Promised Regulatory Rollback Gains) have on large commercial banks. The two major announcements of the Dodd-Frank Act are expected to show that large banks suffered major financial losses while the election of Trump is expected to show large banks achieving tremendous gains. We also find the Trump Effect outweighs the Dodd-Frank Effect, the sum of which we term the Combined Effect.

Many research papers have used event studies to examine regulatory actions. Moll, Kunkel, Beck, and Niendorf (2018) use an event study to evaluate how investment companies fared under Obama versus Trump with respect to the Fiduciary Rule. They find investment companies suffered under Obama reign, but greatly benefitted with the election of Trump. Kuhlemeyer, Compton, and Kunkel (2014) used an event study to determine how the Durbin Amendment reduced debit card fees from 44 cents to 21 cents per transaction. They found that variety stores and restaurants benefitted tremendously from the new debit card regulation while the credit card companies charging the debit card fees suffered tremendously. Kuhlemeyer and Kunkel (2010) employed an event study to analyze The Credit Card Act of 2009 that better protected consumers. They found large retailers who issue credit cards collectively lost $9.9 billion with the passing of the Credit Card Act. Hoag (2002) used an event study to analyze the Cable Communications Policy Act of 1984 and found the regulation benefitted cable companies. Cornett and Musumeci (1999) employed an event study to examine how credit card legislation in 1991 impacted commercial banks and found that banks with high credit card exposure suffered from the legislation. This is the first paper to our knowledge that examines large commercial banks with respect to the Dodd-Frank Act of 2010 and the 2016 Presidential election.

II. Data and Research Objective

An event study methodology is used to calculate the immediate financial impact of the Dodd-Frank Effect and Trump Effect on the stock prices of large commercial banks (Brown and Warner, 1985; Peterson, 1989; Schweitzer, 1989; and Wells, 2004). It is possible to isolate the impact of these events because of two unique stock price characteristics. First, a stock price is determined by the forecasted earnings of the company. Second, the stock market is efficient in that stock prices react quickly and efficiently to the announcement of an event that will impact a company's forecasted earnings. Thus, if investors conclude the Dodd-Frank Effect will decrease forecasted earnings of large commercial banks, then their stock prices will decline. Conversely, if investors perceive the Trump presidential election will roll back regulation and increase forecasted earnings, then their stock prices will increase. In this way, policy makers can gauge the expected economic impact on large commercial banks and American households who were protected by provisions of the Dodd-Frank Effect.

The event study methodology divides a stock return (or price change) into two components. Component one is driven by a general stock market movement. Component two is attributed to an informational event, which in this study is either the Dodd-Frank Act or the Trump Presidential Election. For the purposes of this study we will examine component two of the stock return and to extend the depth of the study we include both standard parametric and non-parametric tests.

A. Event Windows

To extend the breadth of our study, we examine both the Dodd-Frank event, the Trump event, and the combined results. We define the Dodd-Frank Effect event windows as the House vote and the Senate vote as shown in Table 1. We define the Trump Effect as the Presidential Election. These event windows are based on an announcement that provided significant information to the markets. To capture how these events affected stock prices, we will use a two-day event window. Since we want the event window to capture the immediate financial impact on the stock price, it is common to use two days for the event window. Day zero, (t = 0), is defined as the announcement date while day plus one, (t = +1), is one trading day after day zero.

Table 1: Event Windows for Dodd-Frank Effect and Trump Effect

	Day 0 and Day +1	**Activity**
Dodd-Frank Effect		
House Vote	July 1, 2010 July 2, 2010	House agrees to conference report on H.R. 4173 (Restoring American Financial Stability Act of 2010) by a vote of 237-192-4 at 6:54 PM on June 30, 2010.
Senate Vote	July 15, 2010 July 16, 2010	Senate agrees to conference report on H.R. 4173 (Restoring American Financial Stability Act of 2010) by a vote of 60-39 at 2:29 PM on July 15, 2010.
Trump Effect		
Presidential Election	Nov. 9, 2016 Nov. 10, 2016	Republican nominee Trump elected President.

