DURABLE DOMINANCE

by

Johan Chu

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Business Administration)
in The University of Michigan
2014

Doctoral Committee:

      Professor Gerald F. Davis, Chair
      Professor Gautam Ahuja
      Professor Mark S. Mizruchi
      Professor Kathleen M. Sutcliffe

To my late grandmother, who showed us the durable power of love.

ACKNOWLEDGEMENTS

知音知己를 위하여 (To my friends, who recognize my music)

Long ago in China, during the Spring and Autumn Period, a musician called Yu Boya had trouble finding an audience. Nobody understood the music he played on his string instrument, the Guqin. So he went away from the city, and played his song again and again in the mountains far from other people.

One day, a lumberjack passing by stood and listened. As Yu Boya played, Chung Tzu-Chi cried out: "Your music rises to the sky and draws the highest mountain!", "Your music overflows and draws the Yellow River!" Yo Boya was overjoyed to finally find someone who grokked what he was trying to say. Yu Boya and Chung Tzu-Chi became the closest of friends, and agreed to meet again two years later. After the two years had passed, Yu Boya arrived to meet Chung Tzu-Chi and found that he had passed away from illness. With no one who could understand his song, Yu Boya cut the strings of his beloved Guqin, and vowed never to play again.[1]

I am indebted to my committee, who recognized the music I was trying to sing before I fully realized what I was singing. They trained me so I could sing better, and helped shape my song so more people could recognize the message. They also carried my tune far and wide:

---

[1] This story appears in the Tang Wen chapter of Liezi (列子 湯問篇).

Often, I'd meet professors for the first time, and find they'd already heard about me and my work from one of my committee members.

Jerry Davis has been a mentor since before I arrived on campus. I still vividly remember our first phone call, where he led off with, "채식주의자입니다." ("I am a vegetarian." in Korean.) Throughout my years at Michigan, Jerry has been the best possible sounding board for my wild and uncouth ideas, and has, with great patience, prodded me into making something of them.

While Mark Mizruchi is not formally listed as a co-chair, he has done far more for me than most advisors do for their students. He grokked my ideas on durable dominance early, when I could only wave my hands and talk excitedly about old Hollywood actors. All my knowledge of elites in the United States (well, all the correct knowledge) came from Mark. He covered the history of elite theory in the United States while we were sitting in his office one afternoon. I scribbled furiously to keep up with his stream of thought, and those few hours gave me a semester's worth of learning.

Kathie Sutcliffe is amazing! She is a kind mentor and insightful scholar. Kathie found a place for me and my wife on her research projects, and her genuine concern for our well-being touched our hearts. On my own research, she has provided a point of view that I could not get from anyone else. She has a knack for getting at the gist of what is not yet well understood.

Gautam Ahuja thinks my work makes a contribution, ergo I know it matters. He has been a supporter since I audited his strategy class—where I learnt what little I know about theories of strategic management. He cares deeply about his students, and shows us firsthand what dedication to scholarship and to colleagues looks like.

Thank you all for your time, your patience, and most of all, your recognition of what was good in me and my scholarship. (And your forbearance in waiting for what was bad to pass.)

Garrett, Lindsey Cameron, Chen Zhang, and Teddy DeWitt. And a fond and teary farewell to my office mates, Laura, Chris, Dan Rush, Jason Stornelli,and Hakjin Chung—we'll need to have one more toast of bad whisky after my defense.

This is an incomplete list, and I sin by omission. I also need to thank many others, including professors and students in Strategy and other departments at Ross, and outside Ross in Sociology, Public Health, Organization Studies, Education, and elsewhere, who created a true community of scholarship and friendship. And the administrators who made sure I was funded, found me time on the schedules of visiting speakers, and helped me with my job applications: Paula Kopka, Shelley Whitmer, Brian Jones, Roberta Perry, Kelsey Belzak, and Jennifer Downey. And the students in my MO 300 class (Hail hail to Section 2!) who made teaching a joy. And I need to thank others outside of Michigan: Professors Seung-Yoon Rhee, Hong-gi Kim, Hong Seok Oh, Myung-ho Chung, and their students in Korea, for example. And my many non-Michigan friends who've made the trip more fun. I thank you all!

The list above, incomplete as it is, provides proof of how much community has mattered and will matter in developing my music. But I couldn't have done any of this without the support of my family. One of the key themes throughout this dissertation is that order of magnitude differences (say, in income) matter. Notwithstanding this, my lovely wife, Hyunzoo, allowed herself to be convinced that it was ok to choose a two-order of magnitude decrease in income for five years to secure (only) a one-order of magnitude decrease for life. Perhaps not a smart decision (but then, she has a history of making not-smart decisions—she married me). My parents, too, supported their prodigal son through his second Ph.D., financially and emotionally. (My mother once told me, when I was going to quit my Physics Ph.D. program to join a Silicon Valley startup, "If you don't want to do Physics, just get the degree and get another Ph.D. later if

you want to research something else." To which I replied, "Only utter fools and those who have nothing better to do with their lives would get a second Ph.D." I plead guilty to both.) The love of my sister's family and my wife's family also helped me throughout the Ph.D. program.

Last but definitely not least, my two children—Iain and Celine—every day give me new reasons to rejoice, to live, and to strive. I pray that the world they live in is better than the world today, and that as they grow, they come to know how much they are loved and how to love greatly in their own turn.

Some of what I know of love comes from my maternal grandmother, Sang Geum Kim. My uncle tells the story of coming back from the army and running into a homeless man at the bus station wearing familiar clothes. He arrived home to find no clothes in his closet. My grandmother saw the homeless in their need, and couldn't stop herself from giving away her beloved son's clothes. The "S. G." in my author name for academic papers is in remembrance of my grandmother, who showed how to truly love, who listened to my babbling before I could talk, and encouraged my music even then.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

I advance an explanation for durable dominance—dominants' enduring control of vastly disproportionate shares of contested resources in the face of mass entrepreneurial entry and increased competitive parity. I argue that increased, more potent competitive entry and more level rules of competition can benefit dominants. More and stronger new entrants disproportionately disadvantage non-dominants compared to dominants, and weaken near-dominants' ability to challenge dominants. Durable dominance is observed in many settings, for example, in the increased gap between the wealthiest in the U.S. and everyone else, and in industries where dominant companies maintain their dominance in open, competitive markets.

I test the predictions of this theory in two settings. First, I investigate the implications of this theory with thirty years of data on competition among U.S. mutual funds. As predicted by the theory, the effects of increased competitive entry on incumbents were nonlinear: deleterious for incumbent funds on average, but beneficial for dominant funds. New entry of similar competitors depressed future annual flows of investor money into 96.5% of mutual funds, but the top 1.3% of mutual funds gained on average almost $70 million of assets under management from the entry of a similar competitor. Increased competitive entry also increased dominant funds' probability of remaining dominant for longer than three years.

Second, I examine the process of board seat accumulation for directors on the boards of S&P 1500 companies from 1997 to 2010. A shift in the dynamics of hiring eliminated preferential attachment. Those with many board seats (dominant directors) compared to those

with only one board seat were about twice as likely to gain another board seat in 2000, but no more likely by 2010. The theory predicts that such a leveled playing field should prevent non-dominants from rising to dominance, and this prediction is supported in the data. Very few non-dominant directors accrued many board seats and became dominant after the change in board appointment patterns. A Monte Carlo simulation supports the causal relationship between the changed micro-dynamics of hiring and the observed non-appearance of new dominant directors. This setting provides insight into a special case of the theory, where existing dominants disappeared. Dominant directors grew old and retired from board service. The "inner circle" of dominant directors, which held together the board interlock network of U.S. companies connected through shared directors, disappeared after a century of continued existence.

The proposed theory suggests policy implications for dominants, non-dominants, and policy-makers in a variety of settings. I close by suggesting future investigations that could test the general applicability of the theory. I argue that the study of most-often-true "social laws" is a useful complement to the current focus on social mechanisms in organization theory.

Chapter 1:

Introduction

1.1 Overview

The number of mutual funds offered in the United States increased almost 30-fold from 1976 to 2009, and the number of fund management companies more than quadrupled. Despite this influx of new competitors, Fidelity and Vanguard maintained dominant positions from the late 1970s onward, with each managing about 12% of the total net assets held in mutual funds as of 2009 (Khorana and Servaes, 2012). Fidelity and Vanguard's entrenched dominance is far from the only instance of durable industry dominance. Budweiser beer, Wrigley gum, and Coca-Cola and Pepsi colas have all maintained dominance in their respective markets for decades.

Beyond industry, the wealthy in the United States are also durably dominant. U.S. society as a whole has become more open over the past half-century, and many class-, ethnicity-, and gender-based barriers to entry into previously-exclusive cultural spheres and social organizations have weakened (Peterson and Kern, 1996; Khan, 2011). The elite as a class are also less cohesive than in previous decades (Mizruchi, 2013; Chu and Davis, 2013). Yet an increasing and very large proportion of resources in the United States is controlled by a small group of individuals, and entry into this elite group has become almost impossible for those not born elite (e.g., Kopczuk, Saez, and Song, 2010; Piketty and Saez, 2003).

Today's top movie stars have also maintained their dominance over many years—even as the number of new actors earning their first starring roles increased dramatically. Middle-aged

men (Brad Pitt, then age 48; George Clooney, 50; Johnny Depp, 48) and women (Sandra Bullock, 47; Meryl Streep, 62) topped the 2011 list of top box office draws[2]. The average age of the actors in the top 10 of this list rose from 38.5 years in 1990 to 46.2 in 2011.

These examples are puzzling because dominance was durable, when we would expect it not to be. Increased competition in mutual funds and beer, and for movie roles, should have eroded dominants' advantages. More open access and competitive parity in society should have led to more equality in wealth. This dissertation proposes an explanation for how such durable dominance occurs. I present theory that predicts that dominants—those with vastly disproportionate control of contested resources—benefit from increased competitive entry into their markets and decreased advantages of scale. Initial tests of the theory, with data on competition in the mutual fund industry and among corporate directors for additional board seats, support the theory's predictions.

After briefly defining durable dominance, the remainder of this chapter summarizes classical theories of dominant entrenchment—or sustained competitive advantage—and argues that we need to extend these theories to explain dominant entrenchment in contemporary contexts. Chapter 2 presents a simple model of processes that lead to dominant entrenchment in open, competitively level, resource-abundant settings. These models show how increased entrepreneurial entry and competitive parity can benefit dominants and entrench dominant/non-dominant dichotomies. Durable dominance ensues when a highly-skewed distribution of resource levels is coupled with a less-skewed distribution of changes in resource levels. Results from an investigation of mutual funds' competition for investments are presented in Chapter 3.

_____

[2] Quigley's Movie Almanac, 2012.

While the vast majority of incumbent mutual funds were adversely affected by increased

entrepreneurial entry, the dominant few benefited immensely. Chapter 4 uses archival data and

Monte Carlo simulation to investigate the dynamics of board appointments for directors of S&P

1500 companies. Directors already on multiple boards were preferentially invited onto more

boards before 2000, but this was no longer true by 2010. The disappearance of rich-get-richer

dynamics stopped new dominant (many board) directors from emerging, with dramatic

consequences for the shape of the U.S. corporate board interlock network. Chapter 5 summarizes

the findings of the dissertation, and discusses the general validity and practical implications of

the proposed theory. I argue that the establishment of social "laws" is a useful complement to the

study of mechanisms in organization studies.

1.2 The Paradox of Durable Dominance

This dissertation advances an explanation for durable dominance. I define dominance as

controlling a vastly disproportionate share of contested resources. For companies or their

products, this means having an order of magnitude higher market share than the average

competitor. For individuals in society, this means possessing a vastly disproportionate amount of

wealth, power, fame, or career success. Ideas that attract a vastly disproportionate amount of

attention and legitimacy are also dominant. Dominance is durable when it endures in the face of

increased competitive entry and structural changes that level the playing field, attenuating the

competitive advantages of scale[3].

---

[3] Note that dominants need not be capable of agentic action. A scientific paradigm, for example, can be dominant. I talk of dominants "doing" things below for ease of presentation. Existing

Dominant Entrenchment in Economics, Strategy, and Sociology

While scholars in the disciplines of economics, strategy, and sociology disagree on the desirability of dominant entrenchment—the continuous control of a vastly disproportionate share of contested resources by a fixed group of actors—there is broad theoretical agreement that increased numbers of competitors and more level (i.e., less scale-dependent) rules of competition make it harder for dominants to maintain their positions. Neoclassical economics asserted that competition optimizes social welfare, partially by preventing dominants from unduly maintaining their positions (Samuelson, 1947: Chapter 8). Following this logic, structuralists (Bain, 1968; Mason, 1939; Hunt, 1972) maintained that barriers to industry entry and intra-industry mobility should be lowered to prevent monopolistic predation and oligopolistic collusion. Other economists (Stigler, 1968; Demsetz, 1973) argued instead that market dominance was often the result of firms' successful innovation. Dominants could only maintain their positions by continually out-innovating competitors—as long as resources could flow between industries and the "lure of profit induces entry" (Fisher, 1979: 675). Some scholars asserted that even such innovation capability-based market dominance was inherently unstable against competitive pressures, with dominated industries providing fertile ground for "industrial mutation … that incessantly revolutionizes the economic structure from within, incessantly destroying the old" (Schumpeter, [1942] 1994: 83).

Strategy scholars—for whom dominant entrenchment (i.e., sustained competitive advantage) is, in some respects, the Holy Grail—have built on these economic theories. Firms were advised to enter industries with high barriers to entry and to erect such barriers in their own

---

theory on dominance tends to assume agentic action. I show later that this is not necessary to maintain dominance.

industries (Porter, 1980), and to build distinctive capabilities. The resource-based view (Penrose, 1959; Wernerfelt, 1984; Barney, 1991) deemed sustained competitive advantage possible only if dominants controlled unique resources—"assets, capabilities, organizational processes, firm attributes, information, knowledge, etc." (Barney, 1991: 101)—that allowed them to execute their chosen strategies profitably, whereas other firms lacking these resources could not profit from the same strategies. Other theories argued that resource-based dominance was not durable, however. Challengers developing disruptive innovations—technologies that initially only address niche needs, but over time evolve to cost-effectively address the needs of the mass market—could nullify dominants' resource advantages and usurp their positions (Christensen and Bower, 1996; Christensen, 1997). A sociologically-inspired line of reasoning suggested, furthermore, that the presence of one or more dominant firms in an industry fostered an abundance of small, niche-oriented competitors. This process of resource partitioning (Carroll, 1985) would create fertile conditions for the development of disruptive innovations.

Unlike strategy scholars, sociologists typically viewed elite entrenchment and durable inequality as moral ills to be diagnosed and cured, and focused on understanding individual, family, or class dominance in society. Early scholarship deemed the existence and domination of elites inevitable (Michels, [1911] 1962; Mosca, [1896] 1939), arguing that the challenges of organizing large groups invariably led to small cadres of well-coordinated governing elites. Indeed, a large number of social institutions—e.g., kinship ties, shared organizations, and business relationships—supporting cohesion and coordination among elites were identified during the twentieth century (Mills, 1956; Domhoff, 1967; 1970; Miliband, 1969; Useem, 1984; Mizruchi, 1992). Elites also distinguished themselves from non-elites by monopolizing certain types of resources—"economic, social, cultural, political, or knowledge capital" (Khan, 2012:

361; see also Tilly, 1998, on opportunity hoarding). U.S. elites during the Gilded Age sought to set themselves apart culturally by excluding non-elites from highbrow art and music, for example (Levine, 1990). Habits, tastes, and dispositions acquired at an early age helped elites succeed later in life (Bourdieu, 1984; DiMaggio and Mohr, 1985; Lamont, 1992).

In sum, while scholars of economics, strategy, and sociology often disagreed on the value of dominant entrenchment and were focused on different units of analysis, they agreed that exclusion, collusion, and monopolization supported dominant entrenchment. High barriers to entry, whether into industries or social groups, preserved existing positions. Dominants, often collectively, used their disproportionate resources to maintain their advantages. Companies colluded in predatory pricing to bankrupt smaller competitors. Elite individuals instinctively preferred to help others from similar privileged backgrounds. Dominant companies and individuals alike banded together to collectively influence policy. Dominants attempted to monopolize valuable resources to keep them "rare, imperfectly imitable, and non-substitutable" (Barney, 1991: 116), and thus separate themselves from the non-dominant.

There are settings where this common understanding does not hold, however. Dominants sometimes maintain their dominance in spite of massive influxes of new competitors, and regulatory, technology, and market changes that level competition and take away large competitors' preferential access to key resources. The barriers to entry into the mutual fund market were low ($100,000 capitalization), and the number of new entrants into the industry exploded in the 1980s and 1990s. Yet Fidelity and Vanguard have maintained their dominance throughout. Manufacturing and distributing beer is no longer technically difficult—you can contract for both brewing and delivery. Yet Anheuser-Busch products have dominated the U.S. beer market since the end of Prohibition, maintaining almost 50% market share in the face of

growth in the number of U.S. breweries from 82 in 1980 to 2,126 in mid-2012. The number of new actors making their feature film starring debut each year has been increasing since 1990, yet the leading stars of 1990 maintained their ability to garner new starring roles and draw audiences in 2013. All but two of the top ten actors on Quigley's list from 1990 were still active, with a starring role in at least one Hollywood release in the past year. Business academia has seen the blooming of "a thousand flowers" (Pfeffer, 1995) as the number of business authors, journals, theories, and articles increased dramatically, yet "we have become stuck in theories developed in the latter half of the twentieth century" (Schoonhoven, Meyer, and Walsh, 2005: 327). The apparent disappearance of a cohesive, distinct elite (Mizruchi, 2013; Chu and Davis, 2013) suggests that elites and privilege matter less in the U.S., and social elites are no longer distinguishable by their monopolization of highbrow culture (Peterson and Kern, 1996; Khan, 2011). Yet over the past forty years, economic mobility in the United States has declined (Kopczuk, Saez, and Song, 2010), while the wealth gap between elite and non-elite has dramatically increased (Piketty and Saez, 2003).

A focus on durable dominance is timely, as U.S. society and its subfields have become increasingly open, competitively level, and resource-abundant over the past half-century (see, e.g., Davis, 2013). Overt categorical barriers to entry into social enclaves have all but disappeared. Barriers to industry entry have similarly been lowered. New technologies and business norms have democratized access to resources previously available only to dominants, making them available for easy purchase. For example, even one-person companies now have access to scalable sources of financing, manufacturing, marketing, and distribution. Financialization has simplified the reallocation of resources across fields. More and more markets are becoming characterized by low barriers to entry, weakened size advantages, and

increased availability, transposibility, and portability of key resources. Theories from economics, strategy, and sociology need to be extended to explain entrenched dominance in this ever more open, level, and resource-abundant world. In the next chapter, I introduce a model that shows one way such durable dominance may occur.

Chapter 2:

A Model of Durable Dominance

2.1 Introduction

This chapter introduces a model that describes causal processes leading from increased and more level competition to dominant entrenchment. The model is a stylized ecological model of resource-based market competition. I model resource distributions and trajectories in an industry characterized by two conditions:

1) The industry is closed to new entry and exit.

2) Companies with higher revenues can invest more in building future resources than competitors with lower revenues.

I then examine the consequences of relaxing each of these conditions in turn—i.e., opening the market to new entry, and increasing competitive parity—and show that either of these changes can benefit dominants and lead to durable dominance, by preventing non-dominants from becoming dominant. Based on the model, I suggest a typology of processes that foster durable dominance and boundary conditions for the processes' operation. I conclude the chapter by summarizing the theoretical predictions suggested by the model, and comparing these predictions to those of strategy theories of firm heterogeneity. The model's predictions are contrary to those of established theories of competitive advantage.

In presenting the model, I do not assert that the causal relationship between competition and dominant benefit will always hold, nor that the processes described are necessary for such a

relationship to hold. The model merely shows that the causal relationship is plausible, given certain boundary conditions. I will examine concerns of general validity and alternative mechanisms in Chapter 5, after establishing empirical support for the relationship between increased and more level competition and dominant entrenchment in Chapters 3 and 4.

2.2 Classical Dominant Entrenchment

Consider an industry, closed to new entry and exit, where companies with higher revenues can invest more than those with lower revenues into building resources—capabilities, attributes, and holdings that contribute to firm performance. Firms with higher levels of resources will have higher revenue. Also assume strong resource-based barriers to intra-industry mobility; firms which have previously done well are expected to continue doing well. We can model these conditions by assuming that the magnitude of change in revenue during each time period is stochastic and proportional to the firm's current revenue—i.e., a rich-get-richer Matthew effect (Merton, 1968) holds. Formally:

$$R(f, t+1) = R(f, t) \times [1 + n(m, \sigma)] \qquad \text{(Equation 2.1)}$$

where a firm f has revenue R at time t, and n is a random value drawn for each firm and time step from a normal distribution with non-negative mean m and standard deviation σ. This equation approximates a random walk on a logarithmic scale, which after a sufficient number of time periods results in a highly-skewed, log-normal distribution of revenues across firms (cf. Gibrat, 1931). Such highly-skewed distributions are commonly observed in real industries (Schmalensee, 1989: 994).

Dominants naturally emerge under these conditions. Because of the multiplicative nature of the trajectories of revenues, one or two firms will end up with thousands or millions of times the revenue of the median firm after a sufficient period of time, even if all firms start with the same initial revenue and no firm is inherently better than another. On the other hand, the identity of the firm with the lion's share of revenues can and does change. Again because of the compounding inherent in the Matthew effect, non-dominant firms can rise into dominant positions and dominant firms can lose their positions over sufficient time. Dominants' reigns are limited in duration in the absence of sustained predation, collusion, or dominant-led innovation.

2.3 Change in Resource Distributions

Dominants may become entrenched, however, if a large number of new entrants enter the market. Figure 2.1 presents stylized revenue distributions in an industry before competitive entry. The distribution of revenue levels is highly-skewed, approximating a power law distribution. If we assume that firms compete primarily against those with similar revenues (as strategic group theory [Caves and Porter, 1977] predicts), firms with larger revenues will have fewer direct competitors. A firm with $100 million in revenue may compete against only ten direct competitors, while a firm with $10 million in revenue competes against 100 similar companies. This reasoning implies that the revenue distribution curve equates to a competitive intensity curve.

Insert Figure 2.1 about here

Figure 2.2 shows revenue distributions—the competitive intensity curve—after massive industry entry. Entering firms rarely enter with resources of the level of dominants, since dominant firms have resources that are of the order of magnitude of the total resources in the industry. Entrants often enter with resources greater than the median incumbent firm, however, because entry is endogenous—a firm will not enter the market unless its management believes that the firm possesses, or can quickly build, a competitive level of resources.

Insert Figure 2.2 about here

After mass entry, the competitive intensity curve flattens up to a revenue threshold corresponding to the thinning of the right tail of the new entrant revenue curve. Incumbents with revenue an order of magnitude above this threshold (indicated by R_t in Figure 2.2) do not experience appreciable changes in the number of similar-size competitors. Firms with revenue of the same order of magnitude as the threshold, on the other hand, experience a dramatic increase in the number of their direct competitors. These unfortunate incumbents are forced to devote more of their resources to competition against similar competitors, and have less slack left to challenge larger incumbents. To the extent that incumbent near-dominants must divert resources to defend against new entrants' advances, incumbents above the threshold—now durable dominants—face less threat from competition below and become entrenched in their dominant positions.

