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Three Essays on Legitimacy and Organizational Outcomes

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By

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Abstract

Three Essays on Legitimacy and Organizational Outcomes

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Essay 1. This research demonstrates that CEO dismissal can be one form of activism utilized by a board of directors against CEOs' prior records of violating institutional logics (i.e., cultural beliefs, norms, and assumptions about appropriate conduct) especially during poor performance. To this end, it examines two organizational outcomes of CEO dismissal and post-dismissal strategic changes in large U.S. Fortune companies between 1984 and 2007. During this period, the field of large firms was characterized by the rise of a shareholder-value logic, in which maximizing shareholder returns was the ultimate goal of the firm and corporate refocusing and employment downsizing were appropriate and necessary means to that end. According to event-history analyses, poor performance generally led to an increase in the CEO dismissal rate, but this effect was even stronger for CEOs who were reluctant to refocus and downsize during their tenures in the position. Moreover, when their predecessors were dismissed, new CEOs were more inclined to refocus and downsize, especially during their early tenures. These results indicate that when firms deviating from logics perform poorly, directors attribute the performance problem to the deviation itself, and thus seek the removal of the CEO as a means of strategically reorienting towards prevailing logics. This study contributes to institutional theory and upper echelon research.

Essay 2. This research explores the cognitive underpinning of the identity construction of entrepreneurial ventures pursuing a novel organizational form. Emphasizing the importance of news media as market intermediaries, it examines how audiences' sensemaking about the identity of entrepreneurial ventures are affected by media reports about the relationships that position those firms in cognitive networks and make them categorically meaningful. I suggest that firms obtain survival benefits from a prominent position that signals their membership in a collective entity and helps establish their market identity in audiences. I situate my analysis in the South Korean population of semiconductor integrated-circuit(IC) design firms, where I trace the position of each firm in cognitive relational networks and its effect on the firm's survival between 1994 and 2010. Event history models show that high levels of cognitive network prominence tend to lower firm failure rates, but the magnitude of this impact declines with a firm's age, size, and patent performance which are indicative of the ambiguity about the firm's identity. They also show that the impact of cognitive prominence declines as the population

becomes legitimated. Overall, I show that media coverage for cognitive networks constitutes a critical condition fostering collective sensemaking about organizations doing something new.

Essay 3. Recent advances in organizational theory have emphasized that the legitimation of a new organizational form is a collective process that depends on the ability of relevant audiences to make sense of the categorical identity features (prototypes) of organizations using the form. It remains unclear, however, when and how audiences become aware of the categorical distinction of organizations of a new form. I suggest a discursive condition affecting audiences' sensemaking about the categorical standing of an emerging population: the degree to which population entrants are inter-connected within cognitive market networks configured from the accumulating media coverage across time—which I label *cognitive association density*. The legitimating effect of cognitive association density is demonstrated through the examination of organizational founding and failure rates in the South Korean population of semiconductor integrated-circuit (IC) design firms between 1994 and 2010. The results suggest that media coverage for inter-organizational networks helps legitimate a new form by generating cultural-cognitive frames of reference around which audiences recognize the homogeneity and categorical independence of organizations using the form. Implications for the work on ecological theory and cultural entrepreneurship are discussed.

Contents

Essay 1

Logics in Executive Power: Corporate Strategy, Performance, and CEO Dismissal in the Shareholder Value Era, 1984-2007

Key Words: Institutional logics; shareholder value; corporate refocusing and downsizing; CEO dismissal

INTRODUCTION

Scholars of leadership power have been interested in investigating the dismissal process of chief executive officers (CEOs), particularly because the dismissal event is a most striking public indication of the underlying power structure of the firm (Zald and Berger 1978; Fredrickson, Hambrick, and Baumrin 1988). Grounded in the idea that CEO dismissal is an outgrowth of political processes, researchers have focused on demonstrating that although poor performance is a primary trigger for considering CEO dismissal, its impact on the likelihood of dismissal varies depending on the firm's internal conditions affecting the strength of CEO power. For example, CEO dismissal has been shown to be less sensitive to poor performance when the CEO held a high percentage of firm equity, when directors were less independent from management, and when the CEO assumed the board chairman position simultaneously (Salancik and Pfeffer 1980; James and Soref 1981; Weisbach 1988; Boeker 1992; Parrino 1997; Shen and Cannella 2002; Zhang 2006). What is missing from these studies, however, is an understanding of the characteristics of external environments that can influence a wide range of organizational outcomes, including executive turnover.