Fiscal policy is federal government policies (laws) enacted by the Congress and the President. To become law, a bill must be passed by both the House of Representatives and Senate in identical form and then be signed by the President. Thus, when one party takes control of all three parts of government, it will oftentimes pass regulations that their party favors. Other than a filibuster in the Senate, it can be hard for the minority party to hinder passage of the new regulation. In 2008 the Democrats took control of the House, Senate, and Presidency, while in 2016 Republicans took control of the House, Senate, and Presidency.

Dodd-Frank Effect

The Dodd-Frank Act was passed when the Democrats controlled the House, Senate, and Presidency in 2009-2010. To analyze the impact of the Act on commercial banks, our event study considers the actions of the House, Senate, and President. We include the House vote and the Senate vote, but we do not include the President signing since it was a foregone conclusion when President Obama make it quite clear that he would sign the bill. This means no new information was provided to the financial markets when on July 21, 2010 President Obama signed House Resolution (H.R.) 4173 into law, which is now known as the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010.

The House event is when the House of Representatives passed the bill late in the evening of June 30, 2010. Since this event came after the financial markets had closed, day 0 is defined as July 1, 2010 rather than June 30th. The vote in the House was very controversial with 19 Democrats joining the Republicans and three Republicans breaking rank to join the Democrats. After passage in the House, the focus shifted to the Senate and whether the Democrats could convince a handful of Republicans to join the cause and overcome a likely filibuster.

The Senate event is when the Senate passed the bill early in the afternoon of July 15, 2010. Since this event came before the financial markets had closed, day 0 is defined as July 15, 2010. The Senate vote had been delayed until mid-July in a large part due to the death of Senator Bryd, Democrat from West Virginia, and his death is why there were only 99 votes cast versus 100 votes. Democrats were able to pass the bill and avoid a filibuster when three Republican senators joined Democrats earlier in the day.

Trump Effect

The third event window, the Trump Effect, is the election of President Trump. The 2016 presidential election was called well after the financial markets had closed on November 8, 2016, so day 0 is defined as November 9, 2016. The Republicans' sweeping victory in the 2016 election gave them control of the House, the Senate, and the Presidency. This change of leadership led financial markets to expect a rollback of the Dodd-Frank Act and other restrictions on large commercial banks.

Combined Effect

The combined event is the combination of both events: (i) Dodd-Frank Effect and (ii) Trump Effect. The combined effect helps us to identify how the two events impacted large commercial banks.

B. Data

The sample, collected from *Research Insight,* is comprised of large commercial banks that meet all the requirements listed in Table 2 with the calendar year set equal to 2009. Requirement one is that the bank is listed in *Research Insight's* U.S. company dataset. Requirement two is a SIC code of 6020, which is the commercial bank industry. Requirement 3 is that the bank have total assets of at least $10 billion, which is our definition of a large commercial bank. Requirement 4 is trading on the NYSE, AMEX, NASDAQ, or a regional stock exchange. Requirement 5 is that the bank have an unqualified auditor's opinion. Requirement 6 is that the bank must also have daily returns available for each event window and have no major news announcements over an event window. The final sample includes sixty-six large commercial banks including forty-two U.S., seven Latin American, and seventeen Rest-of-World commercial banks which are listed in Tables 3 and 4.

Table 2: Commercial Bank Requirements to be Included in the Sample

Requirements	Banks that passed
1. Listing in the U.S. company dataset: $C+$R	32,935
2. Primary SIC code of 6020 (commercial banks): SIC=6020	1,124
3. Total assets of at least $10 billion: AT>=10000	94
4. Listing on NYSE, AMEX, NASDAQ, regional stock exchange: EXCHG<5	77
5. Unqualified auditor's opinion: @OR(AUOP=1,AUOP=4)	77
6. Daily stock returns for all event windows and no major news	66

Research Insight's "Open Screen" is used for requirements 1 through 5.