This argument is not dependent on the specific shape of the competitive intensity curve after mass entry. The only assumption needed is that mass entry does not happen at the highest resource levels. If this assumption holds, there will be a point where the changed competitive

intensity curve slopes down more severely than the curve before mass entry. Those few incumbents to the right of this point benefit; those immediately to the left suffer. Those who benefit are always a minority because of the skewed shape of the revenue distribution curve—the vast majority of incumbents have the lowest levels of resources.

Incumbents near the threshold also suffer from a dilution of consumer attention. Consider an industry with one dominant firm and ten near-dominant firms. Consumers may attempt to compare the offerings from each of these eleven firms when making a purchase decision. A lucky or good near-dominant may gain business and successfully challenge the dominant and take over its position. Successful challenges become unlikely if mass entry of new competitors creates 90 more near-dominant firms, however. Search costs will preclude consumers from carefully comparing offerings from the 101 dominant and near-dominant firms. A near-dominant firm attempting to overtake the dominant will find it harder to distinguish itself from other near-dominants, while the dominant firm will strengthen its consumer recognition and distinctiveness.

Entrants in this model need not be newly-established firms, but can be established firms entering new (to them) industries. A special case worth considering is the effect of market mergers from processes of industry convergence (when companies from multiple industries come to compete in the same product market) or globalization (when companies from different geographical markets come to compete in a single world-wide market). If pre-convergence or pre-globalization resource distributions are highly-skewed within each market, and the size distribution of the pre-merger markets is also highly-skewed, then the post-market merger resource distribution will have a shape similar to the distribution predicted after mass entry (Figure 2.2). Near-dominant firms in the post-merger market will face sharply increased

competition, benefiting the dominant firm from the largest pre-merger market. This largest dominant will enjoy entrenched dominance in the newly merged market.

2.4 Change in Resource Trajectories

Dominants also become entrenched if the playing field in the competition for revenue growth is "leveled" by making increases in revenues independent of existing revenue size—i.e., eliminating the Matthew effect so the poor can gain or lose as much wealth in each time step as the rich. If Bill Gates was constrained to gain or lose $1,000 a day, his position atop the wealth distribution would be frozen in place. Even if he lost $1,000 every day for 50 years, he would lose less than $20 million of his $70 billion[4] fortune. Conversely, a penniless graduate student gaining $1,000 every day over the same period would amass less than $20 million—a large sum to the student but much below Gates's wealth[5]. Leveling the playing field leads to entrenched dominants. Dominants' levels of contested resources never diminish to non-dominant levels, and non-dominants can never become dominant.

Formally, when resource level changes become additive where they were previously multiplicative:

$$R(f, t+1) = R(f, t) + n(m_2, \sigma_2) \qquad \text{(Equation 2.2)}$$

---

[4] Forbes, May 2013.
[5] Indeed, the introduction of this rule would cement Gates's position atop the list of the world's richest people, protecting him from being overtaken even by those such as Carlos Slim, whose net worth Forbes estimates at $69.86 billion. Note that the graduate student could catch up to Gates's wealth if the daily flat bet was of an order of magnitude similar to Gates's wealth. This scenario—equivalent to debasing U.S. currency so that $100 million is a reasonable day's wages—is unlikely, however.

the probability of dominant displacement effectively vanishes across wide ranges of values for average change in resource level m_2 and standard deviation σ_2.

This change in resource trajectories can act directly to stop non-dominants from accumulating dominant levels of resources as detailed above. Such a change can also entrench dominants indirectly by changing the resource distribution. In the Bill Gates example above, if everyone's net worth moved up or down by $1,000 each day, many more people could amass wealth on the order of a few million dollars. (And those with a million dollars would find their fortunes more precarious.) This increase in the number of multi-millionaires would benefit those with wealth above this threshold in ways laid out in Section 3 of this chapter.

2.5 Conditions of Durable Dominance

In the models described above, the introduction of more open and level competition has differential effects on dominants and non-dominants. In fields where previous conditions allowed dominants to emerge (i.e., a small group of firms amassed disproportionate resources orders of magnitude higher than the average firm), mass entrepreneurial entry and increased competitive parity entrench dominant positions. It is worthwhile to consider the general principle behind these results: Durable dominance occurs when the distribution of contested resources is highly-skewed, and the distribution of changes in contested resource levels for non-dominants is less-skewed. Then non-dominants with levels of contested resources an order of magnitude below dominants' levels cannot accrue resources of the order of magnitude necessary to overtake dominants.

The distribution of changes in resource levels for non-dominants can become less-skewed through two types of processes. The first type of process affects the dynamics of resource accumulation indirectly by changing the competitive intensity curve. Such distribution changes may stem from increased de novo entry into the industry, or processes of industry convergence and globalization. The second type of process entails a change in the micro-dynamics of resource accumulation—for example, weakening of rich-get-richer effects. This second type of process may also change the shape of the competitive intensity curve, further lowering the probability that the non-dominant can take large steps to become dominant.

The reasoning above rests upon three assumptions about the nature of resources, and the effects of the proposed mechanisms will be stronger to the degree these assumptions are met in a given setting:

1) Resources and revenue are abundant and scalable—that is, levels of resources and revenue can differ between firms by many orders of magnitude.

2) All actors share and have access to the same types of resources; no actor holds a proprietary resource that locks out competitors.

3) Only aggregate resource levels matter in determining an actor's success; there are no resources that are crucial, and no resource combinations which are more potent than others. This last assumption is equivalent to assuming that all resources are equally transposable to each other.

Note that all three assumptions are satisfied if we assume that all needed resources can be bought and sold easily—that is, factor markets are efficient (cf. Barney, 1986). Money is inherently scalable and widely-held. If it can be used to buy all needed resources, then aggregate levels of cash become the key to determining success. Development of technologies of

outsourcing, distributed contract manufacturing, and network organization strengthens the effects of the proposed mechanisms.

Beyond these assumptions, the model imposes few constraints on the types and characteristics of actors, resources, outcomes, and competition. Dominants need not engage in agentic anti-competitive action, such as predatory pricing, collusion, or political influence to maintain dominance. Indeed, dominants need not to be capable of action at all. Popular ideas may become durably dominant if the number of competing ideas increases rapidly, for example. The theory developed above should apply across a variety of settings.

2.6 Distinctive Theoretical Predictions

The reasoning above predicts distinctive non-linear effects of increased and more level competition. Increased competitive entry will reduce flows of contested resources to non-dominant incumbents. Dominants, on the other hand, will benefit and receive an increased flow of contested resources compared to non-dominants, and the expected reign of dominants will lengthen. Increased competitive parity between actors with disparate levels of contested resources will have the same effects.

These outcomes arise because of the differential effect of increased competition on near-dominants compared to dominants. Increased competitive entry disproportionately increases competitive intensity for near-dominants compared to dominants. Decreased advantages of scale weaken near-dominants' ability to cross the gap separating them from dominants. The benefits to dominants of increased competition are greater in settings where key resources are abundant and widely-available. These conditions make it harder for near-dominants to defend their positions

against new competitors and prevent near-dominants from building unique, inimitable, and valuable capabilities that can be leveraged to challenge dominants.

These predictions are quite different from—often opposite to—the predictions of established theories of sustained competitive advantage. To my knowledge, none of the major theories of heterogeneity in firm performance predict a nonlinear effect of increased competition that benefits only the few dominants in an industry. On the other hand, almost all theories of firm heterogeneity assume some mechanism of exclusion, whereby dominants monopolize access to resources.

Strategy scholars typically classify sources of firms' performance advantage (most often profit, but sometimes revenue or market share) as stemming from either privileged market positions or unique resources (e.g., Cool, Costa, and Dierickx, 2002). Privileged market positions allow dominants to protect their position through strategic commitments or network externalities. Strategic commitments (or sunk costs; Sutton, 1991) by dominants in building resources such as brand recognition or production capacity can entrench dominants by removing the incentive for challengers to similarly invest in increased scale or scope, if the anticipated cost for a challenger to build scale-efficient resources is larger than the anticipated benefit. Expected benefits are smaller for challengers than for dominants who have already built up their resources, because challengers who invest must compete for market share with dominants who have already invested. The proposed theory complicates the picture, predicting that dominant entrenchment will be strengthened by increased entrepreneurial entry. As consumer demand is further divided among incumbent and new firms, non-dominant incumbents' potential benefits from resource investments decrease, weakening their incentives to grow larger.

Network externalities (e.g., Katz and Shapiro, 1992) are also portrayed as locking in dominant advantage, by increasing value and switching costs for consumers and suppliers. The classic network strategy is to exclude the strongest competitors from your own platform, while increasing the number of other parties who use your platform. The proposed theory suggests that a better way for the strongest firm to maintain dominance would be to invite all competitors to compete on the same network platform, and to support the smallest competitors so that they grow to compete against and weaken larger competitors. Sharing the same resources (such as the network platform) is better for maintaining dominance than allowing competing—and possibly disruptive—sets of resources to be developed.

This last observation drives home the boundary between the proposed theory and theories of unique resource-based heterogeneity (Barney, 1991) and disruptive innovation (Schumpeter [1942] 1994; Christensen, 1997). Unique resource-based competitive advantage requires that resources be imperfectly mobile and imperfectly imitable. Dominants can protect their resource advantages through rich-get-richer economies of resource accumulation (either mass efficiencies or connectedness of asset stocks; Dierickx and Cool, 1989) and barriers to imitation (time compression diseconomies, causal ambiguity [Lippman and Rumelt, 1982; Reed and DeFillippi, 1990], or exclusivity). The resource-based view does not satisfactorily explain sustained heterogeneity in settings where rich-get-richer resource dynamics are absent, and resources are abundant and widely-available, however. In such settings, theory such as that presented in this dissertation is needed to explain durable dominance.

Like the resource-based view, Christensen's (1997) theory of disruptive innovation assumes that dominants control resources different from those of non-dominants. Non-dominant, niche players who lack the technology to successfully address the mainstream market use their

inferior but cheaper technologies to meet niche market needs. Over time, some of these originally-inferior technologies evolve enough that they can address mainstream market needs at low cost. Challengers who control these new mainstream-capable technologies displace incumbent dominants. The existence of proprietary, non-shared resources is essential for this narrative of disruptive innovation; the reasoning suggests that disruptive innovation will be unlikely in industries where key resources are abundant and widely-available. In such settings, the dearth of disruptive innovation will increase the duration of durable dominance.

The proposed theory will apply to an increasing number of settings in a world where resources are becoming abundant and widely-available. One factor driving this resource trend is the increased availability of outsourced services. In durable product markets, for example, the rise of contract manufacturing services has eliminated the need for upfront investment in dedicated production capacity. You no longer need to own a factory to produce goods, and you can often scale production from single-unit prototypes to millions of units easily with the help of offshore OEM manufacturers. Marketing, sales, and distribution are even easier to scale using Internet-based services.

It is important to understand how industry dynamics are affected by this trend towards financialization of key industry resources. What happens when money, which is inherently abundant (i.e., a large total amount exists) and widely-available (almost everyone can have some money), can efficiently purchase all the necessary expertise and resources for firm success? To answer this question, it is instructive to study industries where competitive dynamics have historically centered around abundant and widely-available resources. In the next chapter, I present a first test of the proposed theory in a setting where money itself—in the form of consumer investments—was (and is) the contested resource.

FIGURES

Figure 2.1: Revenue Distribution with Matthew Effect and No Entry
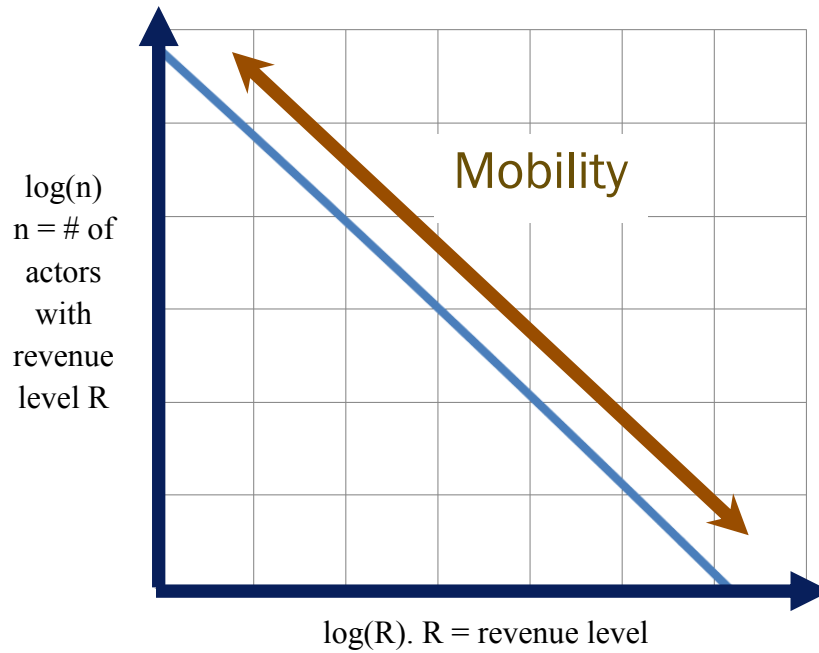
Stylized illustration of highly-skewed (power law) revenue distribution, or competitive intensity curve, in a market with no exit or entry, and rich-get-richer dynamics. Companies with higher revenue levels have fewer competitors with similar revenues.

Figure 2.2: Revenue Distribution with Matthew Effect and Mass Entry
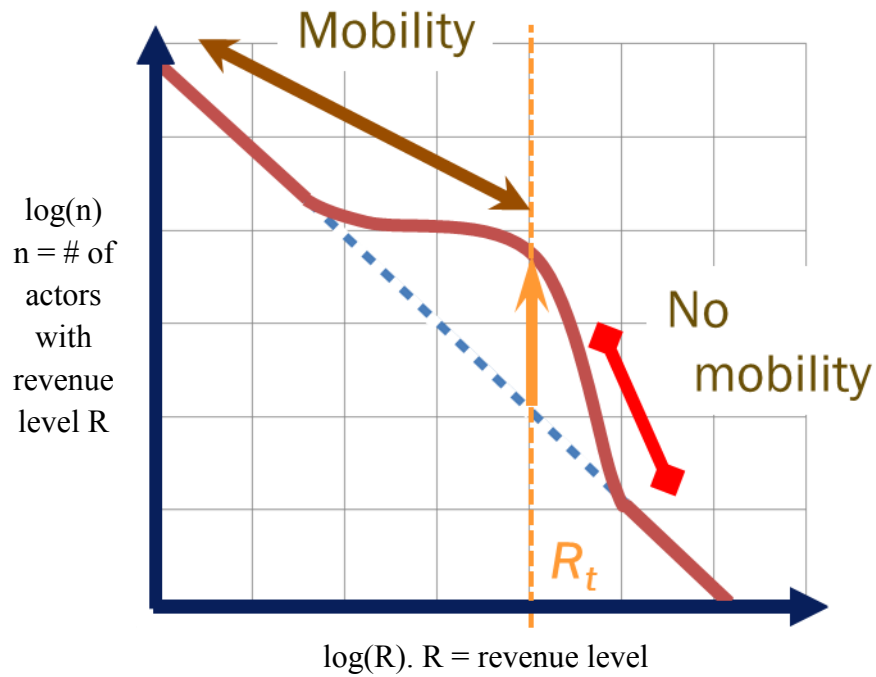
Competitive intensity curve (solid line) after market is opened to entry. Mass entry of new competitors changes the shape of the competitive intensity curve, increasing competitive intensity for firms near the threshold. In the stylized case depicted above, the number of similar competitors for an incumbent with revenue level R_t increases by almost two orders of magnitude.

Chapter 3:

Durable Dominance in the U.S. Mutual Fund Industry, 1980-2010:

Increased Competitive Entry Benefits Dominants

3.1 Introduction

This chapter describes an initial test of the proposed theory in the context of U.S.

domestic equity mutual funds. Analysis using thirty years of data on competition among mutual

funds supports the theory's predictions: While increased entrepreneurial entry reduced

investment flows into incumbent funds on average, dominant mutual funds—those with orders of

magnitude higher assets under management compared to competitors with similar portfolio

holdings—*benefited* from increased competition. Heightened entrepreneurial entry increased

flows into dominant funds and entrenched them in their dominant positions.

I examine the competitive dynamics of open-ended U.S. domestic equity mutual funds

from 1980 to 2010. Mutual funds compete against each other to secure investor assets to manage.

This market was competitive in recent years; increased competitive entry decreased incumbents'

future flows of assets under management (Wahal and Wang, 2011). The proposed theory predicts

that these competitive effects should be non-linear, with flows into dominants behaving

differently from flows into non-dominants.

Hypothesis 1: *Increased entry will increase flows of assets into dominant funds compared to flows into non-dominant incumbent funds.*

Figure 3.1 helps clarify the predictions of this hypothesis. We know from recent research (e.g., Wahal and Wang, 2011) that the average incumbent loses future flows of assets when similar funds enter the market. Hypothesis 1 predicts that this effect is not uniform across relative fund sizes (Figure 3.1, Panel A), nor linear in relative fund sizes (Panel B). The predicted effect is instead non-linear, with only a small minority of the largest in relative size funds benefiting from competitive entry, while all other funds suffer (Panel C).

Insert Figure 3.1 about here

Flows of assets into non-dominant funds should decrease when new entry increases. On the other hand, flows into dominant funds increase, as dominant funds face weakened competition from near-dominants. This strengthened position will also lead to dominant funds remaining dominant longer.

Hypothesis 2: *Increased entry will increase the probability of dominant funds remaining dominant for longer time periods.*

The mutual fund setting is well-suited for the current inquiry in three ways. First, this setting appears to be characterized by durable dominance. Dominant companies maintained their position in the face of mass influx of new competitors. Barriers to entry were low, contested

resources were scalable, and the resources needed to operate a fund were widely-available. This setting thus provides a testbed to examine whether dominant entrenchment can be explained by the proposed theory's predictions of non-linear effects of increased competitive entry[6]. Second, data are available for the whole population without survivor bias for a suitably long period. Finally, the setting is substantively important. Mutual funds have grown to occupy a central place in the U.S. economy during the period under study.

3.2 The Development of the U.S. Mutual Fund Industry

As of 2009, $11.1 trillion was invested in U.S. mutual funds. This figure corresponded to more than one fifth of total U.S. household net worth, which stood at $54.2 trillion. Mutual funds were not always so consequential, however. Mutual funds managed only $51 billion in 1976, less than 1% of the total U.S. household net worth of $5.8 trillion[7].

The tremendous growth (17.72% CAGR during the 33 years from 1976 to 2009) in mutual funds' assets under management was driven by several factors. The 1980s and 1990s were bull markets for both stocks and bonds, making them attractive alternatives to traditional bank offerings. Perhaps more importantly, during this period, employer-managed, defined-benefit retirement plans were largely superseded by newly-available employee-managed,

---

[6] The empirical studies in this dissertation examine settings where entrenched dominance is observed in the face of increased competitive entry or decreased scale advantages. The goal of these studies is to establish the non-linear and disparate effects of increased or more level competition on dominants versus non-dominants. Future studies should examine contexts with less observed dominant entrenchment, and lower levels of resource abundance and availability to test the effect of different boundary conditions.

[7] Data on investments in mutual funds and defined contribution plans from Investment Company Institute Fact Book (2012, 2010). Data on U.S. household net worth published by the Federal Reserve, downloaded from http://www.federalreserve.gov/releases/Z1/20100311/z1r-1.pdf., http://.../ Current/annuals/a1975-1984.pdf.

defined-contribution plans, such as 401(k)s and IRAs. 401(k) plans were first offered in 1982, and became hugely popular after the passage of the Tax Reform Act of 1986[8]. The 1986 Tax Reform Act also introduced individual retirement accounts (IRAs). By 2009, $4 trillion was held in defined contribution plans (401(k), 403(b), 457) and another $4.4 trillion in IRAs. Mutual funds managed a large portion of the assets in these self-managed retirement plans. Fifty-five percent of the assets in defined contribution plans and 45% of the assets in IRAs were held in mutual funds at the end of 2009. Innovation in the types of funds available was another factor driving demand (and vice versa). Money market, index, tax-exempt bond, sector, international, target date, and exchange-traded funds were all introduced in the late 1970s to 1990s.

Burgeoning consumer demand and an increased supply of experienced fund management professionals created a surge of entrepreneurial entry into the mutual fund management market. The number of companies offering mutual funds increased from 134 to 584 from 1976 to 2009 (Khorana and Servaes, 2012). Accounting for exits, the number of new management companies entering the market during this period was much higher—in the thousands. The number of mutual funds also increased dramatically, as new entrants and incumbent management companies competed to offer more choices to investors. The number of open-end mutual funds increased from 385 in 1976 to 11,452 in 2009, a compound annual growth rate of 10.9%[9].

Despite the influx of new competitors and innovations, the top management companies maintained market dominance. Fidelity and Vanguard increased their market shares from 6% and 3.6% respectively in 1976 to about 12% each in 2009 (Khorana and Servaes, 2012). Such

---

[8] Employee Benefit Research Institute (2005), downloaded from http://www.ebri.org/pdf/publications/facts/0205fact.a.pdf.
[9] My analysis using data from Khorana and Servaes, 2012.

continued dominance may suggest that the market for investors' assets was not competitive—perhaps because of "stickiness" of already-invested funds. Prominent critics (Bogle, 2003; Swensen, 2005; Spitzer, 2004; Freeman and Brown, 2001) argued that mutual funds did not compete in a competitive market. Others (e.g., Coates and Hubbard, 2007; Wahal and Wang, 2011; Khorana and Servaes, 2012) responded, however, with economic arguments and empirical evidence suggesting that the mutual fund market was indeed a competitive market. Wahal and Wang's (2011) study was particularly suasive. They developed a portfolio-overlap measure of competitive intensity between incumbents and new entrants, and found that, after 1998, "[i]ncumbents that have a high overlap with entrants subsequently … experience quantity competition through lower investor flows, have lower alphas, and higher attrition rates" (Wahal and Wang, 2011: 40).

3.3 Data

Hypotheses 1 and 2 predict non-linear, interactive effects of increased competitive entry and fund size relative to competitors. Funds an order of magnitude larger than similar competitors should benefit from increased entry, while others suffer. To test the hypotheses, I created a dataset combining mutual fund data from CRSP with holdings information from the Thomson Financial CDA/Spectrum database. I used the MFLINKS database to link mutual fund identifiers from the former to the latter. The dataset covers open-end U.S domestic equity mutual funds from 1980 to 2010 (the Thomson database starts its coverage in 1980 and covers only mutual funds with U.S. domestic equity holdings), and contains slightly over 130,000 fund-quarter observations of 5,532 mutual funds.

Funds were defined as competing against each other to the extent that they held the same stocks in similar proportions. I calculated pair-wise cosine similarity measures between each pair of funds existing in the same time period (approximately 313 million pairs) using holdings data. Two funds were defined to be similar if they held the same stocks in similar proportions. A fund's holdings can be represented as a vector in a large-dimensional space where each dimension is one stock and the vector component along each dimension is the dollar amount of the fund's holdings in that stock. Two funds are similar to the degree that their holding vectors point in the same direction. If the funds hold exactly the same stocks in the same proportions, the vectors are aligned, the angle between them is 0 degrees and the cosine of this angle equals one. If the vectors have no stocks in common, the vectors are perpendicular, and the cosine of this 90 degree angle equals zero (see Appendix 1 for more detail on this measure).