A new insight for studies of CEO dismissal comes from institutional theory, suggesting that intra-organizational objectives, practices, and politics are shaped by institutional logics prevailing in organizational fields (Friedland and Alford 1991; Fligstein and Brantley 1992; Thornton, Ocasio, and Lounsbury 2012). From this perspective, competitions for power among different management factions are contingent upon the characteristics of prevailing logics. Institutional logics refer to widespread cultural beliefs, norms, and assumptions about efficient firms, which are embodied in specific sets of corporate goals, strategies, and structures (Haveman and Rao 1997; Suddaby and Greenwood 2005). Within a firm, corporate control tends to accrue among executives who can bring prevailing logics to bear on the firm's strategies and policies (Fligstein 1990; Ocasio and Kim 1999; Zorn 2004). Given that institutional logics play an important role in shaping sources of executive power and authority, we need to investigate the phenomenon of CEO dismissal with an eye toward whether the CEO's strategic orientations are consistent with prevailing logics.

The aim of this paper is to demonstrate that CEO dismissal can be one form of activism utilized by the board of directors against CEOs with prior records of violating prevailing logics, especially during poor performance. Two inter-related literatures are of particular relevance for this purpose. The first is the ex-post settling-up perspective, suggesting that directors evaluate their CEO's quality by taking the CEO's history into account (Fama 1980; Arthaud-Day et al. 2006; Semadeni et al. 2008; Wowak, Hambrick, and Henderson 2011). The second is research on organizational stigma, suggesting that corporate elites associated with organizational

misconduct—i.e., deviation from social norms and values—are discredited and scapegoated, thereby mitigating stigma attached to the firm (Hambrick and Mason 1984; Sutton and Callahan 1987; Wiesenfeld, Wurthmann, and Hambrick 2008; Pozner 2008). By combining these studies with institutional theory, I argue that while directors tend to seek the removal of the CEO in response to poor performance, they are more likely to do so when they acknowledge that the CEO has taken actions that deviate from prevailing logics. I further argue that if CEO dismissal is a negative consequence of prior violations of prevailing logics, these logics will inform what the board expects from the successor CEO, thereby shaping the firm's strategic direction following dismissal.

To verify this argument, I examine CEO dismissal events and post-dismissal strategic changes in large U.S. public firms from 1984 to the end of 2007. During this period, the field in which large firms were situated was characterized by the rise of a shareholder-value logic, described by Useem (1996) as "investor capitalism," and by Fligstein (2001) as the "shareholder-value conception of control." At the core of the shareholder-value logic was the notion that the firm is an entity solely committed to the best interests of shareholders. In practice, this notion translated into corporate strategic refocusing and employment downsizing (Bhagat et al. 1990; Davis, Diekmann, and Tinsley 1994; Lazonick and O'Sullivan 2000; Budros 1997; Jung 2015). Focusing on the historical period when the shareholder-value logic prevailed, I estimate hazard rate models of CEO dismissal, which propose that the impact of poor performance on the likelihood of dismissal will be greater for CEOs who have been reluctant in refocusing and downsizing during their tenures in the position. I also estimate fixed-effects logit models proposing that if CEO dismissal represents the board taking action against the CEO's prior reluctance to refocus and downsize, then newly appointed CEOs will be more inclined to refocus and downsize when their predecessors are dismissed rather than orderly replaced.

THEORETICAL BACKGROUND

Institutional Logics in Executive Power

Institutional theory has posited that organizations gain legitimacy depending on the extent to which their actions are consistent with the field's prevailing institutional logics (Meyer and Rowan 1977; DiMaggio and Powell 1983; Friedland and Alford 1991; Thornton, Ocasio, and Lounsbury 2012). Logics "encode the criteria of legitimacy" by which socially acceptable practices of organization are constructed and sustained (Suddaby and Greenwood 2005). Organizations that embody prevailing logics in their strategies and policies are seen as more legitimate and trustworthy; as such, these organizations are better able to acquire both material and symbolic resources from their external environments, thereby enhancing their chances of prosperity and survival (Baum and Oliver 1992; Suchman 1995). Institutional logics therefore promote stability and homogeneity that make it difficult for organizational actors to deviate from the ruling order.