Table 3: U.S. Commercial Banks and Market Capitalization (MC) in Billions as of 11/08/2016

U.S. Banks (n=42)	MC		MC
Associated Banc-Corp	$3.5	M & T Bank Corp	$18.1
BancorpSouth Bank	$2.4	MB Financial Inc/Md	$3.1
Bank of America Corp	$170.3	Northern Trust Corp	$16.9
Bank of Hawaii Corp	$3.2	People's United Finl Inc	$5.8
Bank of New York Mellon Corp	$43.9	PNC Financial Svcs Group Inc	$44.9
BB&T Corp	$30.1	Popular Inc	$3.8
BOK Financial Corp	$4.6	PrivateBancorp Inc	$3.6
Cathay General Bancorp	$2.4	Regions Financial Corp	$12.1
Comerica Inc	$8.9	State Street Corp	$27.4
Commerce Bancshares Inc	$4.8	Suntrust Banks Inc	$21.2
Cullen/Frost Bankers Inc	$4.8	SVB Financial Group	$6.6
East West Bancorp Inc	$5.8	Synovus Financial Corp	$3.9
Fifth Third Bancorp	$14.7	TCF Financial Corp	$2.3
First Bancorp P R	$1.1	U S Bancorp	$73.9
First Citizens Bancsh –Cl A	$3.5	UMB Financial Corp	$3.1
First Horizon National Corp	$5.0	Valley National Bancorp	$3.3
Fulton Financial Corp	$2.6	Washington Federal Inc	$2.3
Huntington Bancshares	$11.3	Webster Financial Corp	$3.8
Intl Bancshares Corp	$2.1	Wells Fargo & Co	$220.8
JPMorgan Chase & Co	$238.4	Wintrust Financial Corp	$3.0
Keycorp	$15.3	Zions Bancorporation	$6.3
		Mean U.S. Bank Market Cap	***$25.4***
		Median U.S. Bank Market Cap	***$4.9***

The Latin American banks and the Rest-of-World banks are often listed as American depository receipts (ADR), which were first created in 1927 by financier J.P. Morgan. ADRs allow investors to indirectly own foreign shares of stock without the complexities and costs of direct ownership. Foreign banks transfer shares of stock to a finance company which then creates an ADR that is backed by the corresponding shares and tracks the price of the underlying shares. The Latin American banks are of particular interest given President Trump's promises included dismantling the North American Free Trade Agreement (NAFTA). We note, Mexican exports to the U.S. account for almost 30 percent of Mexico's economy and Mexico is the U.S.'s largest trade partner. Following Trump's victory, the Mexican peso depreciated by over 13%, marking the largest decline in value since 1994 and making $1 worth more than 20 pesos, something never seen before.

Table 4: Latin American and Rest-of-World Commercial Banks and Market Capitalization (MC) in Billions as November 8, 2016

Latin American (n=7)	Country	MC	Rest-of-World (n=17)	Country	MC
Banco Bradesco SA -ADR	Brazil	$28.5	Westpac Banking Corp -ADR	Australia	$81.3
Banco Santander Brasil -ADR	Brazil	$32.1	Credicorp Ltd	Bermuda	$13.0
Itau Unibanco Holding SA -ADR	Brazil	$38.7	Deutsche Bank Ag	Germany	$29.3
Banco De Chile -ADR	Chile	$11.6	HDFC Bank Ltd -ADR	India	$60.7
Banco Santander-Chile -ADR	Chile	$10.8	ICICI Bank Ltd -ADR	India	$24.0
Itau CorpBanca -ADR	Chile	$4,6	Mitsubishi UFJ Finl Gp -ADR	Japan	$70.5
BanColombia SA –ADR	Columbia	$4.4	Mizuho Financial Group -ADR	Japan	$42.0
Mean Latin American Bank		***$18.7***	Sumitomo Mitsui Fin Gp -ADR	Japan	$48.4
Median Latin American Bank		***$11.6***	KB Financial Group Inc -ADR	S. Korea	$15.1
			Shinhan Finl Grp Co Ltd -ADR	S. Korea	$17.9
			Woori Bank –ADR	S. Korea	$7.5
			Banco Bilbao Vizcaya -ADR	Spain	$48.0
			Banco Santander SA -ADR	Spain	$77.9
			Barclays Plc/England -ADR	UK	$39.4
			HSBC Holdings Plc -ADR	UK	$153.2
			Lloyds Banking Gp Plc -ADR	UK	$50.8
			Royal Bank Of Scotland –ADR	UK	$28.1
			Mean Rest-of-World Bank		***$47.5***
			Median Rest-of-World Bank		***$42.0***

C. Research Questions and Hypotheses

The research question is whether large commercial banks experienced a significant stock price change during the Dodd-Frank Effect event windows and Trump Presidential Election event window. To answer this question, the following hypotheses are considered in the alternative form.