The main dependent variables are 1) *flow of assets next 12 months* and 2) dichotomous variables indicating whether a fund is dominant one, two, three, and five year(s) later (*dominant in year+n*). I define dominant funds as those funds with an order of magnitude or larger assets under management compared to the average assets under management of similar competitors. The independent variable of interest is *(dominant fund) x (new entrant overlap)*, the interaction term of the similarity-averaged number of new entrants and whether the focal fund is currently dominant or not. Control variables include those identified in previous studies of mutual funds (e.g., Wahal and Wang, 2011), such as measures of previous flows of assets into the focal fund, fund returns and return volatility, fund size, age, fee level, and portfolio turnover. I add a measure of flow of assets into similar funds to control for overall segment growth. I also control for the total assets under management at the focal mutual fund's management company. (See Table 3.1 for specifics of these constructs.)

Insert Table 3.1 about here

The identity of the fund's management company is not included as a control variable because this variable does not change value during the study period for almost all of the funds in the dataset, and so is collinear with fund fixed effects. Most funds remain under the same ownership throughout their lifetimes. Including fixed effects for mutual funds effectively controls for management company characteristics (e.g., a Fidelity or Vanguard effect).

3.4 Analysis and Results

The first step in the analysis was to substantively replicate Wahal and Wang's (2011) results, which found that new competitive entry decreased flows into incumbent funds. Their data differ from mine in several ways. They ended their sample in 2005, their measure of new entrant overlap was defined differently, they used an ordinal variable coded 0, 1, and 2 for funds with bottom 20%, middle 60%, and top 20% performance respectively instead of a z-score, they included front-end load as a control variable, and they do not control for the size of total flows into similar funds. An additional difference is that Wahal and Wang used Fama-MacBeth regressions, while I use fixed-effect panel regressions. Notwithstanding these differences, the results are substantively identical. On average, new competitive entry led to decreased asset flow into incumbent funds.

The second regression tested the prediction (Hypothesis 1) that new entrant overlap would be beneficial to dominant incumbents but deleterious to non-dominants, by adding the dominant fund variable and the *(dominant fund)* × *(new entrant overlap)* interaction term.

Results are shown in Model 1 of Table 3.2[10]. As predicted by the proposed theory, the coefficient of the interaction term was significant and positive. Expected asset flow over the next 12 months decreased by $3.8 million for each unit increase in new entrant overlap for non-dominant funds. Dominant funds, on the other hand, *benefited* from increased competitive entry. Expected asset flow into dominant funds increased by $66.2 million for each unit increase in new entrant overlap.

Insert Table 3.2 about here

To further check that the effect of new entrant overlap was indeed non-linear and not just a linear interaction effect with the size ratio, I examined the effects of increased new competitive entry at various levels of the *size ratio*. I created z-scores for the *size ratio* across each time period, then binned the observations using this z-score as shown in Table 3.3. I created dummy variables (*bin 1, bin 2, …, bin 11)* for each bin, and re-ran the regression using (*bin 1, bin 2, …, bin 11)* and (*bin 1, bin 2, …, bin 11) × (new entrant overlap)* instead of *dominant fund* and (*dominant fund) × (new entrant overlap)*.

---

[10] Including the lagged dependent variable on the right side of the fixed effect panel regression equation can lead to inconsistent and biased results. These errors should not substantively affect the reported results, however, given the current study's observed levels of residual autocorrelation and the large number of time periods. Additionally, estimates of the effects of non-lagged dependent variables will be biased downwards (Keele and Kelly, 2006), so the reported significant effects are, if anything, under-estimated. In any case, alternative analyses using Arellano-Bond difference and system GMMs also supported the hypothesis.

Insert Table 3.3 about here

Figure 3.2 and Model 2 in Table 3.2 show the results from this regression. The difference in the coefficient for *(bin 10) × (new entrant overlap)* and *(bin 11) × (new entrant overlap)* compared to the other interaction terms is striking. Non-dominants—about 96.5% of observations—lost assets when similar new competitors entered the market, but dominants— approximately the top 3.5%—gained tremendously from new competitive entry. The top 1.3% of funds each gained on average almost $70 million in new assets under management for each similar new competitor, while the next 2.2% gained on average slightly over $20 million in increased asset flow. Models 1 and 2 both support Hypothesis 1's prediction of a non-linear effect of competitive entry on dominants versus non-dominants.

Insert Figure 3.2 about here

I next examined the effects of new entry on dominants' (non-dominants') chances of maintaining (attaining) dominance in later years to test Hypothesis 2. Table 3.4 shows the results of these regressions. Dominant funds' chances of staying dominant three or five years later were positively influenced by increases in new entrant overlap, as predicted by the theory. Each new entry by a similar competitor increased the probability the dominant fund would remain dominant in three years by 12%. New entrant overlap had no impact on the chances of becoming dominant for non-dominant funds. While the focal fund's size ratio significantly predicted the

probability of being dominant up to five years into the future, currently being dominant was only consequential in determining whether the fund was dominant the following year.

Insert Table 3.4 about here

These results support the predictions of the proposed theory. Increased entry of similar funds decreased non-dominant incumbents' future flows of assets, but increased dominants' future flows. Increased competitive entry also increased the probability of dominant funds maintaining dominance for three or more years. On the other hand, in the absence of new competitive entry, a fund's current dominance significantly predicted continued dominance only in the following year. In sum, increased entry disadvantaged non-dominant incumbents, but benefited and entrenched dominants.

3.5 Robustness Checks

A series of robustness checks provide additional support for these results. The effects described above are robust to defining competitors in different ways. Regressions using CRSP segment codes instead of overlap measures yielded substantially similar results to those seen in Model 2. CRSP segment codes are used inconsistently over the years, however. Further robustness tests should use social network community detection algorithms to divide funds into communities. Funds can be considered linked if their cosine similarity is greater than zero, and the strength of the link defined as the cosine similarity between the funds.

Using different definitions of new entry does not substantively change the results. The definition above counts a fund as a new entrant only if it is a newly-formed fund. An existing

fund may also come into competition with a focal fund when either fund changes its portfolio composition to be more similar to the other. To examine effects of overall competition increase, I replaced *new entrant overlap* with *change in competitive overlap* in the regression models. *Competitive overlap* was calculated for each fund at each time period as the sum of pair-wise cosine similarities for the focal fund across all other funds existing in the time period (and not just new entrants). *Change in competitive overlap* is defined as the net difference between the current value of *competitive overlap* and the value 12 months prior.

Regressions using data from 1980 to 1998 yielded the same substantive results for the independent variables of interest. This is in contrast to Wahal and Wang's (2011) findings, which showed no effects of competitive entry on incumbent fund flows before 1998. One possible reason for their null result is that they were averaging across dominants and non-dominants. The mutual fund industry grew tremendously from 1980 to 1998. The large number of new entrants may have resulted in greatly increased flow to dominants that offset any decrease in flows to non-dominants, resulting in an average effect that was not significant. Another possible reason for their null result is that they did not control for total flows into similar funds. A rising tide may have lifted all boats.

3.6 Discussion

Increased competitive entry of similar competitors was found to be beneficial for dominant mutual funds, and detrimental for non-dominant mutual funds. The results support the theory advanced in Chapter 2. Further investigations are needed to establish the mechanisms responsible for this effect. Such investigations may examine whether this effect was driven by fund management actions (i.e., changes in portfolio strategy and marketing in response to

competition), or consumer actions (e.g., a higher probability of investing in dominant funds when faced with too many similar choices). Data on the evolving structure of the mutual fund industry and its segments, such as that outlined in Appendix A, may be useful for these further investigations.

This study consisted of analysis at the mutual fund level rather than the management company level. What do these findings tell us about competition among management companies, especially the durable dominance of Vanguard and Fidelity? A partial answer to this question can be obtained by examining each management company's dominant funds. As of 2009, five dominant funds[11] contributed 43% of Fidelity's total net assets under management. The remaining 57% of Fidelity's total net assets under management was split across 111 non-dominant funds. Explaining the durable dominance of the five dominant funds explains much of Fidelity's durable dominance.

While a Fidelity fund enjoys distribution and marketing advantages compared to funds from smaller management companies, this by itself is not enough to make the fund dominant (only 5 of 116 Fidelity funds were dominant in 2009). Indeed, the causality may be in the reverse direction—a durably dominant fund may keep Fidelity dominant. Consider this plausible (congruent with known facts) explanation of Fidelity's durable dominance: Fidelity had a dominant fund as the number of mutual fund entrants soared. Many of these newly formed funds were similar (in portfolio allocation) to Fidelity's dominant fund, making the fund durably dominant. Fidelity took some of the profits from its now durably-dominant fund, and used them to establish many more funds with different portfolio strategies. If there was a new portfolio

---

[11] Fidelity Growth Company, Fidelity Low Priced Stock, Fidelity Magellan Fund, Fidelity Contrafund, Fidelity Diversified International Fund.

allocation type that was becoming fashionable, Fidelity would create a fund of that type.

Fidelity's new funds enjoyed advantages in distribution, marketing, and name recognition

compared to similar funds from smaller management companies. These advantages were by and

large not enough to make the new funds dominant in terms of assets under management

compared to similar competitors, however. Occasionally, by luck or skill, a Fidelity fund would

become dominant. If the Fidelity fund was dominant as the new fund type became very

fashionable, and many similar competitors entered the market, the Fidelity fund would become

durably dominant. This provided Fidelity with further resources to establish new exploratory

funds, thus increasing its chances of having yet another dominant fund.

     This explanation is empirically testable with the current data. Additional data from

Fidelity and other mutual fund management company's prospectuses could provide information

on strategic intent. If this explanation holds, then the observed durable dominance of mutual fund

management companies is explained by the durable dominance of individual mutual funds—

which I have sought to explain in this chapter.

Figure 3.1: Predicted Non-Linear Effect of New Competitive Entry on Flow of Assets
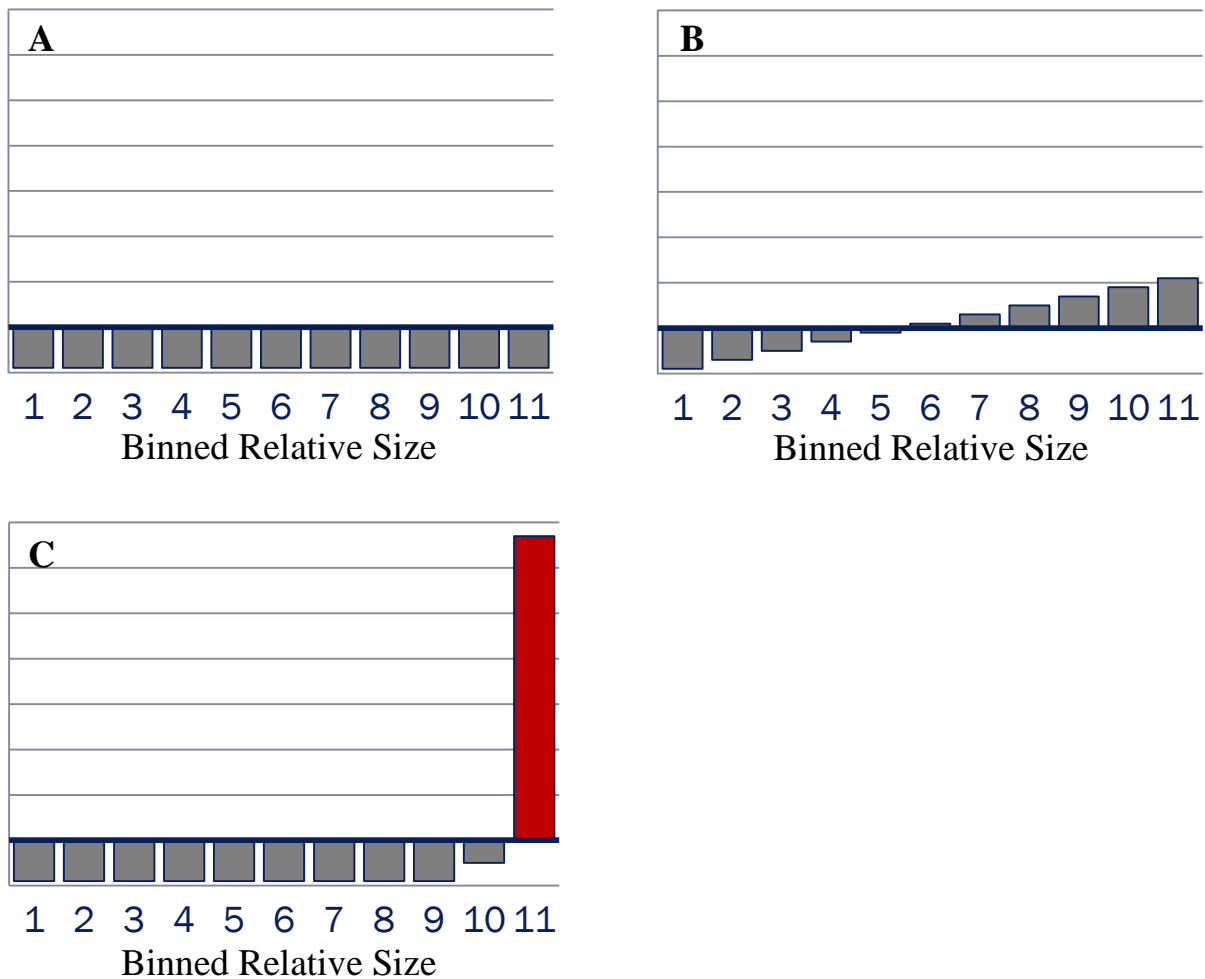
Bars in Panel C illustrate the predictions of Hypothesis 1. Increased competitive entry is predicted to have a non-linear effect on future flows of assets. Only the largest funds (in relative size of assets under management compared to competitors) will benefit.

Figure 3.2: The Non-Linear Effect of New Competitive Entry on Flow of Assets
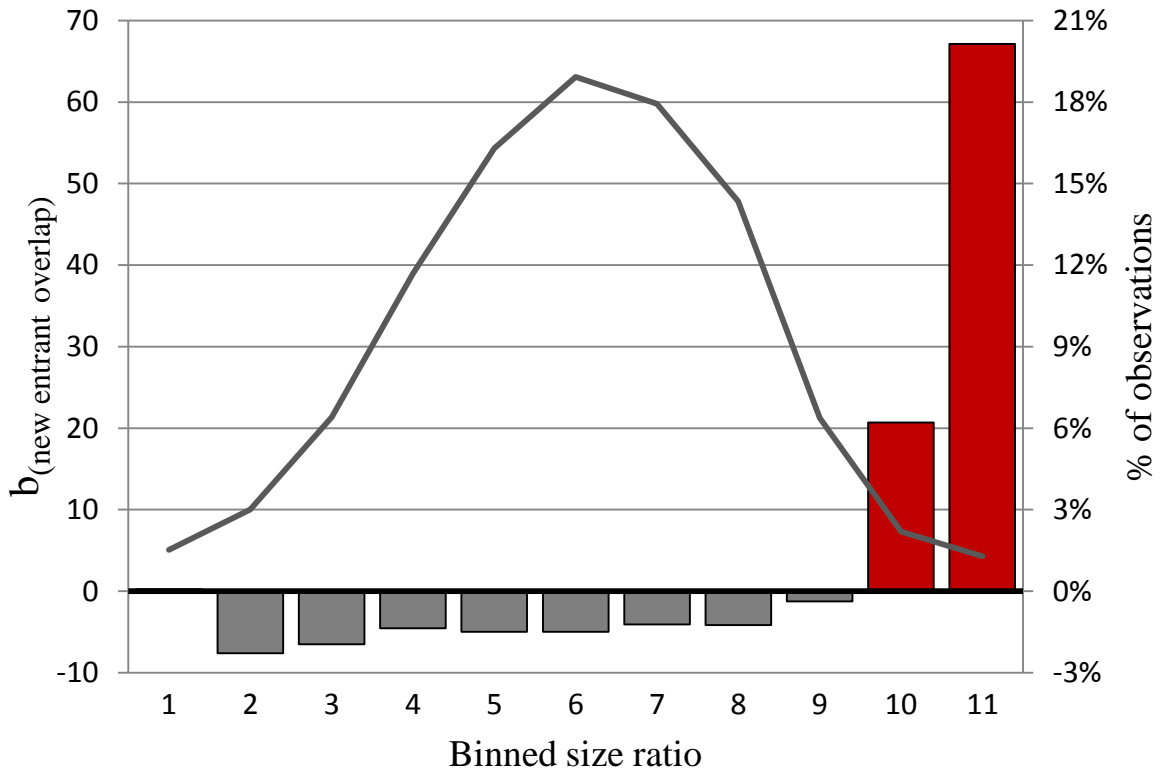
Bars and left axis indicate the predicted effect (in millions of dollars) of a unit increase in new entrant overlap on the focal fund's flow in the next 12 months. Line and right axis show the percentage of fund-quarter observations within each size ratio bin. See Table 3.3 and chapter text for details of the binning.

TABLES

Table 3.1: Data Descriptions

Variable	Description
Flow of assets next 12 months	The net flow of investments into the focal fund over the next 12 months, calculated as the net growth in fund assets beyond reinvested dividends and asset influx from mergers (cf. Sirri and Tufano, 1998). Flows for four quarters were summed to create twelve month trailing measures.
Dominant in year+n	A dichotomous variable that equals 1 if *Dominant fund* in year+n, where n = 1, 2, 4, 5. See below for definition of *Dominant fund*.
Flow of assets previous 12 months	The net flow of investments into the focal fund over the previous 12 months. See *Flow of assets next 12 months* above for measure details.
Flow of assets into similar funds	Cosine similarity-weighted average of flows into similar funds. Flow into the focal fund is included in the sum.
Standardized return	The focal fund's z-score (across all funds present in each time period) of 12-month fund returns from CRSP.
Standard deviation of returns	The standard deviation of the focal fund's past 12 months' monthly returns from CRSP.
Logged total net assets	The base 10 log of the total net assets of the fund from CRSP.
Logged age	The base 10 log of the age of the fund in months from CRSP.
Expense ratio	The fund's expense ratio from CRSP.
Turnover ratio	The fund's turnover ratio from CRSP.
Logged management company size	The base 10 log of the total net assets of the fund's management company. The management company code from the Thomson database was used to determine a fund's management company.
New entrant overlap	The sum of pair-wise cosine similarities for the focal fund across all new entrants.
Size ratio	The ratio of the focal fund's total net assets to the cosine similarity-weighted average of its competitors' total net assets.
Dominant fund	A dichotomous variable that equals 1 when the focal fund's *size ratio* is greater than ten. *Dominant fund* = 1 for 1,212 observations (1.04% of total observations). Seventy-six funds are dominant in one or more time periods. I also use the z-score of the *size ratio* across contemporary funds as an alternate measure of dominance.

Table 3.2: The Effect of New Competitive Entry on Flow of Assets

Fixed effect panel regressions.

Dependent variable: Flow of assets next 12 months	Model 1	Model 2
Flow of assets previous 12 months	0.492***	0.505***
	(146.08)	(149.67)
Flow of assets into similar funds	0.000	0.001***
	(1.79)	(3.69)
Standardized return	32.259***	32.495***
	(14.54)	(14.74)
Standard deviation of returns	203.890*	204.606*
	(1.99)	(1.99)
Logged total net assets	-208.898***	-309.718***
	(-28.10)	(-25.12)
Logged age	64.487***	110.854***
	(5.04)	(8.27)
Expense ratio	210.049	69.682
	(0.43)	(0.14)
Turnover ratio	-1.024	-1.179
	(-0.57)	(-0.66)
Logged management company size	9.583	17.224**
	(1.81)	(3.26)
New entrant overlap	-3.852***	-4.969***
	(-4.46)	(-3.53)
(Standard deviation of returns) × (New entrant overlap)	10.207***	9.591***
	(11.72)	(11.01)
Dominant fund	-1048.696***	
	(-30.86)	
(Dominant fund) × (New entrant overlap)	70.090***	
	(16.07)	
Bin 1		-489.447***
		(-10.67)
Bin 2		-378.420***
		(-13.93)
Bin 3		-280.731***
		(-14.65)
Bin 4		-188.921***
		(-13.90)
Bin 5		-93.193***

		(-10.16)
Bin 6		(omitted)
Bin 7		66.418***
		(7.53)
Bin 8		65.410***
		(5.19)
Bin 9		-88.697***
		(-4.90)
Bin 10		-518.626***
		(-18.69)
Bin 11		-1501.781***
		(-32.13)
(Bin 1) × (New entrant overlap)		5.207
		(0.27)
(Bin 2) × (New entrant overlap)		-2.634
		(-0.38)
(Bin 3) × (New entrant overlap)		-1.526
		(-0.38)
(Bin 4) × (New entrant overlap)		0.425
		(0.15)
(Bin 5) × (New entrant overlap)		-0.029
		(-0.01)
(Bin 6) × (New entrant overlap)		(omitted)
(Bin 7) × (New entrant overlap)		0.885
		(0.46)
(Bin 8) × (New entrant overlap)		0.813
		(0.40)
(Bin 9) × (New entrant overlap)		3.711
		(1.64)
(Bin 10) × (New entrant overlap)		25.645***
		(7.27)
(Bin 11) × (New entrant overlap)		72.114***
		(15.26)
Constant	333.164***	511.850***
	(11.18)	(15.57)

Table 3.3: Binning on Standardized Size Ratios

Bin number	Z-score range	% of observations
1	< -2.25	1.52%
2	-1.75 - -2.25	3.00%
3	-1.25 - -1.75	6.41%
4	-0.75 - -1.25	11.70%
5	-0.25 - -0.75	16.30%
6	-0.25 - 0.25	18.93%
7	0.25 - 0.75	17.94%
8	0.75 - 1.25	14.35%
9	1.25 - 1.75	6.37%
10	1.75 - 2.25	2.19%
11	> 2.25	1.29%

Table 3.4: Effect of New Competitive Entry on Log-Odds of Being Dominant in N Years

Fixed effect panel logistic regressions.