One important mechanism through which institutional logics are linked to the action of an organization is that they influence who can gain control of the organization. In particular, logics operate as cultural-cognitive frameworks with which organizational actors analyze their internal and external problems and define an appropriate way to solve those problems (Fligstein and Brantley 1992; Rao 1998). This means that logics define what issues or problems actors should attend to (Ocasio 1997) and what strategies or tactics are appropriate and available to them

(Haveman and Rao 1997). Within a firm, executives who can appeal to prevailing logics are likely to gain corporate control because their ways of managing are seen as appropriate and necessary for dealing with urgent performance problems facing the firm (Fligstein 1990; Zorn 2004). Subsequently, those executives who succeed in entrenching themselves in the highest levels of organizational hierarchy bring prevailing logics to bear on the firm's strategies and policies.

If institutional logics shape the sources of executive power and authority, then this implies that any significant change in prevailing logics can lead to a corollary change in the underlying power structure of the firm. Of particular importance in this regard is Fligstein's (1990) research on large U.S. firms. He documented the succession of three distinct conceptions of the efficient firm, each differentiated by its associated pattern of corporate control—that is, the prominence of manufacturing personnel in 1919-1939, marketing personnel in 1940-1959, and finance personnel in 1960-1979. He argued that these changes came about as each management faction succeeded in the power struggles within many large firms by espousing a particular conception that enabled these firms to continue growing. Ocasio and Kim (1999) updated Fligstein's research in historical time. They found that the prominence of financially-trained executives declined during the 1980s and early 1990s, when economic and political changes in the environment made those executives' claims on the finance conception ideologically and politically obsolete. Moreover, Thornton and Ocasio's (1999) research on the higher education publishing industry found that a historical shift in logics from the editorial logic (viewing publishing as a profession) to the market logic (viewing publishing as a business) led to changes in intra-organizational political dynamics and the determinants of CEO succession.

Consequently, institutional research suggests that the characteristics of prevailing logics constitute a critical contingency for the locus of corporate control within firms. A logical extension of this argument is that organizational leaders will be punished for their violations of prevailing logics. An important feature of logics is that they take on a rule-like standing (Hsu and Hannan 2005; Suddaby and Greenwood 2005). This means that logics prescribe how stakeholders expect organizations can or should act, while a common set of expectations comprises an evaluative model of organizational worth that renders otherwise incomprehensible actions meaningful. As such, logics generate approval and advantages when respected, but impose limitations on action due to implied sanctions when violated (Jepperson 1991). In particular, firms that deviate from logics are likely to be subject to legitimacy challenges and may thus have difficulty mobilizing resources. In turn, stakeholders may form negative perceptions about the quality of the CEO responsible for the deviation because the CEO's strategic direction is not seen as appropriate for dealing with the firm's urgent problem. Therefore, CEOs without allegiance to prevailing logics are likely to be disadvantaged in maintaining their control of the firm.

Violation of Logics, Performance, and CEO Dismissal

The role of logics in shaping the legitimacy of executive power portends that they will have a significant influence on the CEO dismissal process. The concept of stigma helps explain why directors are likely to consider ousting the CEO when they acknowledge that he or she has behaved in ways that violate prevailing logics. Goffman (1963) identified three types of stigma—physical stigma, race stigma, and conduct stigma—that detrimentally classify actors. Of particular interest to this study is conduct stigma that results from actors taking deliberate actions that deviate from social norms and values. CEOs at the helm during organizational deviations

from logics are inextricably linked to the deviation through time and responsibility (Sutton and Callahan 1987). This linkage then becomes stigmatized with respect to the normative environment. A firm is a reflection of its top managers, so the spoiled image of the CEO can reflect badly on the firm itself (Hambrick and Mason 1984). Stakeholders typically consider CEO quality when they assess the firm's prospects; if they do not perceive the CEO as credible, they withdraw their support from the firm (Wiesenfeld, Wurthmann, and Hambrick 2008; Pozner 2008). In turn, directors are likely to seek the removal of the CEO associated with the deviation as a means of signaling to stakeholders that the firm regrets the deviation and intends to pursue a different strategic direction. Removing the discredited CEO can help restore organizational legitimacy by symbolically placing the blame squarely on the CEO (Suchman 1995).