H_{a1}: The stock returns (cumulative abnormal returns) of the large commercial banks attributed to the Dodd-Frank Effect are different from zero.

H_{a2}: The percent of positive stock returns (cumulative abnormal returns) of the large commercial banks attributed to the Dodd-Frank Effect are different than fifty percent.

H_{a3}: The stock returns (cumulative abnormal returns) of the large commercial banks attributed to the Trump Effect are different from zero.

H_{a4}: The percent of positive stock returns (cumulative abnormal returns) of the large commercial banks attributed to the Trump Effect are different than fifty percent.

H_{a5}: The stock returns (cumulative abnormal returns) of the large commercial banks attributed to the Combined Effect are different from zero.
H_{a6}: The percent of positive stock returns (cumulative abnormal returns) of the large commercial banks attributed to the Combined Effect are different than fifty percent.

To test the odd numbered hypotheses, that the cumulative abnormal returns are different from zero, both a parametric t-test and non-parametric Wilcoxon signed rank test are used. To test the even numbered hypotheses, that the number of positive and negative cumulative abnormal returns are not equal (50%), non-parametric sign tests are used.

III. Methodology

We calculate the predicted (or normal) return for each day in the event window for each large commercial bank. The predicted return is what one would expect if there were no event. Following Schweiter (1989) we will use the daily market return of the S&P 500 Index as the predicted return. The S&P 500 represents America's 500 largest companies and account for approximately 75% of the U.S. stock market's value. Hence, the S&P 500 return is an excellent proxy for the market return.

We then calculate the daily abnormal return for each large commercial bank for each day over the two-day event window. The daily abnormal return represents the return not predicted by the market index and is an estimate of the change in the stock price on that day due to the event. The daily abnormal return, AR_{it}, for each large commercial bank i on day t is defined as:

$$AR_{it} = R_{it} - R_{mt} \qquad (1)$$

where R_{it} is the return on the common stock of large commercial bank i on day t and R_{mt} is the return on the market index (S&P 500 Index) on day t. When Brown and Warner (1985) examine random samples and short time-periods, they find the market-adjusted model explained here has similar robustness to the market model that is also often used in event studies.

Next we calculate the cumulative abnormal returns for each large commercial bank over the two-day event window. The cumulative abnormal return, CAR_i, for each large commercial bank i for the two-day event window beginning with day 0 through day +1 is defined as:

$$CAR_i = \sum_{t=0}^{+1} AR_{it} \qquad (2)$$

where AR_{it} is the daily abnormal return for large commercial bank i on day t.

Both the mean and median CAR are calculated for the large commercial banks in the sample. The mean CAR can be viewed as a diversified portfolio that eliminates unique individual stock returns by offsetting random positive stock returns with random negative stock returns. Thus, we have a mean CAR, which only captures the characteristics of the Dodd-Frank Act or the Trump Presidential Election. Furthermore, if the event did not impact the future earnings of large commercial banks, then the mean CAR should not be significantly different from zero. Likewise, the median CAR should not be significantly different from zero if the event did not impact future earnings of large commercial banks. Finally, we examine the percent of CAR that are positive for each event window. If the event did not impact the future earnings of large commercial banks, then the percent of CAR that are positive should not be significantly different from fifty percent.

We employ three separate tests to examine our proposed hypotheses: t-tests, Wilcoxon signed rank tests, and binomial sign tests. The parametric t-tests examine the mean return while the non-parametric Wilcoxon signed rank (WRS) tests, which do not assume normally distributed data, examine the median returns. Non-parametric sign tests are used to determine whether the proportion of positive CAR are significantly greater than 50 percent under the assumption of no reaction to the event. Since the sign test does not require a normally distributed sample or that the sample be symmetric, the sign test is appropriate for small samples with non-normal distributions.