Dependent variable: Dominant in year+n	Year + 1	Year + 2	Year +3	Year + 5
Flow of assets previous 12 months	0.000*	0.000***	0.000*	-0.000
	(2.50)	(3.52)	(2.36)	(-0.47)
Flow of assets into similar funds	0.000*	0.000***	0.000***	0.000***
	(2.01)	(4.55)	(4.14)	(7.85)
Standardized return	0.332**	0.411***	0.375***	0.528***
	(3.23)	(3.91)	(3.56)	(3.51)
Standard deviation of returns	-4.573	-19.837***	-22.034***	13.269*
	(-1.20)	(-4.53)	(-4.74)	(2.09)
Logged total net assets	2.471***	1.873***	0.307	-4.850***
	(4.51)	(3.79)	(0.66)	(-6.05)
Logged age	-7.524***	-8.965***	-10.225***	-7.792***
	(-6.89)	(-7.69)	(-8.30)	(-4.42)
Expense ratio	57.236	250.625**	209.917*	395.607**
	(0.61)	(2.63)	(2.18)	(2.81)
Turnover ratio	-0.536	-0.351	-0.351	-0.845
	(-1.59)	(-0.96)	(-0.92)	(-1.57)
Logged management company size	-0.728*	-0.723*	-1.015**	-2.623***
	(-2.03)	(-2.02)	(-2.78)	(-5.11)
New entrant overlap	-0.007	0.026	-0.029	-0.042
	(-0.26)	(0.77)	(-0.93)	(-1.05)
Size ratio	0.046*	0.033*	0.034*	0.067**
	(2.49)	(2.07)	(2.20)	(2.91)
Dominant fund	1.311***	0.206	-0.047	-0.060
	(6.82)	(1.00)	(-0.22)	(-0.18)
(Dominant fund) x (New entrant overlap)	-0.012	0.034	0.114**	0.264***
	(-0.44)	(0.81)	(2.75)	(4.97)

Chapter 4:

The De-Cohesion of the U.S. Corporate Interlock Network, 1997-2010:

Disappearance of Matthew Effect Prevents Non-Dominants from Attaining Dominance[12]

4.1 Introduction

The model of Chapter 2 predicts that a disappearance of rich-get-richer Matthew effects will prevent non-dominants from rising to dominance. In this chapter, I test this prediction in the sociologically-important context of board appointments at S&P 1500 companies. I present data showing the disappearance of a Matthew effect for board appointments in the early 2000s: Directors on multiple boards were more likely to gain additional board seats before 2000, but lost this advantage by 2010. As predicted, this change prevented non-dominant directors from rising to dominance (i.e., gaining many board seats).

Straightforward application of the model predicts that the dearth of newly-dominant directors should lead to entrenchment of existing dominant directors. In this setting, however, exogenous factors forced dominants to leave the population—the most dominant directors grew old and retired from board service during the period under study. This chapter's findings thus shed light on a special case of the theory: What happens when processes of durable dominance

---

[12] This chapter draws extensively from Chu and Davis (2013), which we are currently revising for second-round submission to a sociology journal. Much of the data and analysis is shared between the draft article and this chapter. Some of the text is also repeated from the draft article. I have tried to reuse only passages that I initially penned, either for the draft article or for my second-year paper on which the article builds.

operate, but the dominant disappear? (This would be equivalent to asking what would happen if the largest mutual funds were terminated by legislative decree in the setting of the previous chapter.) Throughout the twentieth century, a few dominant directors each served on many U.S. corporate boards. The identity of the dominant directors changed as older directors retired and new directors rose to dominance. This ever-renewed "inner circle" of many-board directors made the U.S. corporate interlock network (the network of companies linked by shared directors) strikingly cohesive. I find the inner circle disappeared by 2010. The retirement of dominant directors coupled with the non-appearance of new dominant directors destroyed the century-long cohesiveness of the U.S. interlock network. The chapter closes by asking what the disappearance of the inner circle implies for our understanding of elites in the United States.

4.2 The U.S. Corporate Interlock Network in the Twentieth Century

From Louis Brandeis (1914) and Vladimir Lenin ([1916] 1939) to C. Wright Mills (1956) and Michael Useem, observers of society have accorded great power to a small "inner circle" (Useem, 1984) of corporate directors who serve on multiple corporate boards and "often seem to know one another, seem quite naturally to work together, and share many organizations in common" (Mills, 1956: 294). Structurally, this inner circle was the glue that made the American corporate board interlock network a "small world" (Davis, Yoo, and Baker, 2003), where the most-connected directors were friends or friends of friends of the majority of all large company directors in America and the most-central companies were less than three steps away from the majority of all large companies. This network is the substrate through which corporate practices diffuse (Davis, 1991), political action is shaped (Mizruchi, 1989; 1992), and a class-consciousness is created (Useem, 1984). (See Mizruchi, 1996, for an early review on the

functions of interlocks.) Since its rise in the early twentieth century, the board interlock network has been written and theorized about perhaps more extensively than any other social network (e.g., Mintz and Schwartz, 1985; Stokman, Ziegler, and Scott, 1985; Scott, 1997; Davis and Mizruchi, 1999; Windolf, 2002; Kogut, 2012).

The interlock network was not only a symptom of elite cohesion, but also an important instrument in screening and socializing new members of the corporate elite and creating a political consensus among them (Useem, 1984; Mizruchi, 1992). Board meetings gave new directors exposure to powerful "corporate diplomats" (Useem, 1984) who (if the newcomers met their approval) could introduce the less-connected to other influential elite members and provide sponsorship leading to political appointments and further board appointments. This feedback loop from consequence (interlock network cohesiveness) to cause (elite cohesiveness) suggests a functional force (Stinchcombe, 1968: Chapter 3-II) acting to maintain the cohesion of the interlock network. Dips in local interlock network connectedness would inconvenience elites who used board meetings for intelligence gathering and social connection, leading them to seek out new board memberships for themselves or to have well-connected individuals appointed to the boards they served on.

Indeed, the cohesion of the interlock network was remarkably stable. Mizruchi (1982) found that the percentage of large companies that could be reached in three network steps from the most-central company ("three-step reach") was 90.9% in 1904 and stayed above 80% past 1974 (the end of his study period). The cohesiveness of the network was maintained even as the network transitioned from being dominated by "robber barons" in 1912 to being institutionalized—not person- but company-centric—from 1935 onward. During the transition from robber barons to institutions, the three-step network size remained roughly constant, even

while the number of directors serving on six or more boards and the density (proportion of possible connections realized) of the network declined precipitously.

This cohesiveness persisted to the end of the twentieth century, with Chase Manhattan in 1999 being three or fewer steps away from 82.4% of the 811 companies in Davis et al.'s (2003) study. Davis et al. found that "in spite of the rampant turnover among boards and directors, and nearly complete turnover in ties, distances among the corporate elite remained virtually constant." (2003: 321). Their finding was even more striking in that during the period covered in their study—1982 to 2001—two other long-standing features of the network changed completely: Banks were ousted from their 80-year reign as the most central companies in the interlock network, and the demographic composition of the inner circle changed from all-white and all-male to one where the most-connected directors tended to be African-American and/or female. But mean geodesics—the average number of steps between any two companies—among the largest companies remained small and near-constant: 3.38 in 1982, 3.46 in 1990, and 3.46 in 1999. Davis et al. concluded that a small network diameter was an "emergent propert[y] of networks qua networks" (2003: 322).

4.3 The Matthew Effect in Board Appointments

The enduring cohesion of the interlock network can be explained by the continued existence of dominant directors—those with disproportionately more board seats than the average director. Dominant directors create many ties. Vernon Jordan sat on nine corporate boards in 1999 with 106 other directors, for example. A basic finding of network theory is that the existence of a few nodes with many ties (dominant directors in this setting) shortens overall

path lengths in the network (Watts and Strogatz, 1998; Barabási and Albert, 1999; Bianconi and Barabási, 2001).

Two factors advantaged a director who sat on many boards in being hired onto yet more boards. First, a director on many boards (e.g., Vernon Jordan) had many co-directors, who were likely to collectively sit on many other boards, which increased the focal director's chances of being recommended to a new board. Second, sitting on many boards increased the value of a director for other boards. Useem (1984) argued that directors sitting on many boards gained broad-based business intelligence, social connections, and legitimacy within the corporate and political worlds, thus making them attractive as co-directors. Others have suggested that well-connected directors brought mainly symbolic status benefits to the companies on whose boards they served. For example, writing after the Penn Central bankruptcy in 1970, Myles Mace compared directors to "ornaments on the corporate Christmas tree" (1971: 90) and Davis and Robbins showed that "directors who serve on many outside boards—particularly boards of prestigious firms—make better ornaments" (2005: 290-291). Directors gained prestige by being on many and prestigious boards, and boards gained prestige by hosting prestigious directors. A rich-get-richer dynamic prevailed.

Demography was also a factor in board hiring, with preferences for certain demographic groups shifting over time. Directors were predominantly white (usually "well-bred" Protestant) males until the 1980s. Women and minorities started to be sought after to bolster companies' claims to diversity during the 1990s. Another basis for hiring was skill. Fama and Jensen (1983) argued that directors who were good stewards of shareholder value would be invited onto more boards, and several studies (e.g., Yermack, 2004) have found that directors of firms with good performance tended to join more boards. There are other types of skill, however. Westphal and

colleagues (Westphal and Stern, 2007; Zajac and Westphal, 1996) have shown that being skilled at ingratiation and having a reputation for not actively monitoring CEO actions led to more board appointments.

The long-standing preference for directors on many boards may have changed after the corporate scandals of the early 2000s. During the twentieth century, a company gained prestige if it managed to attract a sought-after (i.e., already on many boards) director to its own board (Useem, 1984; Davis and Robbins, 2005). After the corporate scandals of the early 2000s, however, hiring a board member sitting on many other boards may have become regarded as risky for two reasons. First, the director's affiliations would taint the focal firm's reputation if one of the affiliated companies should become embroiled in scandal (cf. Bothner, Smith, and White, 2010). Second, directors on many boards became regarded as "overworked"[13] or "busy" (e.g., Ferris, Jagannathan, and Pritchard, 2003; Fich and Shivdasani, 2006). "Overboarded" directors were identified as corporate governance risk factors by the influential advisory firm, Institutional Shareholder Services in 2004. ISS now recommends that institutional investors withhold votes for directors who serve on more than six public company boards[14].

The models of Chapter 2 suggest that non-dominant directors would be prevented from becoming dominant if the negative shift in the perception of dominant directors led to a change in hiring patterns, such that directors with many board seats stopped being preferentially-hired compared to those with one board seat. The non-dominant (in number of board seats) directors

---

[13] E.g., Forbes. 2002. America's most overworked directors.
[14] The current policy is available at
http://www.issgovernance.com/files/2013USPolicyUpdates.pdf on page 8.

would find it difficult to rise to dominance (many board seats) after the breakdown of preferential attachment.

4.4 Data

To capture shifts in the micro-dynamics of board hiring, I created a dataset covering S&P 1500 boards from 1997 to 2010, using data from RiskMetrics, Boardex, and CRSP/Compustat. Annual board composition data were created using board data from RiskMetrics and interlock data from Boardex. While the RiskMetrics dataset is the one most commonly used in studies of board interlocks, it suffers from issues of data quality. Names are listed inconsistently, different people with the same name or similar names are sometimes indicated as being the same person, and the same person is often listed using several "unique" identifiers. The Boardex dataset uses company and director unique identifiers consistently. (During data processing, I found only one instance of an identifier being used inconsistently in Boardex, compared to thousands of inconsistencies in RiskMetrics.) Boardex has its own weaknesses, however. The data coverage is incomplete for firms and individuals that were not active into the late 2000s and Boardex sometimes splits one company into two entries.

I corrected RiskMetrics company and director identifiers by matching them to Boardex identifiers, using text similarity matching for company and director names, director board lists and company director lists, and pattern-matching for interlocks. I created algorithms to automatically generate suggested corrections to RiskMetrics data based on linked Boardex data. Suggested corrections were manually checked before being reflected in the final dataset.

Using this corrected data set, I created the list of companies that were on the S&P 1500 as of their annual meeting date according to RiskMetrics, and generated the corresponding lists of

board members. Finally, I added annual performance data from CRSP/Compustat, matching

entries on CUSIPs and ticker symbols. The S&P 1500 sample includes 2,454 distinct companies

and 17,065 company-years, and 27,192 directors and 151,135 director-years. From these lists of

companies and boards, I created lists of annual board interlocks (companies sharing a director)

and director interlocks (directors serving together on the same board). The sample consisted of

54,220 corporate interlock-years for an average of slightly under 3,900 interlocks per year, and

882,120 director interlock-years for an average of slightly over 63,000 interlocks per year.

I examined over-time changes in whether directors on more boards were more likely than

directors on one board to gain another board seat in the subsequent year, controlling for other

network, demographic, and skill factors. Demographically, I tracked whether directors were

female, members of an ethnic minority, members of the social elite (defined as non-minority men

educated at Harvard, Yale, Princeton, or Stanford). I also tracked whether each director was a

corporate executive for each year of the study period. I collected director-year measures of the

size (logged number of employees) and annual performance (total annual returns) of the

companies on whose boards each director served. For each director, I used the maximal value of

each size and performance measure in the regressions[15]. I also created four network measures for

each director for each year in our study period. Using the director-director network of directors

linked by common board memberships, I measured each director's degree centrality (how many

different directors does the focal director sit on boards with) and eigenvector centrality. The

---

[15] Exploratory regressions showed that the maximal values of these measures explained more of
the variance in subsequent director hiring than means or medians. Using means or medians
instead yields the same significant regression results. Alternate specifications used logged market
value for size and return on assets or return on equity for performance. The empirical
conclusions below were unaffected by these substitutions.

latter measure is a recursive indicator of the focal director's status in the overall director-director network. Directors who are linked to many well-linked directors rank higher in eigenvector centrality. I also created a measure of the number of boards that each director could be introduced to by his peer directors. For each director, I counted the number of different boards served on by directors who sat on the same board as the focal director, then subtracted the boards where the focal director already served. The final and focal network measure was the number of board seats held by the director. In addition to these measures, I also tracked directors' ages and used age and age-squared as controls in the regressions. Regressions also controlled for years since the first year in the dataset, and individual year effects. Table 4.1 contains details of how I constructed each measure from the data sources. Table 4.2 shows descriptive statistics and correlations[16].

Insert Table 4.1 about here

Insert Table 4.2 about here

_____

[16] For obvious reasons, director degree centrality was highly correlated with both the number of board seats held by the director and the number of boards peer directors sit on. Removing director degree centrality from the analysis did not change the pattern of results for the remaining variables.

51

4.5 The Breakdown of Preferential Attachment

Models 1-3 in Table 4.3 show regression results from a random-effects unbalanced panel logistic regression calculating the effects of each independent variable on the probability of a director gaining a new board seat in the subsequent year. To capture monotonous changes in the effect of each independent variable over the years, I included the interaction terms of each independent variable with the number of years since 1997 (the first year in our data).

Model 1 shows results from the full model. Examining the effects of control variables shows that directors associated with larger companies were more likely to gain new board seats, but there was no effect for directors on the boards of higher performance companies, when controlling for demographic and network characteristics. Note the comparison with Models 2 and 3, which show regression results without network measure regressors. Directors from more successful companies were not preferred per se, but may have been popular with board selection committees only because they had good network connections.

Insert Table 4.3 about here

Minority directors and social elite directors were preferentially hired onto additional boards throughout the period of the study. Minority directors were 1.47 times more likely than non-minority directors, and social elite directors 1.36 times more likely than non-elite directors, to gain an additional board seat in the next year. There was no significant preference for female directors, however. Corporate executives were initially less likely than non-executives to gain additional board seats, but this trend shifted over time. I examine this shift in more detail below.

Directors who sat on boards with others who sat on many other boards were more likely to gain additional board seats. Each additional board a peer served on increased the likelihood of the focal director gaining a new board seat by a factor of 1.034. A director whose board colleagues served on ten other boards was predicted to be 40% more likely to gain a new board seat in the next year than a director whose colleagues did not sit on any other non-overlapping boards. Note that when controlling for peer board reach and other network characteristics, increasing the number of co-directors negatively impacted the propensity to gain additional board seats. This is in line with social network research finding that the range and content of connections trumps sheer number of connections in determining outcomes for the focal actor (e.g., Burt, 1992; Cotton-Nessler, 2013).

The Matthew effect for board seats was evident in 1997 but disappeared by 2010. In 1997, directors who sat on two boards were approximately twice as likely to gain additional board seats as those who sat on only one board, and the same held true for directors on three or more boards. This preference for directors on many boards disappeared during the period of the study, however.

To examine this change and the change in preferential hiring of corporate executives in more detail, I repeated the regression above, but substituted interactions with year dummies instead of with years since 1997 for the measures of corporate executive status and number of boards. This allowed the calculation of coefficients for corporate executive status and number of boards for each year in the study period. To do this, I took the coefficient vector from the regression results and added the coefficient of the interaction term of the independent variable with the year to the base year (1997) coefficient for the independent variable. I also calculated

variances for each of these coefficients by using the covariance matrix with the sum formula for variances:

$$\text{VARIANCE}(a_1 + a_2) = \text{VARIANCE}(a_1) + \text{VARIANCE}(a_2) + 2 \times \text{COV}(a_1, a_2)$$

Three separate variance-weighted least-squares regressions confirm the overall shift in the values of these coefficients over the period of the study. Directors on multiple boards became comparatively less likely to gain additional board seats over time (directors on two boards: $t = -4.38$, $p < 0.0005$; on three or more boards: $t = -4.36$, $p < 0.0005$), and corporate executives became comparatively more likely to gain new board appointments ($t = 2.27$, $p = 0.023$).

Using the yearly coefficients obtained above, Figure 4.1 plots the odds-ratios of joining a new board in the subsequent year for directors with multiple board seats compared to those with one board seat for each year from 1997 to 2009. The variance-weighted least-squares models predict that a director with two board seats in 1997 was 1.85 times more likely than a director with only one board seat to join a new board within the next year, but only 1.08 times more likely in 2009. The predicted change in log-odds for directors on three or more boards was even more drastic. A director on three or more boards was 2.00 times more likely than a director on one board to join a new board within the next year, but became only 0.87 times as likely as a one-board director in 2009. This shift in preference for three or more board directors appears to have occurred abruptly between 2002 and 2003 (see Figure 4.1 right panel).

Insert Figure 4.1 about here

Figure 4.2 shows the trend shift for corporate executives. By 2009, corporate executives were predicted to be 1.32 times more likely than non-executives to gain a new board seat in the subsequent year. Corporate executives became increasingly more preferred, perhaps starting a reverse to the trend of non-executive directors dominating the inner circle.

Insert Figure 4.2 about here

4.6 The Dog That Did Not Bark: The Non-Appearance of New Dominant Directors

The previous section established the breakdown of preferential attachment. By 2010, directors with many board seats no longer enjoyed a Matthew effect and competed equally with those with only one board seat for further board appointments. The model from Chapter 2 suggests that such a change in competitive dynamics should make it more difficult for non-dominants to become dominant. Below, I examine whether this prediction holds: Did the disappearance of preferential attachment lead to the non-appearance of new dominant directors?

During the five years from 1998 to 2012, over a hundred directors each accrued four or more board seats (see black diamonds in Figure 4.3), with Shirley Ann Jackson (the president of

Rensselaer Polytechnic Institute) garnering ten different board appointments[17] within this period, and remaining on eight of these boards in 2002. By contrast, only 25 directors took four or more new board appointments during the period from 2006 to 2010 (see red triangles in Figure 4.3), with four directors collecting five new board appointments. Of these four directors, one (John Malone, the billionaire ex-CEO of TCI) remained on four boards at the end of the period, with two remaining on one board and one on none. Accruing many board seats became much less likely after the early 2000s.

Insert Figure 4.3 about here

To test whether the disappearance of rich-get-richer effects could cause such a shift, I created a Monte Carlo simulation. The simulation starts with the S&P 1500 board composition of 1997. I created unique identifiers for each seat on each company's board, and created a history for each board seat using the S&P 1500 data described in Section 4. If a director resigned from a board in the S&P 1500 data, the corresponding seat was removed from the simulation. If a new director was hired, a new seat was created. If the hired director was new to S&P 1500 board service (i.e., had no prior board appointments), I created a new data entry for the director in the simulation and assigned that director to the new seat. On the other hand, if the director already existed in the system, I randomly assigned a new director to the seat from the set of directors

[17] Sealed Air, Fedex, and Utiliticorp in 2000, Newport News Shipbuilding and USX-Marathon in 2001, AT&T, Keycorp, Medtronic, Public Service Enterprise Group, and U.S. Steel in 2002. She kept her seat on Marathon Oil's board as well as joining U.S. Steel's board when USX-Marathon divested U.S. Steel in 2002. Jackson remained on four of these boards (Medtronic, Public Service Enterprise Group, Fedex, Marathon Oil) until the end of this study's data coverage in 2010, at which time she also served on the board of IBM.

existing in the system. Each director was assigned odds of gaining a new board seat according to his or her characteristics and the rules of the simulation scenario.

Figure 4.4 shows results of the simulation with 1,200 trials for each of two scenarios. In Scenario 1, directors with two board seats were given 1.85 times better odds than directors with one board seat of being hired for an open board seat. Directors with three or more board seats were given 2.00 times better odds. (These odds ratios are those predicted for 1997 by the variation-weighted least-squares regressions described in the previous section.) The odds ratios were held constant throughout the period simulated from 1997 to 2010. This scenario thus models a counterfactual where preferential attachment was constant throughout the period of study. No other factors were considered in calculating the odds of gaining a new board seat in this scenario. Scenario 2 used the same parameters, with one key difference: The Matthew effect was eliminated after 2002. All directors were assigned the same odds of gaining a newly-created board seat from 2003 until the end of the simulated period.

The black lines in Figure 4.4 delineate 95-percentile values (2.5% of observations fall below the bottom line and 2.5% above the top) of the number of directors gaining one, two, three, four, five, and six boards in Scenario 1 from 2006 to 2010 inclusive. The red lines delineate the same 95-percentile range for Scenario 2. The change in micro-dynamics from Scenario 1 to Scenario 2 resulted in a dramatically lower number of directors gaining four or more board seats from 2006 to 2010. The disappearance of the Matthew effect made it more difficult for non-dominants to become dominant.

Insert Figure 4.4 about here

The disappearance of the Matthew effect also decreased the number of dominant directors at the end of the simulated period. Figure 4.5 shows 95-percentile ranges from the simulation for the distribution of number of directors by number of board seats in 2010. The number of directors with four or more board seats was significantly lower for Scenario 2 compared to Scenario 1, and the number of directors with five board seats was an order of magnitude smaller.

Insert Figure 4.5 about here

This effect was also observed in the historical S&P 1500 data. The most-dominant directors disappeared from the interlock network by 2010. In 2000, 17 directors each sat on six or more S&P 1500 boards (Vernon Jordan was on nine) and 44 sat on five. By 2010, no directors sat on six or more boards and only 11 sat on five (see Figure 4.6). Unlike the companies in the model of Chapter 2 or the mutual funds of Chapter 3, dominant directors were not entrenched.

Insert Figure 4.6 about here

An examination of the demographic characteristics of dominants in 2000 explains this divergent outcome. Dominant directors in the interlock network differed from the companies modeled in Chapter 2 and the mutual funds described in Chapter 3 in one critical way—they retired. The median age for directors on six or more boards in 2000 was five years higher (64) than the median age for all directors, and almost all of the most-dominant directors in 1997 retired from board service by 2010. Figure 4.7 plots the age of directors with six or more board

seats in 2001 versus the net number of board seats each of these directors lost over the next eight years, and shows a strong linear relationship (t = 4.76, p = 0.001).

Insert Figure 4.7 about here

This setting thus provides insight into a useful special case for the theory, where non-dominants can no longer rise to dominance, but the dominant fall from dominance. The disappearance of dominants changes the structure of the system. Below, I explore the consequences of a world without network dominants.

4.7 The Interlock Network without Dominant Directors

The disappearance of dominant directors caused a decrease in the connectedness distributions of boards and directors. Figure 4.8 shows the degree distribution for companies in the S&P 1500 corporate interlock network in 2000 and 2010. The average degree decreased from 7.14 in 2000 to 4.98 in 2010. There were 62 companies with more than 20 direct board ties (shared directors) to other companies in 2000 with Sara Lee and Allstate having 37 direct ties each. By 2010, only one company with more than 20 direct ties remained—Marathon Oil with only 21. (See Table 4.4 for a list of the most-connected companies and their number of shared-director ties to other companies in 2000 and 2010.)