Meanwhile, directors may have anxiety about retaining a CEO with prior records of violating prevailing logics because this retention can damage their professional reputation and careers (Fama 1980; Arthaud-Day et al. 2006). Boards are primarily responsible for monitoring managers on behalf of shareholders. Particularly in public corporations where ownership and control are separated, boards take a formal role in disciplining managers to act in the best interests of shareholders (Fama and Jensen 1983). When directors fail to exercise this power appropriately, they incur stigma and their reputation as competent overseers becomes compromised (Wiesenfeld, Wurthmann, and Hambrick 2008; Cowen and Marcel 2011). If organizational deviation from logics represents managerial wrongdoing in the eyes of stakeholders, then the incidence of the deviation implies that directors fail to fulfill their contractual duties. As such, the deviation will taint not only the CEO associated with it, but also the directors tasked with overseeing the CEO. Therefore, directors are likely to consider removing the CEO with prior violation records of prevailing logics to protect their prospects for new board appointments.

It is unlikely, however, that directors are always anxious about holding the CEO responsible for deviations. When the firm is performing well, for example, the deviation may go unnoticed. Even when the deviation gets noticed, boards may tolerate it out of concern for disrupting an organizational system that is generating positive returns (Boeker and Goodstein 1993). But once firm performance turns downward, the deviation is likely to become the CEO's salient professional blemish. This means that stakeholders are likely to interpret the performance problem as attributable to the CEO's reluctance to follow prevailing logics. Therefore, while boards tend to consider ousting the CEO in the face of poor performance, they are more likely to do so when they acknowledge that his or her past strategic decisions do not conform to prevailing logics.

Even during periods of poor performance, however, directors are less likely to consider ousting the CEO if the CEO has no prior violation records of logics. This means that performance problems that arise when a CEO is pursuing socially acceptable courses of action may not become a visible target for blame (Wiesenfeld, Wurthmann, and Hambrick 2008; Pozner 2008). In particular, insofar as a CEO's strategic actions have been consistent with prevailing logics, directors and stakeholders are likely to deem performance problems to be temporary, anomalous, and beyond the CEO's control. Moreover, they may not express skepticism about the CEO's worth to the firm because his or her current strategic direction is seen as appropriate and necessary for reversing performance downturns. Therefore, the impact of poor performance on CEO dismissal will be felt less acutely by CEOs who have conformed to prevailing logics.

It therefore follows from this line of reasoning that CEO dismissal is a negative consequence that can result from a CEO's prior records of violating prevailing logics especially during poor performance. If this is the case, then it is reasonable to assume that prevailing logics will have a strong bearing on the firm's strategic direction following dismissal. Upper echelon researchers have held that boards seek the removal of a CEO when they strive to break the firm away from the incumbent leadership regime and make substantive changes in strategic orientations (Cannella and Lubatkin 1993; Finkelstein, Hambrick, and Cannella 2009). This implies that when directors make decisions on CEO dismissal, they expect successor CEOs to embark in a different direction than the one the previous CEOs have pursued. New CEOs usually take office with a directional mandate that stems primarily from the firm's urgent performance problems. If CEO dismissal occurs when directors attribute the performance problem to the CEO's prior violation records of prevailing logics, then these logics will likely constitute key components of the mandate given to the successor CEO. New CEOs often are chosen because their experience and credentials align with the mandate of the board; as such, they are under pressure to conform to the mandate (Hambrick and Fukutomi 1991). If new CEOs behave in ways that are at odds with their early mandates, then they are likely to face an increased risk of dismissal (Hambrick and Finkelstein 1987). Thus, we can expect that newly appointed CEOs will be more likely to institute strategic changes that align with prevailing logics when their predecessors were *dismissed* rather than orderly succeeded.

EMPIRICAL BACKGROUND

This study examines CEO dismissal events and their consequences for strategic changes in large U.S. public firms during a historical period when the shareholder-value logic prevailed in the field. The shareholder-value logic came to dominance in the early 1980s by supplanting the previously orthodox finance logic. Before turning to my empirical hypotheses and analyses, I highlight the differences between these two distinct logics, noting how the firm's objectives and interests are defined under each logic, and how these objectives and interests are associated with different organizational strategies and structures.