IV. Results

Below we discuss the results of the Dodd-Frank Effect, the Trump Effect, and the Combined Effect. We also discuss the Latin American banks versus the Rest of the World banks.

A. Dodd-Frank Effect on U.S. Banks

We evaluate the first two events of the Dodd-Frank Effect cumulatively, and find the U.S. commercial banks suffered tremendous losses. As shown in Table 5 the U.S. commercial banks' mean and median CAR are -5.44% and -4.40%, respectively, while only 2% of the commercial banks (only one of the 42 banks) experience a positive CAR. When we calculate the absolute dollar impact on the commercial banks, we find the mean and median market capitalization losses to be $848 million and $146 million, respectively. Cumulatively, the forty-two commercial banks lost nearly $36 billion in market capitalization. Our results imply that since these commercial banks will incur such significant compliance costs, profits are reduced and the firm is less valuable to investors. All three of our test results, which are both statistically and economically significant, clearly show that commercial banks suffered losses due to the passing of the Dodd-Frank Act.

Table 5: U.S. Commercial Banks - Cumulative Abnormal Returns (CAR) for the Dodd-Frank Effect, Trump Effect, and Combined Effect

U.S. banks (n=42)	Dodd-Frank Effect	Trump Effect	Combined Effect
Mean CAR	-5.44%***	8.05%***	2.62%***
t-statistic	*-7.66*	*18.25*	*4.12*
(p-value)	*(<.0001)*	*(<.0001)*	*(.0002)*
Median CAR	-4.40%***	8.00%***	3.69%***
Wilcoxon signed rank test	*-448.5*	*450.5*	*290.5*
(p-value)	*(<.0001)*	*(<.0001)*	*(<.0001)*
Percent positive CARs	2.4%***	97.6%***	73.8%***
Sign test	*-20*	*20*	*10*
(p-value)	*(<.0001)*	*(<.0001)*	*(.0029)*
Shapiro-Wilk test for normality	Not normal***	Normal	Not normal*
(p-value)	*(.0002)*	*(.2650)*	*(.0589)*

***, **, and * denote one, five, and ten percent significance levels, respectively.

B. Trump Effect on U.S. Banks

When we evaluate the Trump Effect, or the presidential election, we find that commercial banks experience tremendous gains. As shown in Table 5, the commercial banks' mean and median CAR are 8.05% and 8.00%, respectively, while 98% of the commercial banks (all but one of the 42 sample banks) experience a positive CAR. When we calculate the absolute dollar impact on the commercial banks, we find the mean and median market capitalization gains to be almost $2.1 billion and $392 million, respectively. Cumulatively, the forty-two commercial banks gained over $88 billion in market capitalization. It is anticipated these banks will have reduced compliance costs and ultimately, profits will be greater and the banks become more valuable to investors. Again, all three test results, which are both statistically and economically significant, clearly show that commercial banks will benefit financially with President Trump.

C. Combined Effect on U.S. Banks

The Combined Effect is the cumulative result of the Dodd-Frank Effect and Trump Effect. We find the Trump Effect to be more beneficial to commercial banks than the Dodd-Frank Effect is detrimental. With the election of Trump, commercial banks recovered all the losses from the Dodd-Frank Effect and more. In other words, commercial banks expect to benefit not only from the "Dodd-Frank" rollback, but also from rollbacks in other regulations and restrictions.

When the Combined Effect is evaluated, we find the commercial banks experience tremendous gains. As shown in Table 5, the commercial banks' mean and median CAR are 2.62% and 3.69%, respectively, while 74% of the companies experience a positive CAR. When we calculate the absolute dollar impact on the commercial banks, we find the mean and median increase in market capitalization to be $1.25 billion and $340 million, respectively. Cumulatively, the forty-two commercial banks gained nearly $53 billion in market capitalization. The $53 billion gain is driven in part from the fact that the commercial banks had larger market capitalizations in 2016 than in 2010. The combined market capitalization for the 42 banks on November 8, 2016 was $1.06 trillion versus $644 billion on June 30, 2010. Since it is anticipated these banks will experience fewer regulations and restrictions, their future profits are favorable and more valuable to investors. The Combined Effect results clearly show that commercial banks gained with Trump being elected President.