Insert Table 4.4 about here

Insert Figure 4.8 about here

The average degree for directors (number of directors sharing boards with the focal

director) declined from 12.32 to 10.95, a smaller drop as the modal director sat on one board

with eight to ten other directors. The connectedness of the most-connected directors decreased

dramatically, however. In 2000, Vernon Jordan sat on the same boards with 101 different S&P

1500 directors. By 2010, the most-connected director (Sam Nunn) had only 53 direct ties. (See

Table 4.5 for a list of the most-connected directors and their number of same-board ties to other

directors in 2000 and 2010.) In 2000, 71 directors had more than 50 direct ties; by 2010 only five

directors had more than 50 ties (Figure 4.9).

Insert Table 4.5 about here

Insert Figure 4.9 about here

The decreased number of direct ties from companies to companies, and changes in the

distribution of ties, led to a structural change in the interlock network. Figure 4.10 shows the

main component of the S&P 500 interlock network in 1996 and 2010. While the main

component still spanned most of the companies in the S&P 500 in 2010, the network as a whole

had become noticeably less densely-connected.

Insert Figure 4.10 about here

This drop in connectedness resulted in increased path lengths between companies. Figure 4.11 shows mean geodesics in the main component of the corporate interlock network connecting the largest U.S. public companies. Average network distances stayed near constant between 1982 and 1999 (Davis et al., 2003), but increased sharply from 2000 to 2010 (this study). The average distance between two companies in the main component of the S&P 500 corporate interlock network increased from 3.21 in 2000 to 4.23 in 2010, while the S&P 1500 mean geodesic increased from 4.16 to 4.97 during the same period. Table 4.6 lists the sizes of the maximal three-step networks in the large U.S. public company network for selected years from 1904 to 2010. Like the most-central companies over the previous 100 years, the company with the largest three-step network in 2000 (Sara Lee) had board ties linking it to over 80% of S&P 500 boards in three steps, and none of the 425 S&P 500 main component companies were more than five steps away from Sara Lee on the corporate interlock network. By contrast, in 2010 United Technologies Company had the largest three-step network, but had barely more than 60% of S&P 500 boards linked within three steps, and it required eight steps to reach all companies in the main component from United Technologies.

Insert Figure 4.11 about here

Insert Table 4.6 about here

4.8 Discussion

As predicted, the disappearance of the Matthew effect in board appointments prevented the appearance of new dominant directors. The U.S. board interlock network's inner circle of dominant (many board) directors was replenished throughout the twentieth century by a rich-get-richer Matthew effect for board seats. Directors on more than one board had an advantage over directors on one board in gaining further board appointments. I find that this advantage disappeared in the early 2000s. The leveling of the playing field for further board appointments prevented the appearance of new dominant directors.

The findings of this chapter present an important special case for the theory of durable dominance. Unlike dominant mutual funds, which remained dominant for long periods of time, dominant directors could not maintain their dominance. They grew old and retired from board service. The inner circle of dominant directors disappeared, and the macro-structure of the interlock network changed in striking—and historically unprecedented—ways. There is no longer a cohesive network of corporate board directors in the United States.

The United States without a Broad-Based Cohesive Corporate Elite

Where did the elite who previously congregated on the interlock network go? Does a cohesive elite still exist in the United States? Mizruchi (2013) asserts that a moderate, highly-connected and influential core of business leaders—the corporate elite—continually existed from the early twentieth century, but disappeared in the 1990s. In his view, an "active state, powerful

labor, and a financial community whose interests transcended those of particular firms or sectors" forced the corporate elite to unite and defend the corporate system. In the 1980s, the moderating influences of the state, labor and commercial banks were weakened, and instead "shareholder value" became the dominant logic (Zajac and Westphal, 2004). Institutional investors (Useem, 1996), financial analysts (Dobbin and Zorn, 2005) and the capital market itself (Davis, 2009) came to exert control on CEOs and directors. On one hand, the corporate elite had won the war, and the U.S. corporate system had become a taken-for-granted institution, an ideological tautology. Attempts by lenders, labor, or government to place restrictions on corporations were now deemed ill-advised, even unpatriotic. On the other hand, the new shareholder value master proved to be a tyrant. Public company CEOs lost job security, and found themselves scrambling to survive individually by capturing more market value for their individual firms. The corporate elite no longer had the motivation nor the ability to band together to defend their interests as a class. If there is no longer a cohesive elite in the United States, we are left with a puzzle: What maintains the large and growing gap between the wealthiest (often owners and managers of large corporations) in U.S. society and everyone else (cf. Chu and Mizruchi, in press)?

One possibility is that the elite have found new, more hospitable enclaves, protected from non-elite entry and hidden from public scrutiny. Davis (2013) suggests that public corporations are losing their central place in the American economy, finding that the number of listed companies in the U.S. dropped by more than half between 1997 and 2012, as the number of de-listings consistently outpaced the number of companies going public. Moreover, companies going public recently have adopted market-hostile governance structures, giving their founders super-voting rights that ensure their control. (The three founders of Groupon, for instance, hold

stakes giving them 150 votes per share; Mark Zuckerberg personally controls an absolute majority of Facebook's voting rights.) It is possible that the public corporation as we know it is an artifact of the twentieth century, and thus those who control corporations are no longer society's elites.

Another, non-exclusive possibility is that a smaller, still cohesive, and powerful corporate elite still exists, bound together by board, business, and social links. Members of this elite may no longer sit on many boards, but are still individually powerful and connected to powerful others. This elite group may no longer be tied to the broad interests of business, however, and instead be primarily concerned with the welfare of a much smaller segment of society. The disappearance of a climbable ladder into the inner circle for new directors isolates this smaller elite group, and prevents circulation into this elite from the broader pool of corporate directors.

Figure 4.1:
Odds-Ratios for Multiple-Board Directors of Gaining a New Board Appointment
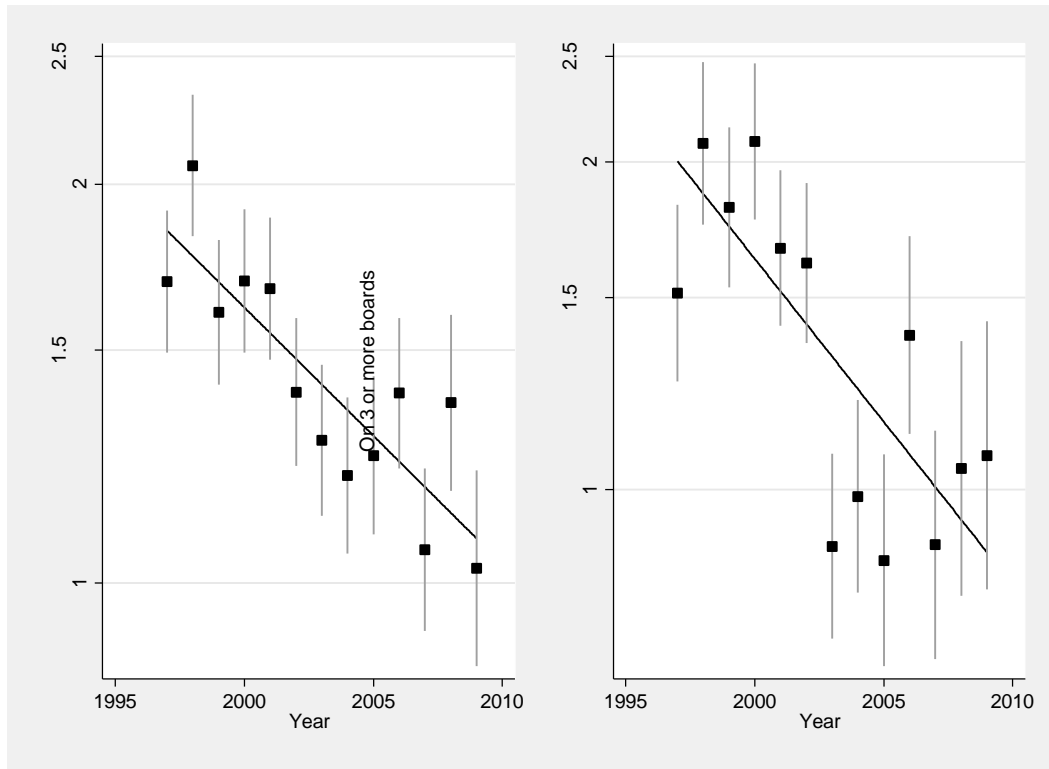
The points are the observed odds-ratios for multiple-board directors compared to directors on one board of gaining a new board seat in the next year for each year, the error bars are standard errors in these odds-ratios, and the lines are predictions of a variance-weighted least squares regression. The y-axis is log-scaled.

Figure 4.2:
Odds-Ratios for Corporate Executive Directors of Gaining a New Board Appointment
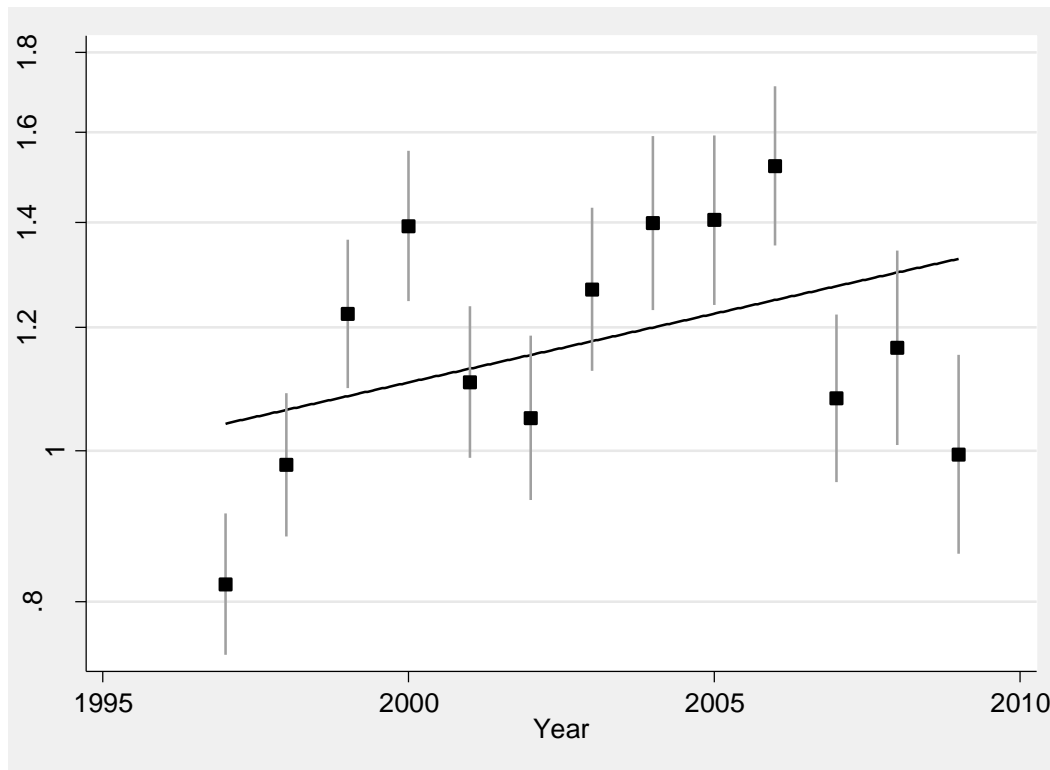
The points are the observed odds-ratios for corporate executive directors compared to non-executive directors gaining a new board seat in the next year for each year, the error bars are standard errors in these odds-ratios, and the lines are predictions of a variance-weighted least squares regression. The y-axis is log-scaled.

Figure 4.3: Distribution of Directors by Number of Board Seats Gained Over 5 Years
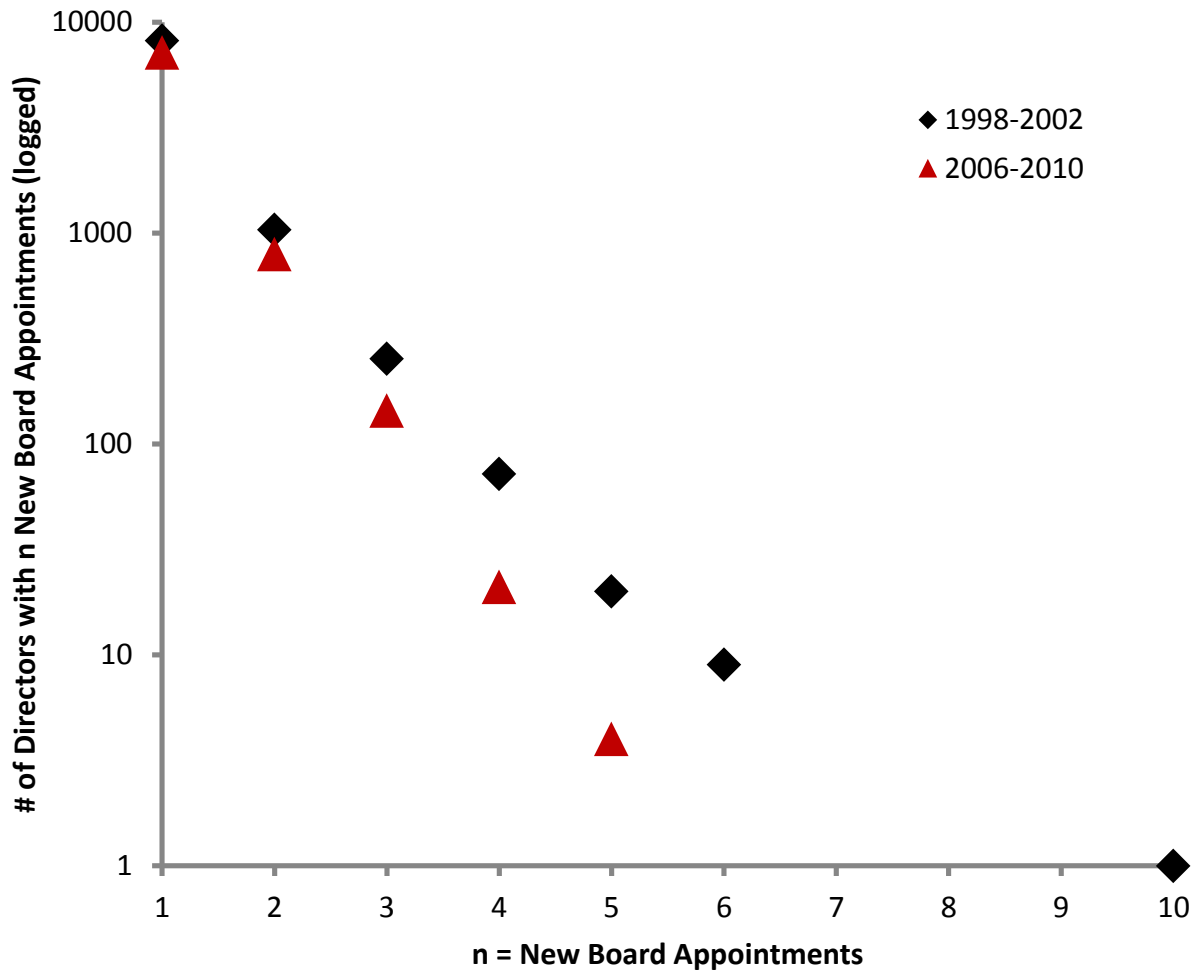
Black diamonds indicate distribution of number of new board seats gained over the five-year period from 1998 to 2002 inclusive. Shirley Ann Jackson gained ten new board appointments during this time. Red triangles indicate same distribution for the five-year period from 2006 to 2010 inclusive.

Figure 4.4: Simulation Results for Number of Board Seats Gained, 2006–2010
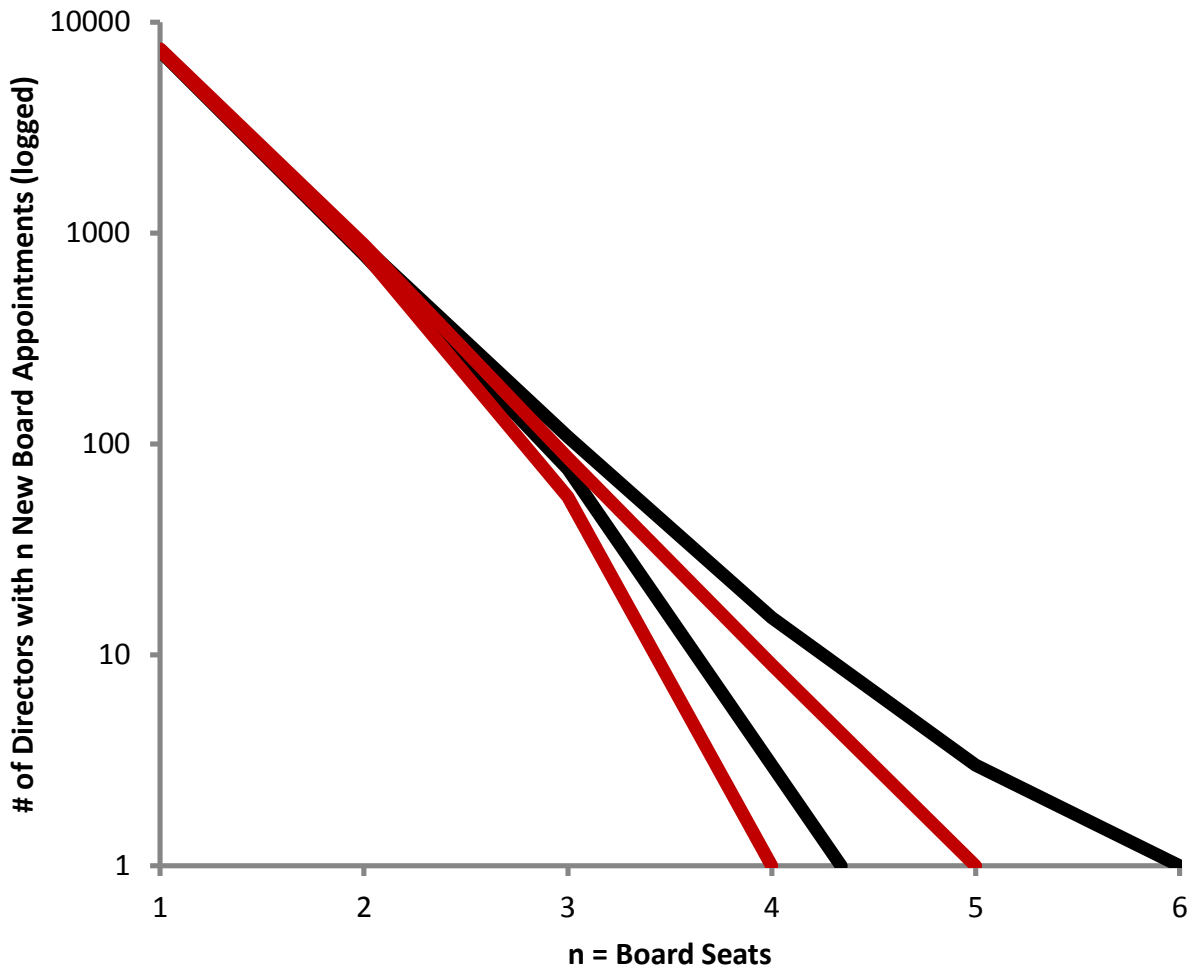
Results from 1200 trials of each scenario. Black lines delineate the 95% confidence interval for number of boards gained from 2006 to 2010 for Scenario 1, where the Matthew effect applied throughout the simulation period. Red lines delineate the 95% confidence interval for Scenario 2, where the Matthew effect disappeared after 2002. The number of directors gaining four or more board seats was significantly lower for Scenario 2 compared to Scenario 1. The lower (2.5 percentile) bound line for Scenario 1 was projected down to the x-axis.

Figure 4.5: Simulated Distributions of Directors by Number of S&P 1500 Board Seats
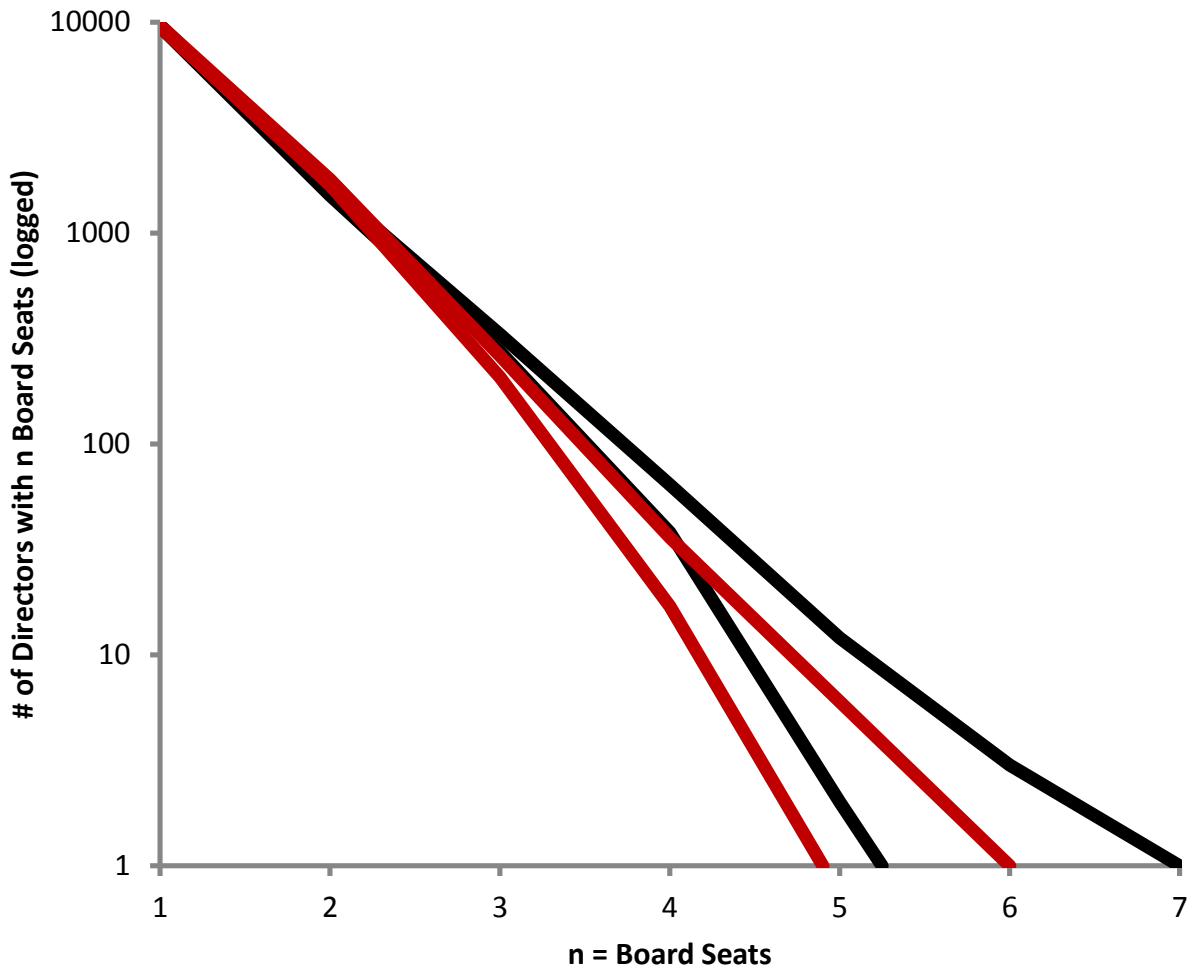
Results from 1200 trials of each scenario. Black lines delineate the 95% confidence interval for number of board seats in 2010 for Scenario 1, where the Matthew effect applied throughout the simulation period. Red lines delineate the 95% confidence interval for Scenario 2, where the Matthew effect disappeared after 2002.The number of directors with four or more board seats in 2010 was significantly lower for Scenario 2 compared to Scenario 1. The lower (2.5 percentile) bound lines were projected down to the x-axis.