The Rise of the Shareholder-Value Logic

The rise of the shareholder-value logic involved a significant shift in the balance of power between managers and owners. For most of the twentieth century, professional managers enjoyed much discretionary power to run large firms according to what they deemed were the best principles of management, leaving owners with minimal say (Berle and Means 1932; Roe 1994). This so-called "managerial revolution" culminated in the prevalence of the conglomerate, multi-divisional organizational form in the 1970s, when firm growth through diversifying mergers in unrelated industries reflected prevailing beliefs about the efficient firm—the finance logic (Fligstein 1990). The finance logic viewed the firm as an investment portfolio of diversified businesses with differential returns, and focused on increasing short-term earnings using financial tools for evaluating existing product lines and merger targets. The widespread adoption of this logic led to the conglomerate merger wave of the late 1960s, spawning a number of large conglomerates run by executives with finance backgrounds. In 1977, when Alfred D. Chandler, Jr. declared "managerial triumph" in his book *The Visible Hand*, he observed that highly diversified conglomerates had a dominant position in the U.S. economic landscape.

However, the finance logic and the managerial revolution more broadly began declining in the mid-1970s, when many conglomerates suffered low performance on the stock market in the face of an economic crisis characterized by economic stagnation, high interest rates, and high inflation (Fligstein 2001). Furthermore, as conglomerates continued to perform poorly into the early 1980s, despite the favorable regulatory environment for business, their performance problems were widely attributed to management itself (Davis, Diekmann, and Tinsley 1994). This attribution became reinforced by the increased influence of agency theory in financial economics. Agency theorists posited that managers should be disciplined because, if left to their own discretion, they tend to deviate from their contractual duty to serve shareholders' interests (Jensen and Meckling 1976; Fama and Jensen 1983; Eisenhardt 1989). They further argued that stock price is a good prediction of a firm's future value and that if effective managers drive stock prices down far enough, then superior management teams could purchase control at a premium from shareholders, oust current executives, and rehabilitate poorly run firms. This agency conception of corporate governance led to a growing perception that the managerial revolution afforded managers the privilege of managing firms for their own interests at the expense of shareholders' concerns.

The shareholder-value logic gained ground as agency theory found its vocal advocates—the Reagan government, takeover firms, and institutional investors. The government sought to end the economic recession of the late 1970s by nurturing free-market environments. In particular, it substantively loosened antitrust enforcement through the 1980s revision of the *Merger Guidelines* (Scherer 1988). This regulatory change provided takeover firms an opportunity to make profits by buying control of undervalued firms on the stock market and selling off their inflated assets, subsequently leading to the hostile takeover wave in the 1980s (Stearns and Allan 1996). As hostile takeover became "normalized" across the business community (Hirsch 1986), managers became relentlessly obsessed with increasing stock prices, because firms with lower stock prices relative to the book value of their assets were attractive targets for takeover. The shareholder-value logic became further entrenched, as institutional investors (such as Calpers) exercised their increased ownership power over a broad range of corporate governance issues, including the election of directors, managerial compensation, and executive replacement (Davis and Thompson 1994; Useem 1996; Brancato 1997). Activist investors emphasized that if managers do not devote sufficient attention to shareholders' interests, they should be replaced by management teams that would.

Corporate Strategic Refocusing and Employment Downsizing

The rise of the shareholder-value logic implied that managers could no longer manage their firms according to what they deemed was the best strategic course, but rather, that they should look to what the stock market deems best. In practice, the shareholder-value logic was embodied in a set of corporate strategies that was widely seen as appropriate and necessary for enhancing the firm's market value. Notably, this set included the breakup of conglomerates, a focus on core competencies, and employment downsizing. Importantly, Davis, Diekmann, and Tinsley (1994) documented that the 1980s hostile takeover wave constituted a critical juncture through which the conglomerate form became de-legitimated and diversification strategies were abandoned on a large scale across the population of large firms. Highly diversified conglomerates were attractive targets for takeovers because they were chronically undervalued on the stock market (Fligstein and Markowitz 1993; Zuckerman 1999). Conglomerates that failed to fend off hostile takeover suitors were split into separate parts that were immediately put up for sale (Stearns and Allan

1996). For managers, the breakup of conglomerates and the pursuit of core competencies became a logical solution for preserving the firm's market value, avoiding being a takeover target, and assuring job security (Davis and Stout 1992; Useem 1993). Therefore, while acquired conglomerates were forcibly dismantled, survivors voluntarily made their activities more industrially-focused through the divestiture (e.g., the spinoff or shutdown of establishments or entire business lines) of unrelated, peripheral businesses. As Bhagat et al. (1990:2) summarized, "By and large, hostile takeovers represent the de-conglomeration of American business and a return to corporate specialization."