D. Latin American Banks versus Rest-of-World Banks

We evaluate the Dodd-Frank, Trump, and Combined Effects separately for Latin American banks versus Rest-of-World banks. We find that when the Dodd-Frank Effect is evaluated the Latin American banks experience tremendous gains while the Rest-of-World banks were not significantly impacted. As shown in Table 6, the Latin American banks' mean and median CAR are 4.79% and 3.90%, respectively, versus -0.15% and -0.32%, respectively, for the Rest-of-World banks. Thus, while U.S. commercial banks suffered large losses after the passing of the Dodd-Frank Act, Latin American banks experienced tremendous gains and the Rest-of-World banks were not significantly impacted.

Next, we examine the ways in which the election of President Trump affected foreign banks (e.g. the Trump Effect). As shown in Table 6, Latin American banks experienced tremendous losses upon the news of President Trump's election. Specifically, the mean and median CAR for

Latin American Banks are -10.39% and -11.00%, respectively. Meanwhile, the Rest-of-World banks were not significantly impacted. Again, both samples of foreign banks react differently than U.S. banks to the announcement.

Overall, as shown in Table 6, the Combined Effect for Latin American banks resulted in significant losses with the mean and median CAR being -5.61% and -7.10%, respectively. Thus, while Latin American banks greatly benefitted from the Obama Administration Dodd-Frank Act, all of the gains and then some were reversed upon the election of President Trump and his promise to dismantle the North American Free Trade Agreement (NAFTA). The Rest-of-World banks experienced no significant combined changes.

Table 6: Latin American and Rest-of-World Banks: Cumulative Abnormal Returns (CAR) for the Dodd-Frank Effect, Trump Effect, and Combined Effect

	Dodd-Frank Effect	Trump Effect	Combined Effect
Latin American banks (n=7)			
Mean CAR	4.79%***	-10.39%***	-5.61%**
Median CAR	3.90%**	-11.00%**	-7.10%*
Percent positive CARs	100%**	0%**	28.6%
Shapiro-Wilk test for normality	Normal	Normal	Normal
Rest-of-World banks (n=17)			
Mean CAR	-0.15%	0.88%	0.73%
Median CAR	-0.32%	-0.12%	2.04%
Percent positive CARs	41.2%	41.2%	64.7%
Shapiro-Wilk test for normality	Normal	Normal	Normal

***, **, and * denote one, five, and ten percent significance levels, respectively.
T-test, Wilcoxon signed rank test, and sign test are used to examine mean CAR, median CAR, and percent positive CARs, respectively. Test values and p-values are available from the authors.

V. Conclusions

The Dodd-Frank Act of 2010 with huge regulatory compliance costs was passed in response to the large banks' role in the Great Recession. The Dodd-Frank Act added capital requirements and more consumer protection at great costs to large banks. Donald Trump, while seeking and securing the 2016 Presidency, promised large banks there would be regulatory rollbacks of the Obama-era legislation. We examined both events and found a large Dodd-Frank Effect whereby large U.S. banks experienced a mean and median loss in market capitalization of $848 million and $146 million, respectively. This result is not surprising, since the profitability of large commercial banks is greatly reduced with large regulatory changes or even perceived changes. Thus, we find the regulation to be suboptimal and greatly reduces the wealth of the shareholders of large commercial banks. Conversely, we also find he Trump Effect completely reversed those shareholder losses and more. Under the Trump Effect, large U.S. banks experienced an astonishing mean and median increase in market capitalization of $2.1 billion and $392 million, respectively. While the U.S. banks cumulatively lost $36 billion under the Dodd-Frank Effect, they gained $88 billion under the Trump Effect so the Combined Effect was a gain of $53 billion in market cap. We also found the shareholders of seven large Latin American banks, cumulatively suffered a $10 billion decrease in market cap as a result of Trump promising to dismantle NAFTA, thereby signaling big changes for Latin American banks

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