Figure 4.6: Distribution of Directors by Number of S&P 1500 Board Seats, 2000 and 2010
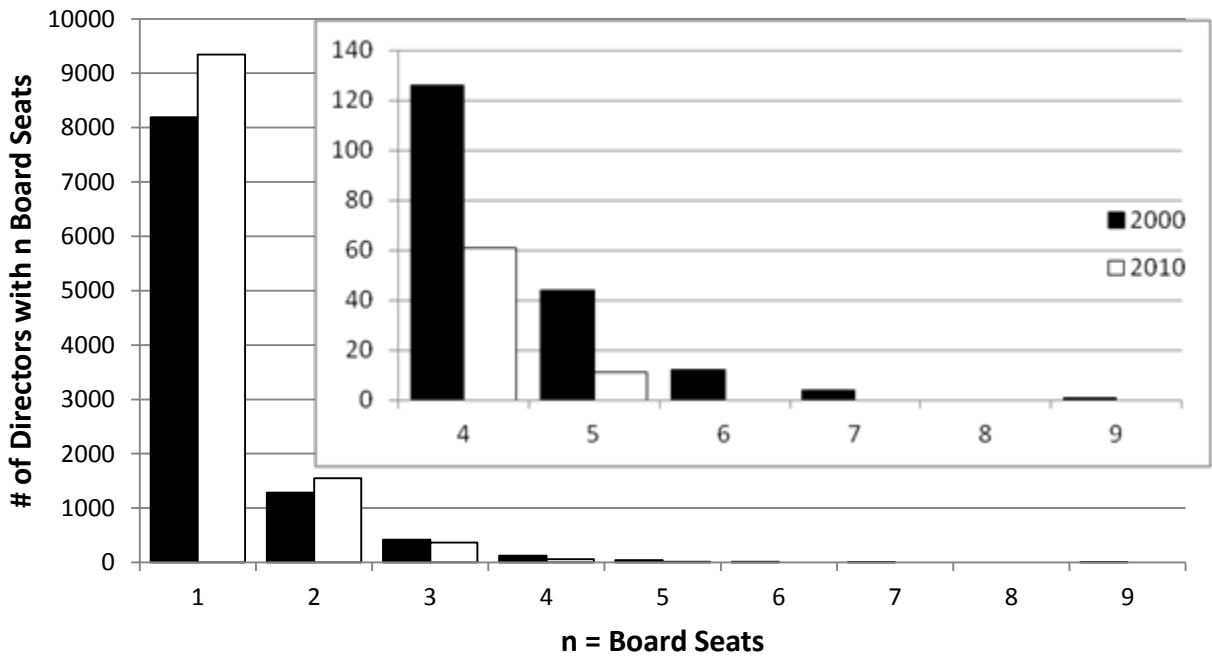
Inset shows detail for directors with four or more board seats.

Figure 4.7: Net Loss of Board Seats by Age for Directors with 6+ Board Seats in 2001
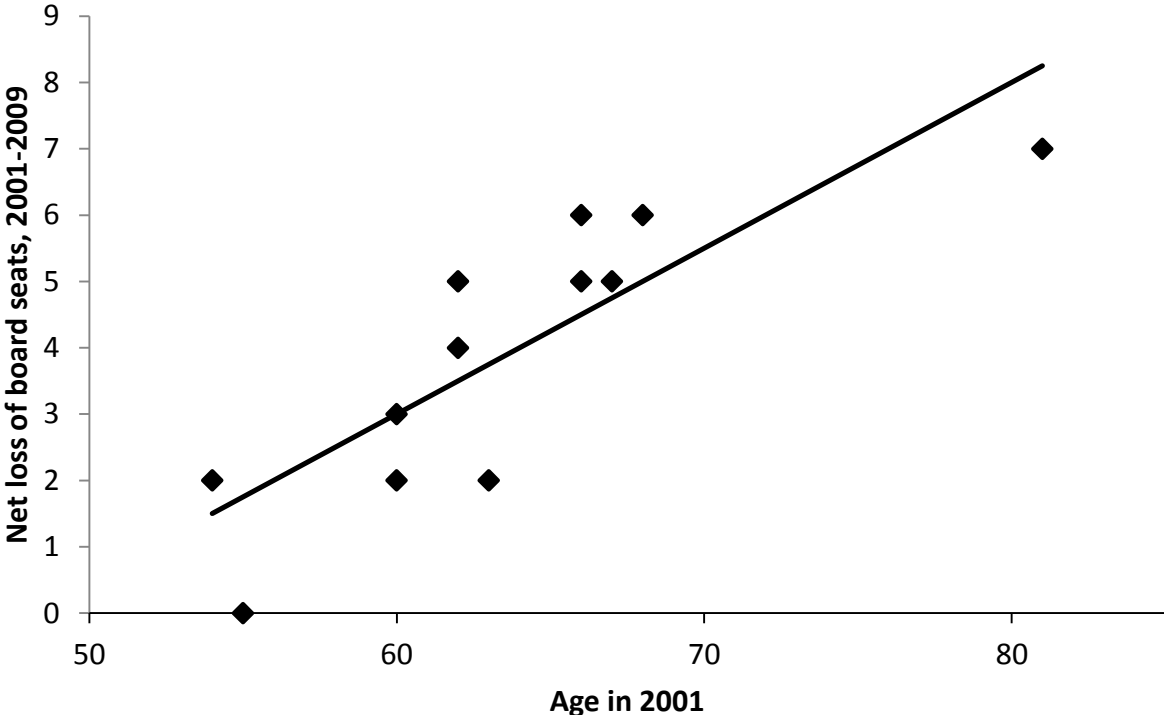
The line is the prediction of an ordinary least-squares regression.

Figure 4.8: Degree Distributions for S&P 1500 Companies, 2000 and 2010
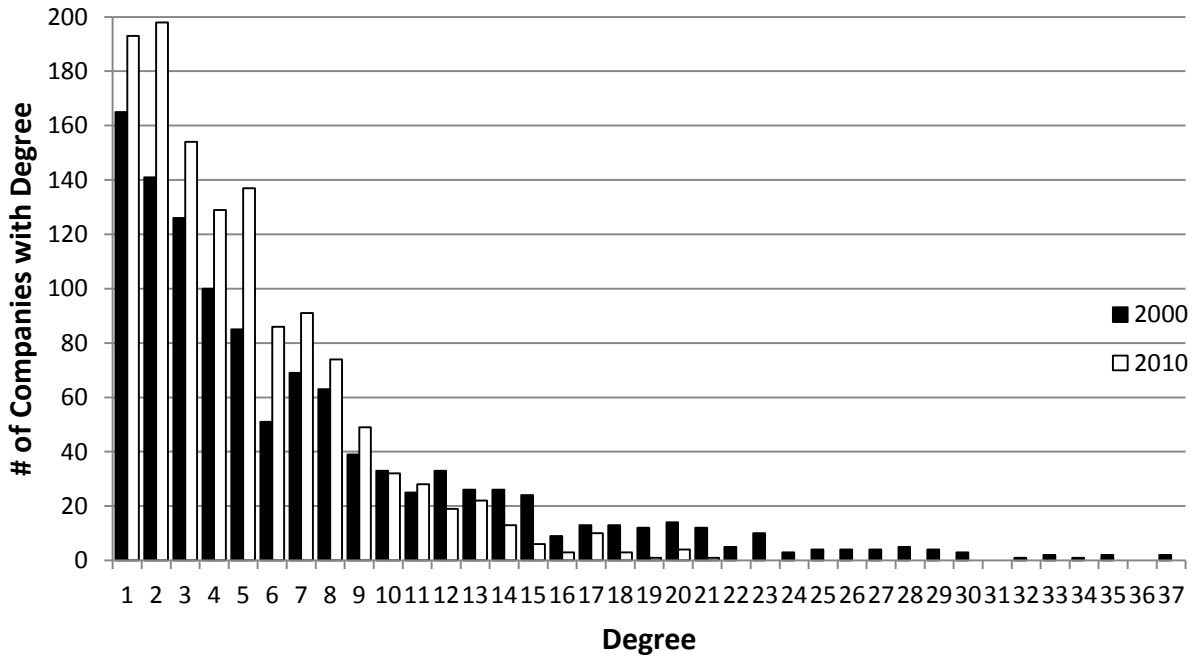
Figure 4.9: Degree Distributions for S&P 1500 Directors, 2000 and 2010
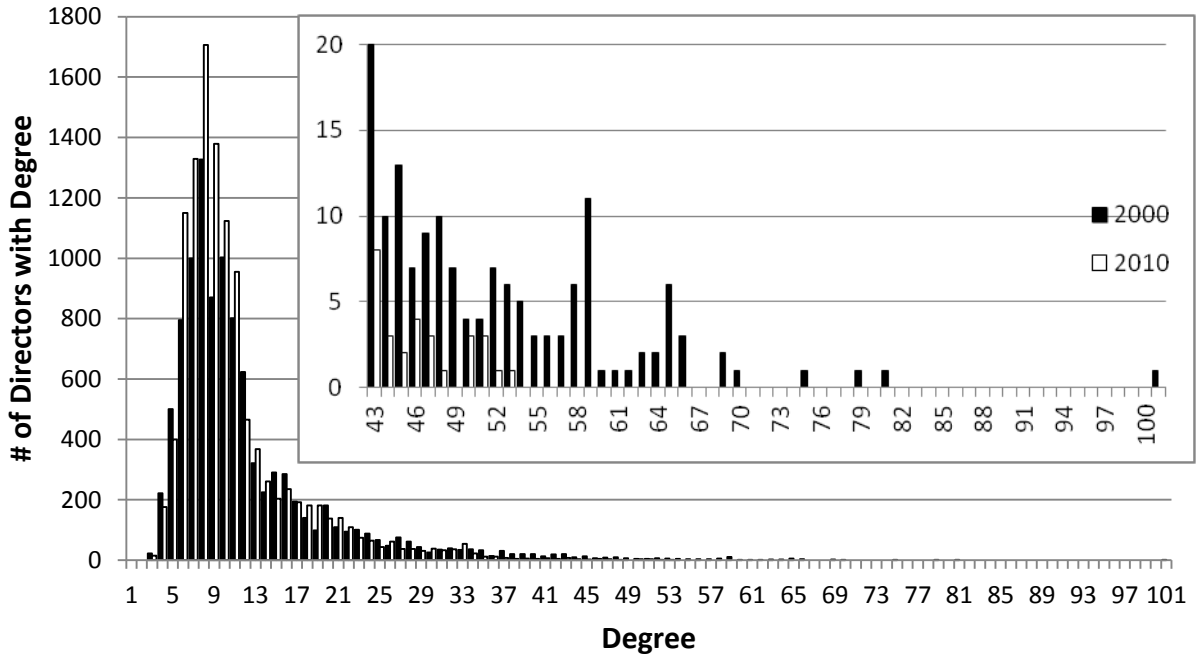
Inset shows detail for directors sitting on the same boards with 43 or more other directors.

Figure 4.10: S&P 500 Interlock Network, 1996 and 2010
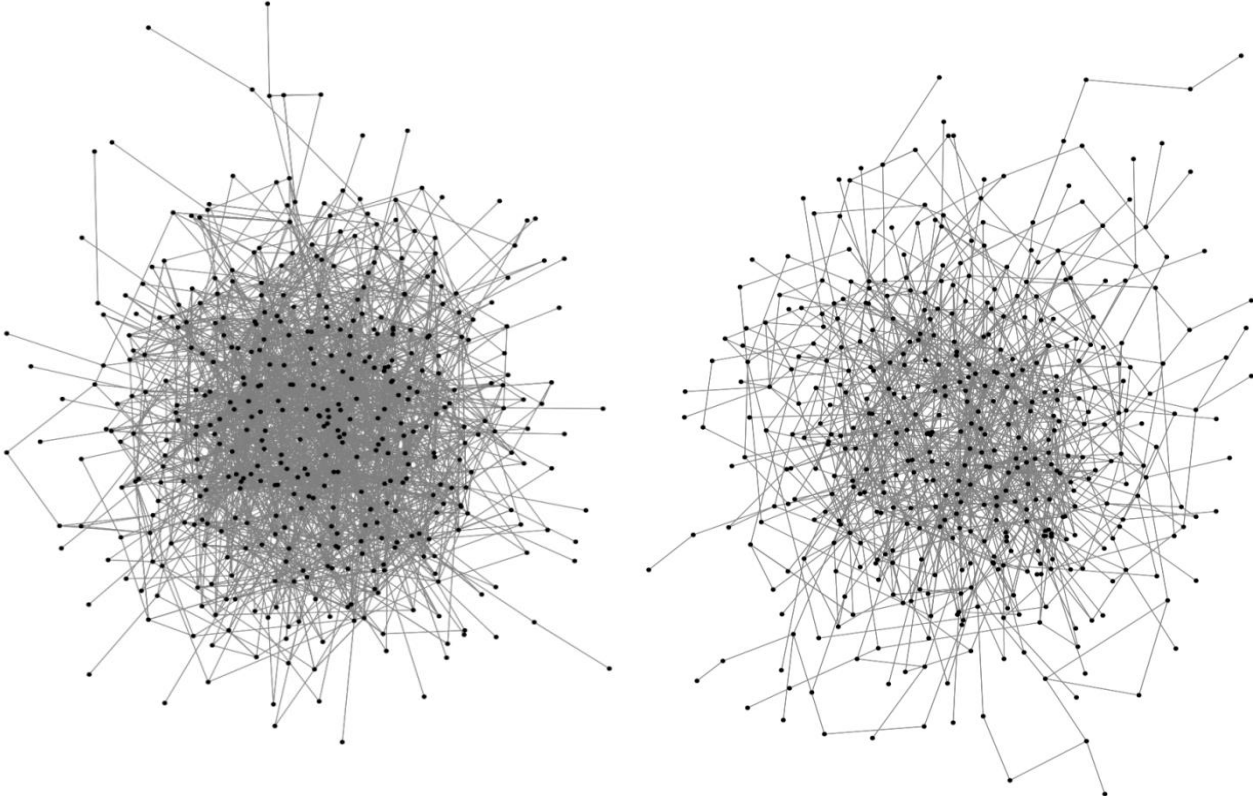
Left figure is main component in 1996, right in 2010.

Figure 4.11: Mean Geodesic in Main Component of Board Interlock Networks, 1982-2010
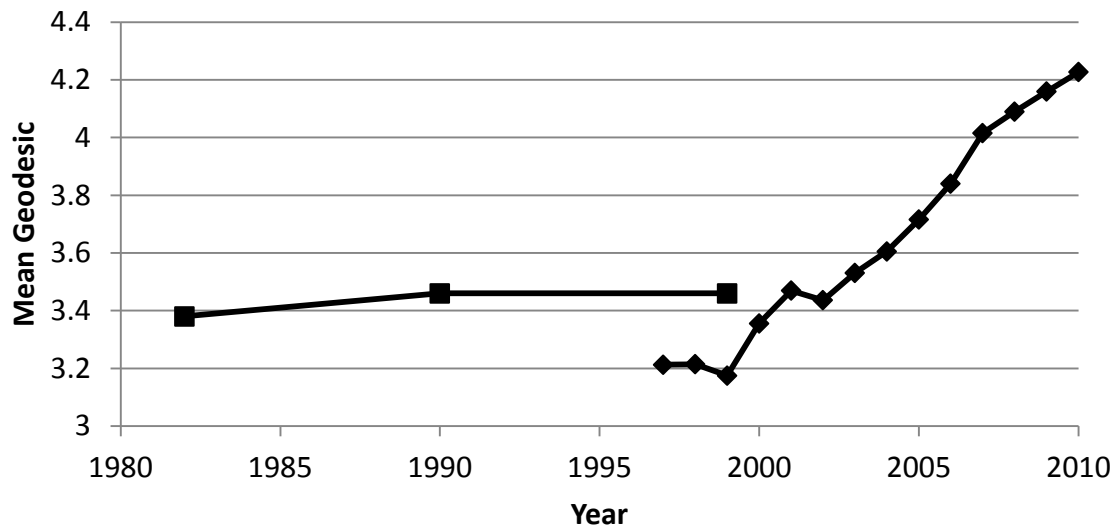
1982-1999 data from Davis et al. (2003); 1997-2010 this study; study population differs across the sources.

Table 4.1: Data Descriptions

Variable	Description
Years since 1997	The data year minus 1997.
Age & age^2	RiskMetrics lists age as of the date of the proxy statement while Boardex lists age as of the data of data access. RiskMetrics often has conflicting age information for the same director. I converted each RiskMetrics age entry into age as of end of 2010, and then took the modal age if the ages listed for a director differed by less than two years for all pairs of entries. For those entries where there was no modal age or the difference between a pair of ages listed was greater than two years, I examined and corrected the entries manually, often using web searches to check birthdates and ages. Boardex data is as of late 2010. For cases where Boardex and corrected RiskMetrics ages differed by more than two years, I again corrected entries manually. Where Boardex and RiskMetrics ages differed but by no more than two years, Boardex-listed ages were used in the final dataset.
Maximum number of employees (logged)	For each director, I selected the largest company (by number of employees) whose board the director sat on during the focal year, and took the log of the number of employees. Preliminary analyses showed that using the largest company value instead of a median or average value has better predictive power. These analyses also showed that number of employees is a better predictor of additional board seats than company market value.
Maximum annual return	For each director, I selected the best performing company (by total annual market return) whose board the director sat on during the focal year. Preliminary analyses showed that using the largest company value instead of a median or average value has better predictive power. These analyses also showed that company market return is a better predictor of additional board seats than industry-standardized ROA or ROE.
Female director	Coded 1 for female directors. Data on gender came from both RiskMetrics and Boardex. First, in cases where RiskMetrics had conflicting listings of a director's gender, I examined and corrected RiskMetrics data manually, using web searches to confirm the gender of the director in question. Second, I cross-checked gender between Boardex and RiskMetrics. Where there were discrepancies, I again manually corrected the entries.

Minority director	Coded 1 for non-white directors. Ethnicity data came from RiskMetrics. RiskMetrics often lists conflicting ethnicity information for the same director in different years or on different boards. If one ethnicity was listed more than 75% of the time for a director, I used that ethnicity for the director. For each director for whom there was no such dominant ethnicity identification, I examined and determined the ethnicity manually, often using web searches to confirm the ethnicity of the director in question.
Social elite director	Directors were coded as a member of the social elite if they were white, male and had an educational affiliation with Harvard, Yale, Princeton, or Stanford listed in Boardex. Ethnicity, gender and elite education credentials have been shown to correspond with social elite membership (e.g., Useem and Karabel, 1986). The correlation between these demographic markers and elite membership is far from perfect, but is reasonable for directors during the period under study.
Corporate executive	Directors were identified as corporate executives in a given year if they were listed in RiskMetrics as being an employee director for a firm. Occasionally, directors may not be on the board of their employer, but sit only on an outside board or boards. These cases are not captured in the data.
Director degree centrality	Degree centrality measures for directors were calculated by flattening the bimodal data to create director-director networks for each year. Two directors are linked if they serve on the same board.
Director eigenvector centrality	Eigenvector centrality measures for directors were calculated by flattening the bimodal data to create director-director networks for each year. Two directors are linked if they serve on the same board.
# of non-overlapping boards served on by peer directors	For the measure of peer director reach, I calculated the number of non-overlapping boards each director's peer directors sat on for each year, excluding any boards the focal director also sat on.
Number of board seats held by director	The number of board seats held by the director in the focal year.
Joined board next year?	Coded 1 if a director joined a new S&P 1500 board in the following calendar year.

Table 4.2: Descriptive Statistics and Correlation Coefficients

Variable	Mean	S.D.	1	2	3	4	5
1. Years since 1997	6.10	3.75					
2. Age	59.82	8.62	-0.03				
3. Age^2	3652.65	1031.28	-0.16	1.00			
4. Maximum number of employees (logged)	3.97	0.69	-0.07	0.03	0.02		
5. Maximum annual return	12.55	55.57	-0.09	0.01	0.00	0.05	
6. Female director? (1 = yes)	0.11	0.31	-0.08	-0.18	-0.18	0.07	0.00
7. Minority director? (1 = yes)	0.08	0.27	0.02	-0.11	-0.11	0.09	0.01
8. Social elite director? (1 = yes)	0.13	0.34	0.05	0.04	0.04	0.04	0.02
9. Corporate executive? (1 = yes)	0.23	0.42	0.05	-0.26	-0.26	0.02	0.01
10. Director degree centrality	12.52	7.85	0.01	0.07	0.06	0.46	0.15
11. Director eigenvector centrality	0.00	0.01	-0.01	0.01	0.01	0.19	0.03
12. # of non-overlapping boards for peer directors	8.15	9.93	0.09	0.04	0.03	0.53	0.11
13. Number of board seats held by director*	1.29	0.58	0.09	0.05	0.04	0.38	0.18
14. Joined new board next year? (1 = yes)	0.06	0.24	-0.05	-0.07	-0.07	0.08	0.02

Variable	6	7	8	9	10	11	12	13
8. Social elite director? (1 = yes)	-0.17	-0.14						
9. Corporate executive? (1 = yes)	-0.16	-0.10	0.01					
10. Director degree centrality	0.05	0.09	0.04	0.04				
11. Director eigenvector centrality	0.01	0.03	0.01	0.02	0.38			
12. # of non-overlapping boards for peer directors	0.05	0.09	0.06	0.06	0.81	0.38		
13. Number of board seats held by director*	0.03	0.06	0.07	0.07	0.85	0.21	0.67	
14. Joined new board next year? (1 = yes)	0.02	0.03	0.02	0.03	0.09	0.04	0.12	0.09

Number of board seats coded as an ordinal variable, with value 3 for three or more boards.

Table 4.3: Log-Odds of Director Gaining a New Board Appointment in Next Year

Random effects panel logistic regression.