Divesting business activities that were peripheral to their core focus and competencies was shown often to be rewarded by the stock market.[1] Importantly, in his research on the de-diversification strategies of public firms during the 1980s and 1990s, Zuckerman (1999, 2000) demonstrated that the conglomerate discount on the stock market had to do with the organization of the stock analyst industry. According to him, stock analysts specialize by industry groups and tend to cover firms fitting into industry categories which they establish for analytical purposes. But highly diversified conglomerates tend to be overlooked because their complex industry profiles do not conform to analyst categories, thus making it difficult for analysts to understand their industrial identities. When firms are not covered by analysts who specialize in the industries in which they operate, they are likely to be out of investors' sight and thus be undervalued on the stock market. As such, managers of conglomerates are encouraged to make their firms operate within the more narrowly defined industries which analysts are better equipped to appraise.

Moreover, employment downsizing has emerged as a principal means by which managers can enhance their firm's market value (Useem 1996; Lazonick and O'Sullivan 2000; Fligstein and Shin 2007; Budros 1997). Downsizing occurs when managers intentionally and permanently reduce the number of employees to increase firm efficiency. Before the 1980s, managers of large firms were generally reluctant to downsize; they begrudgingly laid employees off temporarily, even when necessary because of poor performance (Osterman 1999). Since then, however, mass layoffs—i.e., decrease in employees by 5 percent or more—has become an increasingly prominent corporate phenomenon among large U.S. firms over the last three decades (Budros 1997; Jung 2015).[2] Managers have used employment downsizing to visibly demonstrate their commitment to shareholder interests, even when their firms were performing well (Uchitelle 2007; Kalleberg 2009).

HYPOTHESES

CEO Dismissal. I examine CEO dismissal events in relation to the strategic implications of the shareholder-value logic, which conceptualizes the firm's primary objective as delivering maximal returns to shareholders. My argument revolves particularly around the interaction between firm performance and measures of the CEO's past allegiance to the shareholder-value logic, namely the extent to which the CEO has engaged in strategic refocusing and employment

[1] See Special Issue on Corporate Focus, *Journal of Financial Economics* 1995.

[2] Budros (1997) found that the downsizing rate among *Fortune* 100 companies increased from less than 5 percent to more than 40 percent between 1979 and 1994. Jung (2015) showed that the use of downsizing became even more frequent among large firms during the 1990s and the first half of the 2000s, although the U.S. economy was improving.

downsizing during his or her tenure in the position. I predict that while directors generally tend to consider removing the CEO during poor performance, they are more likely to do so when they acknowledge that the CEO has been reluctant in refocusing or downsizing. In particular, when firms that have not engaged in refocusing or downsizing do not perform well, the CEO is likely to be seen as the primary source of the performance problem and thereby ousted. In contrast, when firms that have refocused and downsized do not perform well, the performance problem will likely be deemed beyond the CEO's control and tolerated. Therefore:

Hypothesis 1: During the historical period when the shareholder-value logic dominated, the impact of poor firm performance on the likelihood of CEO dismissal will be increased when there is no evidence of the CEO's prior pursuit of strategic refocusing or downsizing.

***Post-Dismissal Strategic Changes*.** I further analyze the consequence of CEO dismissal for the firm's subsequent strategic changes. I propose that if CEO dismissal represents the board's activism against the CEO's prior records of violating the shareholder-value logic, then this logic should inform what the board expects from the successor CEO, thereby affecting the firm's strategic direction following dismissal. Newly appointed CEOs usually start their jobs under the pressure to demonstrate promptly that they are the right choice for the position (Hambrick and Fukutomi 1991). New CEOs' need to show their efficacy during earlier times in office will serve to bring about strategic changes that are consistent with the shareholder-value logic. Therefore:

Hypothesis 2: During the historical period when the shareholder-value logic dominated, new CEOs replacing dismissed predecessors will be more likely to refocus or downsize, especially earlier in their tenure.