	DV = join board next year			DV = join survivor panel board
	Model 1	**Model 2**	**Model 3**	**Model 4**
Years since 1997	-0.187	0.188	0.167	-1.059**
	(-0.91)	(1.01)	(0.83)	(-2.75)
Age	0.351***	0.428***	0.405***	0.496***
	(7.58)	(9.95)	(8.79)	(5.84)
Age^2	-0.003***	-0.004***	-0.004***	-0.005***
	(-8.37)	(-10.62)	(-9.39)	(-6.48)
Maximum number of employees (logged)	0.203***	0.683***	0.594***	0.190*
	(3.88)	(16.73)	(13.54)	(2.37)
Maximum annual return	0.001	0.002***	0.002***	0.000
	(1.21)	(3.97)	(3.35)	(0.17)
Female director	-0.019		0.075	0.166
	(-0.20)		(0.81)	(1.24)
Minority director	0.388***		0.500***	0.666***
	(3.88)		(5.05)	(5.00)
Social elite director	0.307***		0.412***	0.164
	(4.31)		(5.84)	(1.48)
Corporate executive	-0.182**		-0.071	0.154
	(-2.82)		(-1.11)	(1.61)
Director degree centrality	-0.030***			-0.032***
	(-4.66)			(-3.34)
Director eigenvector centrality	-2.562			-7.200
	(-0.94)			(-1.50)
# of boards served by peer directors	0.033***			0.039***
	(9.68)			(7.76)
Number of board seats held by director (n=2)	0.607***			0.626***
	(7.42)			(5.05)
Number of board seats held by director (n≥3)	0.656***			0.675**
	(4.38)			(3.04)
(Years since 1997) x				
Age	0.005	-0.004	-0.002	0.032*
	(0.70)	(-0.60)	(-0.22)	(2.40)
Age^2	-0.000	0.000	0.000	-0.000*
	(-0.67)	(0.48)	(0.07)	(-2.27)
Maximum number of employees (logged)	0.005	-0.030***	-0.037***	0.025*
	(0.62)	(-5.29)	(-5.90)	(2.17)
Maximum annual return	-0.000	-0.000*	-0.000*	-0.000

	(-0.19)	(-2.25)	(-2.11)	(-0.18)
Female director	0.012		0.001	-0.010
	(0.98)		(0.07)	(-0.51)
Minority director	-0.021		-0.034*	-0.037
	(-1.56)		(-2.54)	(-1.93)
Social elite director	-0.013		-0.023*	-0.011
	(-1.30)		(-2.23)	(-0.67)
Corporate executive	0.021*		0.010	0.025
	(2.14)		(1.03)	(1.72)
Director degree centrality	-0.001			0.000
	(-1.19)			(0.07)
Director eigenvector centrality	-0.008			-0.202
	(-0.02)			(-0.22)
# of boards served by peer directors	-0.000			0.001
	(-0.28)			(0.71)
Number of board seats held by director (n=2)	-0.043**			-0.054**
	(-3.28)			(-2.66)
Number of board seats held by director (n≥3)	-0.063*			-0.112**
	(-2.48)			(-2.83)

Year coefficients not shown.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$. All tests two-tailed.

Table 4.4: Top-25 Degree Centrality Companies in S&P 1500 Interlock Network

Year 2000

Rank	Degree	Company
1	37	SARA LEE
1	37	ALLSTATE
3	35	BANK OF AMERICA
3	35	SBC COMMUNICATIONS
5	34	BELL ATLANTIC
6	33	CHASE MANHATTAN
6	33	SCHERING-PLOUGH
8	32	EXXONMOBIL
9	30	XEROX
9	30	EQUIFAX
9	30	HONEYWELL INTERNATIONAL
12	29	AMR
12	29	BANK ONE
12	29	SUNTRUST BANKS
12	29	KROGER
16	28	PROTECTIVE LIFE
16	28	KMART
16	28	VULCAN MATERIALS
16	28	BELLSOUTH
16	28	MINNESOTA MINING & MANUFACTURING (3M)
21	27	PROCTER & GAMBLE
21	27	AT&T
21	27	UNION CARBIDE
21	27	FLEET BOSTON
25	26	PEPSICO
25	26	AON
25	26	SPRINGS INDUSTRIES
25	26	SUNOCO

Year 2010

Rank	Degree	Company
1	21	MARATHON OIL CORPORATION
2	20	NORTHERN TRUST CORPORATION
2	20	STANLEY BLACK & DECKER, INC.
2	20	H. J. HEINZ COMPANY
2	20	LOWE'S COMPANIES, INC.
6	19	THE PROGRESSIVE CORPORATION
7	18	CATERPILLAR INC.
7	18	AON CORPORATION
7	18	SUNTRUST BANKS, INC.
10	17	PRUDENTIAL FINANCIAL, INC.
10	17	THE PNC FINANCIAL SERVICES GROUP, INC.
10	17	INTERNATIONAL BUSINESS MACHINES CORP
10	17	KEYCORP
10	17	UNITED TECHNOLOGIES CORPORATION
10	17	CHEVRON CORPORATION
10	17	WELLS FARGO & COMPANY
10	17	MCDONALD'S CORPORATION
10	17	FMC TECHNOLOGIES, INC.
10	17	PFIZER INC.
20	16	SPRINT NEXTEL CORPORATION
20	16	THE BANK OF NEW YORK MELLON CORP
20	16	ENPRO INDUSTRIES, INC.
23	15	ELI LILLY AND COMPANY
23	15	MEADWESTVACO CORPORATION
23	15	NORTHROP GRUMMAN CORPORATION
23	15	DEERE & COMPANY
23	15	3M COMPANY
23	15	QWEST COMMUNICATIONS INTERNATIONAL

Table 4.5: Top-25 Degree Centrality Directors in S&P 1500 Interlock Network

Year 2000

Rank	Degree	Director	Age	Gender	Ethnicity
1	101	VERNON E JORDAN JR	65	Male	Black
2	81	RONALD L KUEHN JR	64	Male	White
3	79	JOHN L CLENDENIN	65	Male	White
4	75	EDWARD E WHITACRE JR	58	Male	White
5	70	WILLIE D DAVIS	66	Male	Black
6	69	ELAINE L CHAO	46	Female	Asian
6	69	CHARLES F KNIGHT	64	Male	White
8	66	LOUIS W SULLIVAN	66	Male	Black
8	66	CHARLES W COKER	67	Male	White
8	66	SAM NUNN	62	Male	White
11	65	JOHN W SNOW	60	Male	White
11	65	STEPHEN R HARDIS	64	Male	White
11	65	GEORGE J MITCHELL	66	Male	White
11	65	LYNN M MARTIN	60	Female	White
11	65	FRANK S ROYAL	60	Male	Black
11	65	JACQUELYN M WARD	62	Female	White
17	64	HANS W BECHERER	64	Male	White
17	64	ANN M KOROLOGOS	58	Female	White
19	63	IVAN G SEIDENBERG	53	Male	White
19	63	JAMES F HARDYMON	65	Male	White
21	62	MARY JOHNSTON EVANS	70	Female	White
22	61	ALAN T DICKSON	68	Male	White
23	60	BRIAN H ROWE	69	Male	White
24	59	ROBERT P LUCIANO	66	Male	White
24	59	JOHN R STAFFORD	62	Male	White
24	59	JOHN G BREEN	66	Male	White
24	59	DONALD F MCHENRY	63	Male	Black
24	59	DONALD V FITES	66	Male	White
24	59	BOBBY R INMAN	69	Male	White
24	59	PAUL FULTON	65	Male	White
24	59	LEONARD S COLEMAN	50	Male	White
24	59	FRANKLIN A THOMAS	65	Male	Black
24	59	RAY J GROVES	64	Male	White
24	59	ROZANNE L RIDGWAY	65	Female	White

Year 2010

Rank	Degree	Director	Age	Gender	Ethnicity
1	53	SAM NUNN	72	Male	White
2	52	EDUARDO MENASCE	66	Male	White
3	51	FREDERIC V SALERNO	67	Male	White
3	51	ROBERT L RYAN	66	Male	Black
3	51	SHIRLEY A JACKSON	63	Female	Black
6	50	DENNIS H CHOOKASZIAN	66	Male	White
6	50	ARTHUR C MARTINEZ	70	Male	White
6	50	ENRIQUE HERNANDEZ JR	54	Male	Hispanic
9	48	RICHARD J SWIFT	65	Male	White
10	47	EDWARD J MOONEY	69	Male	White
10	47	THOMAS J USHER	67	Male	White
10	47	JAMES H HANCE JR.	66	Male	White
13	46	KENNETH M DUBERSTEIN	65	Male	White
13	46	BARRY DILLER	68	Male	White
13	46	RICHARD B MYERS	68	Male	White
13	46	WILLIAM H. GRAY III	69	Male	Black
17	45	STEVEN S REINEMUND	61	Male	White
17	45	MANUEL A FERNANDEZ	63	Male	Hispanic
19	44	J MICHAEL LOSH	64	Male	White
19	44	HANSEL E TOOKES II	63	Male	Black
19	44	LAURA D'ANDREA TYSON	63	Female	White
22	43	CHARLES R LEE	70	Male	White
22	43	JAMES H BLANCHARD	68	Male	White
22	43	ROBERT T BRADY	70	Male	White
22	43	R DAVID HOOVER	64	Male	White
22	43	KRISS CLONINGER III	62	Male	White
22	43	CHARLENE BARSHEFSKY	60	Female	White
22	43	JOHN C. MALONE	70	Male	White
22	43	VIRGIS W. COLBERT	71	Male	Black

Table 4.6: Characteristics of the Board Interlock Network, 1912-2010

Characteristic	1904	1912	1919	1935	1964	1969	1974	1999	2000	2010
Number of connected firms	154	140	143	145	153	153	145	811	425	440
3-step reach of most central corporation (%)	90.9	81.9	85.5	80.7	90.4	91.0	84.9	82.4	84.2	60.9
Directors on 6 or more boards	24	27	14	3	4	2	0	*	8	0

† 1904-1974 data from Mizruchi (1982: 105-108); 1999 from Davis et al. (2003: 320); 2000-2010 this study; study population differs across the three sources.

* Data not available in source article.

Chapter 5:

Discussion

5.1 Overall Summary

The central premise of this dissertation is that increased competition and more level competition benefit and entrench dominants, by preventing non-dominants from rising to dominance. Chapter 2 presented a simple model showing that this proposition is plausible. Chapters 3 and 4 presented empirical support for this proposition in two very different contexts—mutual funds competing for investor dollars and S&P 1500 directors accruing board seats. In the former context, the entry of similar new funds disadvantaged the vast majority of incumbent funds, but dominant funds (those with an order of magnitude more assets under management than other funds with similar portfolios) benefited tremendously from new competitive entry. New competitive entry increased flows of investor funds to dominant funds and increased the probability that the dominant fund would stay dominant over long time periods. In the latter context, the leveling of the playing field in board hiring made it difficult for non-dominant directors to rise to dominance. Directors already sitting on many boards were more likely to gain additional board seats compared to directors on one board in the twentieth century, but this advantage disappeared in the early 200s. This shift in the micro-dynamics of director hiring prevented new directors from accumulating many board seats. As dominant directors retired from board service, no new dominants took their place, and the century-old inner circle of U.S. corporate governance disappeared.

Further investigations, both empirical and theoretical, are called for to help answer two remaining questions about the proposed theory. First, does this relationship between competition and entrenched dominance hold generally across many contexts—what are the boundary conditions for the occurrence of durable dominance? Second, how consequential are processes of durable dominance in shaping outcomes?

5.2 Thoughts on the General Validity of the Theory

Empirical Generalizability

The general validity of the theory can be—and needs to be—established in two ways: empirically and theoretically. Further empirical investigations may look at other settings where dominants have maintained dominance in the face of increased competition or more level rules of competition. Such settings could include the entrenched dominance of the top Hollywood movie stars of the early 1990s. These stars (e.g., Tom Cruise, Brad Pitt, Julia Roberts) have maintained the ability to garner starring roles in feature films for an unprecedentedly long period, even as the number of newly-minted starring actors has soared. Top music acts of the early 1990s (e.g., Radiohead) also maintain their dominance today. Another setting of interest is the market for academic ideas, where it appears that old theories established before explosive growth in the number of publishing scholars and yearly published papers tend to remain canonical field-wide theories, while newer theories have only parochial impact. Study of industry settings such as the U.S. beer market, where Anheuser-Busch products maintain dominance even though (or because of) an explosion of new craft-beer entrants, may also provide useful insight into the dynamics of durable dominance.

Going beyond settings where entrenched dominants are easily identified, further research also needs to establish boundary conditions for the appearance of durable dominance. This can be through comparative case studies or by large-n regressions using large panel datasets. A case study comparing Google's competitive actions in the web application market and its actions in the smart phone market could yield takeaways on when a policy of fostering smaller competitors can work to a company's advantage, for example. In the former market, Google was dominant and remains dominant while maintaining a policy of fostering small entrepreneurial startups. In the latter market, Google followed a similar strategy of fostering new smart phone manufacturers. Apple rather than Google was dominant at the beginning of this strategy, and remains so. Studying industries characterized by waves of disruptive innovation, such as the hard disk drive and steel industries (Christensen, 1997) could also yield important insights. Do processes of durable dominance act even in industries characterized by disruptive innovation (after all, Seagate still ships $15 billion of hard disk drives per year)? How do processes of durable dominance and disruptive innovation interact?

Large-n panel studies examining industries over time would help develop a better understanding of the boundary conditions for processes of durable dominance. Within-industry studies of industries that are segmented geographically and thus have differing rates of new entry could provide support for (or evidence against) the proposed theory. Localized changes in legislation that level the playing field between large and small could provide useful cross-sectional variation to test the theory. Between-industry studies would help establish boundary conditions for the theory's validity.

The predictions of the theory may also be applicable to natural and physical systems. Consider an example from population genetics: predicting how long an allele remains the most-

frequent allele in a population subject to mutations. Established theory addresses a related question, and argues that the higher the mutation rate the less likely the most frequent allele is to be the oldest (Watterson and Guess, 1977). This dissertation's theory suggests this should hold true only when the mutation rate is below a critical threshold. If there is no mutation and a highly-skewed initial distribution of allele frequencies, then the most-frequent allele at the beginning of the study will remain most frequent indefinitely. As mutation rates increase from zero, the probability of a different allele becoming most frequent will increase, as Watterson and Guess (1977) predict. If mutation rates increase past a critical point, however, the probability of a new allele outnumbering the initially most-frequent allele becomes negligible. Less frequent alleles are more likely to be mutated out of existence than the most-frequent allele. The most-frequent allele becomes, in this dissertation's parlance, durably dominant[18]. This prediction could be tested in a petri dish.

Theoretical Generalizability: Laws versus Mechanisms

If the causal relationship between increased and more level competition and dominant entrenchment is observed consistently in a wide range of settings, including non-social systems, this would suggest that the theory of durable dominance may be somewhat more than a mechanism (a "sometimes-true" theory [Coleman, 1964: 516]) and closer to a social "law"—a most-often-true theory. Law-based theorizing has fallen out of favor among organizational scholars, but I argue below that this mode of theory-building is sometimes useful.

---

[18] If you keep increasing the mutation rate even more, even the most-frequent allele will be mutated too often to maintain its numbers. The most-frequent allele will change often, and will only be represented in a small portion of the population.

Davis and Marquis (2005) advocate for mechanism-based theorizing as the mode of scholarship best suited to advance organization theory in a world characterized by constant change. They argue that, "The notion of a 'theory of organizations' now seems like naïve scientism, like a theory of diesel trucks, or a theory of hitchhiking. Organizations simply are not the kind of thing amenable to general theory." (Davis and Marquis, 2005: 335) This argument makes sense. Social scientists striving to understand complicated social phenomena benefit by not over-simplifying their subject. Too high a level of abstraction, metaphor, or "just-so" functionalist explanation creates non-falsifiable, uninstructive theory (Weick, 1974).

On the other hand, the current social scientific aversion to theorizing general laws and paradigms can also be harmful. The tradeoff here is that building an arsenal of social mechanisms helps explain events post-hoc, but does not provide predictive power to predict outcomes before they occur. Many social mechanisms are at work in any given social situation. The more intriguing and important the social situation, the more studied by scholars, each striving to introduce one yet more unexpected but plausible (cf. Davis, 1977: 343) mechanism to explain the observed phenomena. As a result, any important outcome can be explained by several different mechanisms[19]. Conversely, if an effect predicted by a favored mechanism is not observed, a multitude of mechanisms are available to explain the non-occurrence. Social mechanisms cannot be generally falsified. They sometimes act, sometimes don't, sometimes act with other mechanisms, and sometimes are negated by other mechanisms. This leads to a lack of

---

[19] The Management & Organizations area Ph.D. preliminary examinations require students to produce three different alternative theoretical explanations for the empirical findings of a recently-published paper from a top-tier management journal. No paper has withstood the theoretical assault of second-year students and come away unscathed.

predictive and policy power[20]. Compare this situation in organization theory with Physics (great predictions and policy power) and Economics (not so great predictions, great policy power).

Law-like theories make broader claims about reality. They argue that certain causal effects *will* most likely be observed, rather than that such effects *may* be observed. This leads to a higher empirical and theoretical bar to their acceptance by the scholarly community. On the other hand, once a law has been established empirically and theoretically, we can make predictions. A history of correct predictions changes our assumptions about organizational behavior, and thus the questions we ask. Explaining normal is not interesting, and laws define normal. Before a law is well-established theoretically, elaborating more mechanisms underpinning the law is useful. Such investigations provide a better understanding of the law's general validity and boundary conditions. For an established law, however, identifying new mechanisms becomes less useful, and the lack of an identified mechanism should not cause us to expect the law does not apply in any given situation.

Some of the most useful organization theories have a law-like character. For example, resource partitioning (Carroll, 1985) is observed across a range of settings. Similarly, nodes spanning structural holes in social networks tend to enjoy advantages (Burt, 1992). In any given setting, however, it is not obvious why resource partitioning or broker advantage occurs. The "resource" in resource partitioning could be technology, managerial attention, investment funding, consumer attention, consumer categories, etc. Brokers spanning structural holes in networks could benefit because they enjoy faster access to knowledge, more bricolage opportunities, increased flow of resources through them, control over others, control over

---

[20] Ironically, this is more so the more empirically-supported mechanisms scholars catalog. This phenomenon is congruent with this dissertation's theory.

themselves, etc. These theories are often attacked for this lack of clarity on the causal micro-dynamics (mechanisms) underpinning their main effect, and the theories' principal proponents have spent time responding with recent projects focused on specific mechanisms (e.g., Carroll and Wheaton, 2009; Burt, 2012.)

The inability to pin down which micro-mechanism is causing the main effect (e.g., small firms proliferating in the presence of large firms, broker advantage) may actually be strengths of these theories, however. The plenitude of mechanisms militating for the effect versus the paucity of mechanisms operating counter to the effect give the effect its law-like character. Given the many-factored, stochastic, and idiosyncratic nature of social phenomena, over-determined phenomenological regularities may be the closest we get to social "laws", even if (especially if) we can't understand exactly why they hold in all situations.

Durable dominance may be similarly over-determined. In Chapter 2, I described a mechanism of competitive release. Companies at the dominance threshold faced increased competitive pressure from similar-size competitors, and diverted managerial attention and resources to compete against these similar competitors. Near-dominant actors could not spare attention and resources to attack the dominant. The dominant could concentrate on building their lead, freed from fending off direct attacks from non-dominants. I also described a mechanism based on consumer attention. The existence of many near-dominants creates a cognitive burden for the consumer choosing between options, and the consumer will be more likely to forego serious comparison and just opt for a dominant's offerings, rather than incurring the costs to compare all offerings from dominant and near-dominant companies. Mechanisms based on allocation of managerial attention, resources, or consumer attention could all lead to durable dominance.

Other mechanisms can also undergird durable dominance. An influx of new competitors may make capacity investments by near-dominants more risky, preventing them from challenging the dominant. Resource partitioning may work in reverse: Instead of a dominant firm crowding out the middle and creating space for small peripheral competitors, a large mass of small peripheral competitors may crowd out the middle and allow the dominant to thrive. A large influx of new entrants may increase the legitimacy of the industry segment as a whole. The company dominant at the time of this legitimization may become entrenched as the paradigmatic exemplar of the segment. Establishing the operation of these and other mechanisms to create durable dominance can help establish the theoretical generalizability of the proposed theory.

The theory's claim to general validity may also be strengthened using an analytical approach. In exploratory investigations using automata-based simulations, I find that a wide range of measures to increase churn in rankings (i.e., increase equality in opportunity) lead to dominant entrenchment. If the initial distribution of endowments is highly skewed, almost all changes in transition rules to make opportunity more equal benefit the top. This result suggests that formal theorems on the effects of changes in rank and endowment transition rules on dominant entrenchment can be established, both in the time-discrete automata regime and in the continuous time regime. The latter regime can be modeled as a set of stocks and flows equations from Physics.

5.3 Significance and Implications

Even if observed with law-like regularity, an effect is not interesting if it explains little. Durable dominance by its nature attempts to explain the macrostructure of industries and other fields of competition. The studies in this dissertation help us understand how Fidelity maintains

dominance atop the mutual fund industry and why the century-old inner circle of U.S. corporate board directors disappeared, for example. The theory of durable dominance presented here is consequential, and suggests a novel way of viewing the relationship between competition and dominance.

This changed perspective holds implications for scholars and practitioners. Economics, strategy, and sociology have been tremendously successful at generating theories explaining dominant entrenchment based on exclusion, collusion, and monopolization. This dissertation is a first step in developing and validating theory that explains durable dominance—dominant entrenchment in the face of (or because of) mass entrepreneurial entry and decreased advantages of scale in settings where resources are abundant and widely-available. The proposed theory suggests that dominants can maintain distinction—competitive advantage—in a world with no distinctive, monopolizable resources. Durable dominants distinguish themselves by magnitude rather than exclusivity; more of each resource, not different resources. Elite prep school students, for example, no longer pride themselves on their access to highbrow culture, but rather on being able to enjoy a large range of cultural experiences, the scope of which those from less privileged backgrounds find difficult to emulate (Khan, 2011). An order of magnitude difference in resources can lead to qualitative differences in capabilities. Those earning $4 million a year travel in private jets, those earning $400,000 in business class, and $40,000 earners in coach.

Easy transposibility and mobility of resources may act to entrench magnitude-based distinction. Wealth, which is highly scalable, is also increasingly transposable. For individuals, wealth can buy the "right" type of cultural distinction, which can then be transposed into lucrative careers (Rivera, 2012). Companies, too, can transpose wealth into and from other needed resources. High status law firms generate increased profits by attracting partners from

lower-status but high profit firms. Conversely, lower status but high profit firms purchase status by hiring partners from high status firms with lower profits (Rider and Tan, 2012). Product companies can readily purchase scalable resources—manufacturing, marketing, distribution, financing, operations—on the Internet. If all resources are widely available and easily transposable into others, the only differentiator is who has more, not who has what.

This line of thought forces a shift in how we think about dominant entrenchment. Rather than considering dominant tactics of exclusion, collusion, and monopolization, we need to consider the ecological distribution of resources among competitors and the trajectories of these resource distributions. The proposed theory predicts that durable dominance is contingent on order of magnitude differences between dominants' and non-dominants levels of contested resources. Given such a highly-skewed distribution of resources, if the non-dominant have no way of accumulating resources an order of magnitude greater than what they currently possess, they cannot become dominant—and durable dominance occurs.

Analyzing highly-skewed distributions requires separating the analysis of dominants from that of non-dominants. The "1%" are different from the rest, but averaging or taking the median over the population obfuscates these differences. Gathering data on dominants often presents an empirical difficulty, however. Data on the richest Americans, for example, are rarely available in general social surveys. Nonetheless, this study shows that gathering and analyzing data on highly-skewed distributions is possible, and necessary to understand durable dominance.

The policy implications of the proposed theory are straightforward but counterintuitive. Dominants may benefit from a strategy of opening their markets to new entrants and fostering small competitors. These upstarts will weaken potential challenges to the dominants' dominance from large but non-dominant incumbents. Whether guided by altruism or cunning, this seems

precisely the strategy that Google, for example, is executing when it routinely provides funding, employees, technology, and platform access to web startups. An elite business school worried about losing its elite status could conceivably attempt to entrench its position by investing resources in democratizing massive open online course (MOOC) creation and distribution. Giving away access to world-class production and distribution technologies to small colleges could flood the marketplace with new entrants, force other schools immediately below elite status to invest resources in developing their own MOOC capabilities, and ultimately entrench the hypothetical protagonist's elite position.

Policy-makers and non-dominants face a more difficult choice. The proposed theory suggests that currently taken-for-granted measures for loosening dominants' hold on contested resources may backfire—unless the measures are executed in tandem with reductions in dominants' vastly disproportionate resources to levels near their competitors' averages. Durable dominance may be a natural and inevitable consequence of an open society (such as today's United States) where wealth is unlimited and eminently transposable, and competition is revered.

Appendix A:

Cosine Similarity

Funds are represented as vectors in stock space, and cosine similarity is defined as the cosine of the angle between two funds. In the simple two-stock example pictured in Figure A.1, Fund 1 holds $5 million in Stock A and $0 in Stock B, and is represented by the vector (5, 0). Fund 2 holds $2 million in Stock B and none in Stock A. Fund 3 holds $2 million in stock A and $1 million in stock B. The cosine similarities for fund pairs 1-2, 1-3, and 2-3 respectively are 0, $2/\sqrt{5}$, and $1/\sqrt{5}$. Similarity values are calculated numerically using the vector inner product:

$$\cos(XY) = \frac{X \cdot Y}{|X||Y|}.$$

Insert Figure A.1 about here

The actual stock space is high-dimensional, with as many dimensions as distinct domestic stocks held by mutual funds. Multi-dimensional scaling or network layout techniques allow us to project this space onto a 2- or 3-dimensional map. The nodes in this map are mutual funds, and similar (in portfolio composition) mutual funds will be clustered together in the map. This map can then be used to explore the structure of the mutual fund market and its evolution over time (Figures A.2 and A.3).

The models proposed in this paper suggest that the identity of dominants will sometimes change when the number of funds in a segment is still small, but that the dominant fund at the time of an explosion in the number of funds in the segment will remain dominant for a long time thereafter. This intuition can be explored visually, as in Figure A.2.


Insert Figure A.2 about here

The cosine similarity measure may be useful for other research studies. The mutual fund similarity and mapping data is of obvious interest to scholars interested in the industry evolution of mutual funds. The data can show the creation and growth of new fund types, movement of groups of funds in stock space, and movement of funds between groups (see Figure A.3). The dataset may also be of use to researchers studying categories and network communities.

Insert Figure A.3 about here
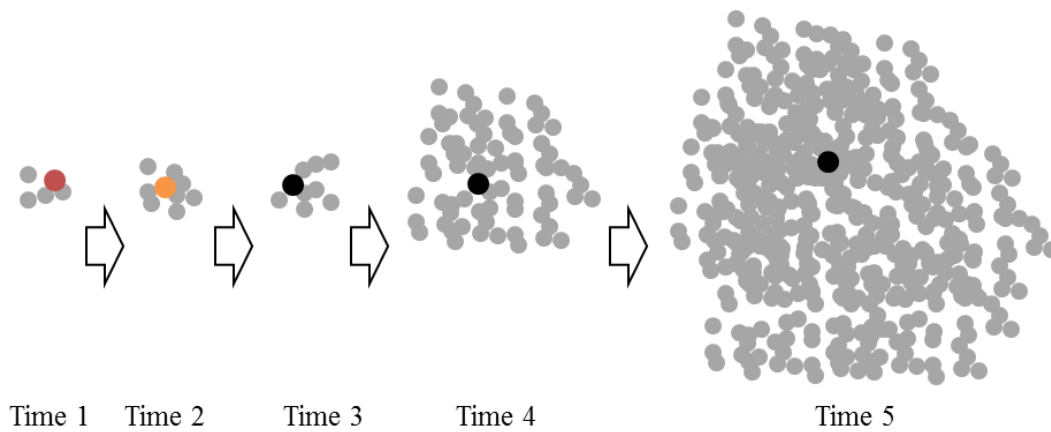

Figure A.1: A Simple Two-Stock Cosine Similarity Example
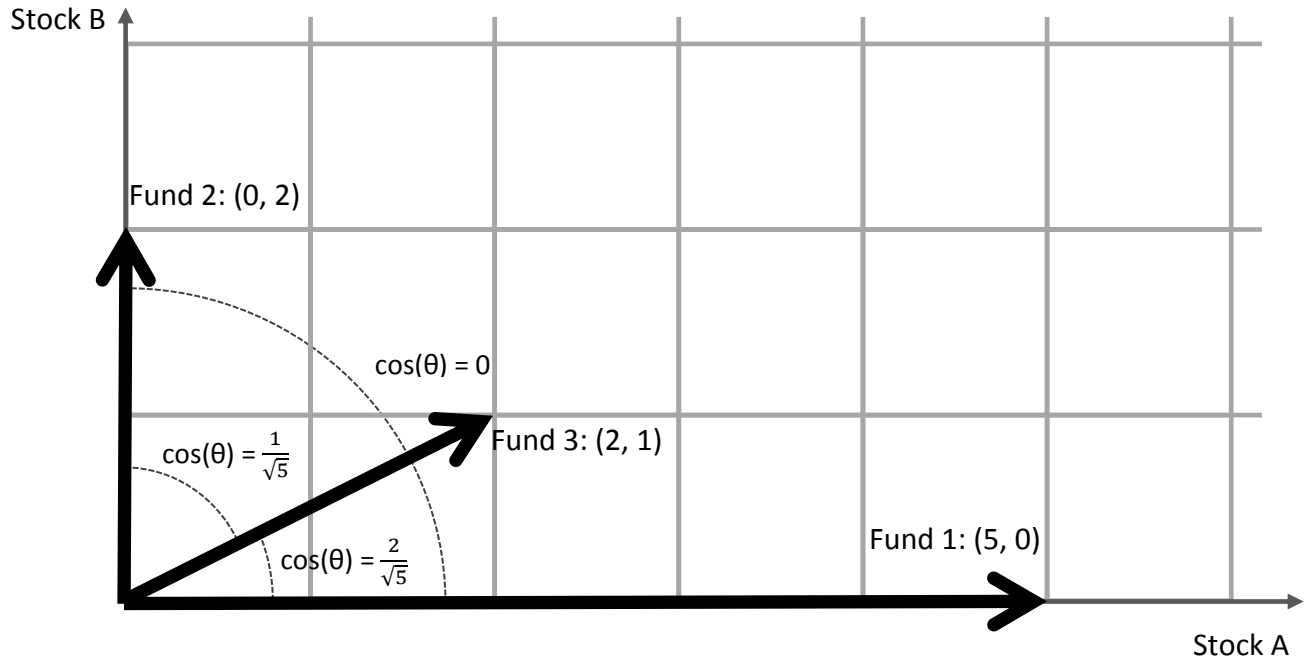
Cosine similarity is defined as the cosine of the angle between two funds, when the funds are represented as vectors in stock space.
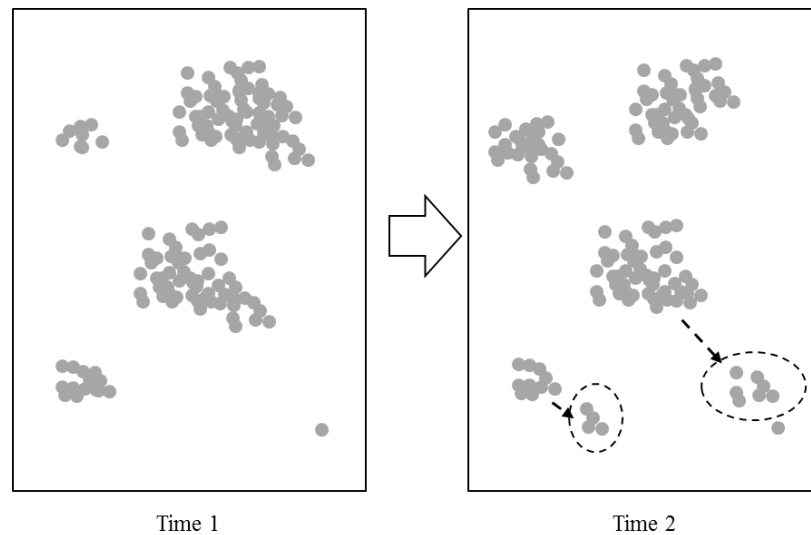
Figure A.2: Dominant Change within a Community (Mockup)

Time 1   Time 2   Time 3   Time 4   Time 5

The points in the figure represent mutual funds. Funds with similar stock holdings are placed closer together on the map.

The red dot represents the dominant fund at Time 1. By Time 2, the yellow dot fund has become dominant, but is replaced by Time 3 by the black dot fund. The community grows rapidly from Time 3 to Time 5, and the black dot fund maintains its dominance throughout this growth.

Figure A.3: Mutual Fund Industry Evolution (Mockup)

Time 1   Time 2

The points in the figure represent mutual funds. Funds with similar stock holdings are placed closer together on the map.

Five distinct communities (including one isolate) exist at Time 1. By time 2: New entrants have increased the number of funds in the top-left community, while fund exits have decreased the size of the top-right community. The bottom-left community has broken apart into two communities. Several funds from the central community have joined the isolate on the bottom right.

References

Bain, J. S. 1968. *Industrial organization* (2nd ed.). New York: Wiley.

Barabási, A.-L., and Albert, R. 1999. Emergence of scaling in random networks. *Science*, 286: 509–12.

Barney, J. 1986. Strategic factor markets: Expectations, luck and business strategy. *Management Science*, 32: 1231–41.

Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17: 99–120.

Bogle, J. C. 2003. Mutual fund industry practices and their effect on individual investors. Statement before the U.S. House of Representatives, Subcommittee on Capital Markets, Insurance, and Government Sponsored Enterprises of the Committee on Financial Services (Mar. 12, 2003). Downloaded from https://personal.vanguard.com/bogle_site/sp20030312a.html.

Bothner, M. S., Smith, E. B., and White, H. C. 2010. A model of robust positions in social networks. *American Journal of Sociology*, 116: 943–92.

Bourdieu, P. 1984. *Distinction: A social critique of the judgement of taste*. Cambridge, MA: Harvard University Press.

Brandeis, L. 1914. *Other peoples' money: And how the bankers use it*. New York: Frederick Stokes.

Burt, R. S. 1992. *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Burt, R. S. 2012. Network-related personality and the agency question: Multirole evidence from a virtual world. *American Journal of Sociology*, 181: 543–91.

Carroll, G. R. 1985. Concentration and specialization: Dynamics of niche width in populations of organizations. *American Journal of Sociology*, 90: 1263–83.

Carroll, G. R., and Wheaton, D. R. 2009. The organizational construction of authenticity: An examination of contemporary food and dining in the U.S. *Research in Organizational Behavior*, 29: 255–82.

Caves, R. E., and Porter, M. E. 1977. From entry barriers to mobility barriers: Conjectural decisions and contrived deterrence to new competition. *Quarterly Journal of Economics*, 91: 241–62.

Christensen, C. M. 1997. *The innovator's dilemma: When new technologies cause great firms to fail*. Boston: Harvard Business School Press.

Christensen, C. M., and Bower, J. L. 1996. Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, 17: 197–218.

Chu, J. S. G., and Davis, G. F. 2013. *Who killed the inner circle? The collapse of the American corporate interlock network*. Working paper, University of Michigan, Ann Arbor, MI. Available at http://ssrn.com/abstract=2061113.

Chu, J. S. G., and Mizruchi, M. S. In press. Elites. In R. A. Scott and S. M. Kosslyn (Eds.), *Emerging Trends in the Social and Behavioral Sciences*. New York: Wiley.

Coates, J. C., and Hubbard, R. G. 2007. Competition in the mutual fund industry: Evidence and implications for policy. *Journal of Corporation Law*, 33: 151–222.

Coleman, J. S. 1964. *Introduction to Mathematical Sociology*. New York: Free Press.

Cool, K., Costa, L. A., and Dierickx, I. 2002. Constructing competitive advantage. In A. Pettigrew, H. Thomas, and R. Whittington (Eds.), *Handbook of strategy and management*: 55–71. London: Sage.

Cotton-Nessler, N. C. 2013. *Skill in interpersonal networks*. Ph.D. dissertation, Stephen M. Ross School of Business, University of Michigan, Ann Arbor.

Davis, G. F. 1991. Agents without principles? The spread of the poison pill through the intercorporate network. *Administrative Science Quarterly*, 36: 583–613.

Davis, G. F. 2009. *Managed by the markets: How finance reshaped America*. Oxford: Oxford University Press.

Davis, G. F. 2013. After the corporation. *Politics & Society*, 41: 283–308.

Davis, G. F., and Greve, H. R. Corporate elite networks and governance changes in the 1980s. *American Journal of Sociology*, 103: 1–37.

Davis, G. F., and Marquis, C. Prospects for organization theory in the early 21st century: Institutional fields and mechanisms. *Organization Science*, 16: 332–43.

Davis, G. F., and Mizruchi, M. S. 1999. The money center cannot hold: Commercial banks in the U.S. system of corporate governance. *Administrative Science Quarterly*, 44: 215–239.

Davis, G. F., and Robbins, G. E. 2005. Nothing but net? Networks and status in corporate governance." In K. Knorr-Cetina and A. Preda (Eds.), *The Sociology of Financial Markets*: 290–311. Oxford: Oxford University Press.

Davis, G. F., Yoo, M., and Baker, W. E. 2003. The small world of the American corporate elite, 1982-2001. *Strategic Organization*, 1: 301–26.

Davis, M. S. 1971. That's interesting! Toward a phenomenology of sociology and a sociology of phenomenology. *Philosophy of the Social Sciences*, 1: 309–44.

Demsetz, H. 1973. Industry structure, market rivalry, and public policy. *Journal of Law and Economics*, 16: 1–9.

Dierickx, I., and Cool, K. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35: 1504–11.

DiMaggio, P., and Mohr, J. 1985. Cultural capital, educational attainment, and marital selection. *American Journal of Sociology*, 90: 1231–61.

Dobbin, F., and Zorn, D. 2005. Corporate malfeasance and the myth of shareholder value. *Political Power and Social Theory*, 17: 179–98.

Domhoff, G. W. 1967. *Who rules America?* Englewood Cliffs, NJ: Prentice-Hall.

Domhoff, G. W. 1970. *The higher circles*. New York: Vintage.

Fama, E. F., and Jensen, M. C. 1983. Separation of ownership and control. *Journal of Law and Economics*, 26: 301–25.

Ferris, S. P., Jagannathan, M., and Pritchard, A. C. 2003. Too busy to mind the business? Monitoring by directors with multiple board appointments. *Journal of Finance*, 58: 1087–112.

Fich, E. M., and Shivdasani, A. 2006. Are busy boards effective monitors? *Journal of Finance*, 61: 689–724.

Fisher, F. M. 1979. Diagnosing monopoly. *Quarterly Review of Economics and Business*, 7: 671–97.

Freeman, J. P., and Brown, S. L. 2001. Mutual fund advisory fees: The cost of conflicts of interest. *Journal of Corporation Law*, 26: 610–73.

Gibrat, R. 1931. *Les inegalites economiques*. Paris: Librairie du Recueil Sirey.

Hunt, M. 1972. *Competition in the major home appliance industry, 1960-1970*. Ph.D. dissertation, Harvard University, Cambridge, MA.

Katz, M. L., and Shapiro, C. 1992. Product introduction with network externalities. *Journal of Industrial Economics*, 40: 55–83.

Keele, L., and Kelly, N. J. 2006. Dynamic models for dynamic theories: The ins and outs of lagged dependent variables. *Political Analysis*, 14: 186–205.

Khan, S. R. 2011. *Privilege: The making of an adolescent elite at St. Paul's school*. Princeton, NJ: Princeton University Press.

Khan, S. R. 2012. The sociology of elites. *Annual Review of Sociology*, 38: 361–77.

Khorana, A., and Servaes, H. 2012. What drives market share in the mutual fund industry?. *Review of Finance*, 16: 81–113.

Kogut, B. 2012. The small world of corporate governance: An introduction." In B. Kogut (Ed.), *The Small Worlds of Corporate Governance*: 1–51. Cambridge, MA: MIT Press.

Kopczuk, W., Saez, E., and Song, J. 2010. Earnings inequality and mobility in the United States: Evidence from Social Security data since 1937. *The Quarterly Journal of Economics*, 125: 91–128.

Lamont, M. 1992. *Money, morals, and manners: The culture of the French and American upper-middle class.* Chicago: University of Chicago Press.

Lenin, V. I. [1916] 1939. *Imperialism: The highest stage of capitalism*. New York: International Publishers.

Levine, L. W. 1990. *Highbrow/lowbrow: The emergence of cultural hierarchy in America*. Cambridge, MA: Harvard University Press.

Lippman, S. A., and Rumelt, R. P. 1982. Uncertain imitability: An analysis of interfirm differences in efficiency under competition. *The Bell Journal of Economics*, 13: 418–38.

Mace, M. L. 1970. *Directors: Myth and reality*. Boston: Harvard Business School Press.

Mason, E. S. 1939. Price and production policies of large scale enterprises. *American Economic Review*, 29: 61–74.

Merton, R. K. 1968. The Matthew effect in science. *Science*, 159: 56–63.

Michels, R. [1911] 1962. *Political parties: A sociological study of the oligarchical tendencies of modern democracy*. New York: Free Press.

Miliband, R. 1969. *The state in capitalist society*. New York: Basic.

Mills, C. W. 1956. *The power elite*. New York: Oxford University Press.

Mintz, B., and Schwartz, M. 1985. *The power structure of American business*. Chicago: University of Chicago Press.

Mizruchi, M. S. 1982. *The American corporate network, 1904-1974*. Beverly Hills: Sage Publications.

Mizruchi, M. S. 1989. Similarity of political behavior among large American corporations. *American Journal of Sociology*, 95: 401–24.

Mizruchi, M. S. 1992. *The structure of corporate political action.* Cambridge, MA: Harvard University Press.

Mizruchi, M. S. 1996. What do interlocks do? An analysis, critique, and assessment of research on interlocking directorates. *Annual Review of Sociology*, 22: 271–98.

Mizruchi, M. S. 2013. *The fracturing of the American corporate elite*. Cambridge, MA: Harvard University Press.

Mosca, G. [1896] 1939. *The ruling class: Elementi di scienza politica*. New York: McGraw-Hill.

Penrose, E. 1959. *The theory of the growth of the firm*. London: Basil Blackwell.

Peterson, R. A., and Kern, R. M. 1996. Changing highbrow taste: From snob to omnivore. *American Sociological Review,* 61: 900–7.

Pfeffer, J. 1995. Mortality, reproducibility, and the persistence of styles of theory. *Organization Science*, 6: 681–6.

Piketty, T., and Saez, E. 2003. Income inequality in the United States, 1913-1998. *Quarterly Journal of Economics*, 118: 1–39.

Porter, M. E. 1980. *Competitive strategy: Techniques for analyzing industries and competitors*. New York: Free Press.

Reed, R., and DeFillippi, R. J. 1990. Causal ambiguity, barriers to imitation, and sustainable competitive advantage. *Academy of Management Review*, 15: 88–102.

Rider, C. I., and Tan, D. 2012. *Labor markets as status markets: Organizational trade-offs between status and profitability*. Working paper, Emory University, Atlanta, GA.

Rivera, L. A. 2012. Hiring as cultural matching: The case of elite professional service firms. *American Sociological Review*, 77: 999–1022.

Samuelson, P. A. 1947. *Foundations of economic analysis*. Cambridge, MA: Harvard University Press.

Schmalensee, R. 1989. Inter-industry studies of structure and performance. In R. Schmalensee and R. Willig (Eds.), *Handbook of industrial organization*, vol. 2: 951–1009. Amsterdam: North-Holland.

Schoonhoven, C. B., Meyer, A. D., and Walsh, J. P. 2005. Pushing back the frontiers of organization science. *Organization Science*, 16: 453–5.

Schumpeter, J. [1942] 1994. *Capitalism, socialism, and democracy*. London: Routledge.

Scott, J. 1997. *Corporate business and capitalist classes*. Oxford: Oxford University Press.

Sirri, E. R., and Tufano, P. 1998. Costly search and mutual fund flows. *Journal of Finance*, 53: 1589–1622.

Spitzer, E. 2004. Testimony before the United States Senate Governmental Affairs Committee, Subcommittee on Financial Management, the Budget and International Security (Jan. 27, 2004). Downloaded from http://www.gpo.gov/fdsys/pkg/CHRG-108shrg92686/html/CHRG-108shrg92686.htm.

Stigler, G. J. 1968. *The organization of industry*. Chicago: University of Chicago Press.

Stinchcombe, A. L. 1968. *Constructing social theories*. Chicago: University of Chicago Press.

Stokman, F. N., Ziegler, R., and Scott, J. 1985. *Networks of corporate power: A comparative analysis of ten countries*. Cambridge, UK: Polity Press.

Sutton, J. 1991. *Sunk costs and market structure: Price competition, advertising, and the evolution of competition*. Cambridge, MA: MIT Press.

Swensen, D. F. 2005. *Unconventional success: A fundamental approach to personal investment*. New York: Free Press.

Tilly, C. 1998. *Durable inequality*. Berkeley: University of California Press.

Useem, M. 1984. *The inner circle: Large corporations and the rise of business political activity in the U.S. and U.K.* New York: Oxford University Press.

Useem, M. 1996. *Investor capitalism: How money managers are changing the face of corporate America*. New York: Basic Books.

Useem, M., and Karabel, J. 1986. Pathways to top corporate management. *American Sociological Review*, 51: 184–200.

Uzzi, B., and Spiro, J.. 2005. Collaboration and creativity: The small world problem. *American Journal of Sociology*, 111: 447–504.

Wahal, S., and Wang, A. Y. 2011. Competition among mutual funds. *Journal of Financial Economics*, 99: 40–59.

Watterson, G. A., and Guess, H. A. 1977. Is the most frequent allele the oldest? ***Theoretical Population Biology***, 11: 141–160.

Watts, D. J., and Strogatz, S. H. 1998. Collective dynamics of "small-world" networks. ***Nature***, 393: 440–2.

Weick, K. E. 1974. Middle range theories of social systems. ***Behavioral Science***, 19: 357–67.

Wernerfelt, B. 1984. A resource-based view of the firm. ***Strategic Management Journal***, 5: 171–80.

Westphal, J. D., and Stern, I. 2007. Flattery will get you everywhere (especially if you are a male Caucasian): How ingratiation, boardroom behavior, and demographic minority status affect additional board appointments at U.S. companies. ***Academy of Management Journal***, 50: 267–88.

Windolf, P. 2002. ***Corporate networks in Europe and the United States***. Oxford: Oxford University Press.

Yermack, D. 2004. Remuneration, retention, and reputation incentives for outside directors. ***Journal of Finance***, 59: 2281–308.

Zajac, E. J., and Westphal, J. D. 1996. Director reputation, CEO-board power, and the dynamics of board interlocks. ***Administrative Science Quarterly***, 41: 507–29.

Zajac, E. J., and Westphal, J. D. 2004. The social construction of market value: Institutionalization and learning perspectives on stock market reactions. ***American Sociological Review***, 69: 433–57.