DATA AND METHODS

My analyses consist of two parts: CEO dismissal and post-dismissal strategic change. In this section, I will first introduce my sample and then describe the research design for each part.

Sample

The sample included 131 U.S. manufacturing firms that were ranked among the 100 largest firms in Fortune magazine at least once between 1984 and 2007, inclusive. These firms operated primarily within the industries denoted by Standard Industrial Classification (SIC) codes 20 to 39.[3] The observation period started in 1984, when hostile takeover activities began to explode, and ended in 2007, the year before the financial crisis erupted. Not all sample firms were in operation for the entire study period. By 2007, fifty-eight firms (about 44 percent) were taken over, merged with other firms, went bankrupt, or ceased to be publicly traded. For each firm, I followed the CEO's identity using Standard and Poor's *Executive Compensation* databases. When a new CEO appeared, I confirmed this change by searching the firm's proxy statement for that year. As a result, I identified a total of 418 CEOs, 340 of whom were replaced.

[3] The SIC is a four-digit industry category system, in which broader categories are represented by numbers with fewer digits—for instance, 20 represents "Food and Kindred"; 201 represents "Meat Products"; and 2013 represents "Sausages and other Prepared Meats."

Data Analyses

CEO Dismissal

MEASUREMENT. CEO dismissal was a dummy variable coded as 1 when the CEO involuntarily departed from the firm. Following extant studies (Parrino 1997; Zhang 2006), I used multiple archival sources—including the Wall Street Journal, Business Week, and Forbes—to distinguish CEO dismissal from orderly CEO succession. I classified CEO succession as orderly when any of the following criteria were applicable: the CEO was reported to have (1) left office but stayed on as a director, (2) reached the company mandatory retirement age, generally 65, (3) handpicked his or her successor, (4) been appointed as CEO at another firm, (5) died or have had a fatal illness, and/or if (6) the firm ceased to exist as a public firm, by merger or going private. I classified CEO succession as dismissal in the following cases: (1) the words "board pressure", "dissatisfied shareholders", "investor concern", "frustrated", or "ousted" were used in the archival sources, (2) the CEO was reported to have taken early retirement and performance problems were discussed, (3) differences in policy orientations and management philosophy between the CEO and board directors were cited, and/or (4) an interim CEO was appointed. As a result, I identified 103 CEO dismissals and 237 orderly CEO successions, as presented in Figure 1. There were generally fewer CEO dismissals than voluntary exits. The number of CEO dismissals averaged 4.3 per year, but waxed and waned throughout this time period, ranging from a low of zero in 1984 and 1988 to a high of nine in 2000.

[Figure 1 about here]

Key independent variables were firm performance, the CEO's past allegiance to the shareholder-value logic, and their interactions. Firm performance was measured as annual earnings per share (EPS) in year *t-1*. EPS represents the bottom line of the summaries of earnings reports and one of the primary determinants of stock price (Espeland and Hirsch 1990). Data on EPS were taken from COMPUSTAT. CEO's allegiance to the shareholder-value logic was measured as continuous variables indicating the extent to which the CEO engaged in employment downsizing and strategic refocusing during the three preceding years in office. Downsizing was measured as percentage change in number of employees between year *t-1* and *t-3* (ΔEMPLOYEES). Similarly, strategic refocusing was measured as percentage change in total tangible fixed assets between year *t-1* and *t-3* (ΔASSETS). Since divesting assets is closely linked to a firm's de-conglomeration strategy, I also measured strategic refocusing as change in the entropy index of firm diversification. The entropy index is designed to decompose the total diversification measure (DT) into related (DR) and unrelated (or conglomerate) diversification (DU) (Jacquemin and Berry 1979; Palepu 1985). DU is defined as diversification arising from operating between different industry groups at the two-digit SIC level; DR is defined as diversification arising from operating in different industry segments at the four-digit SIC level within an industry group. In the analysis, I used changes in DU between year *t-1* and *t-3* (ΔDU). Lower values on ΔDU indicate that the CEO made the firm's business activities more focused on its core industry groups. I calculated the entropy index using the SIC codes and sales data from the COMPUSTAT Business Segment file.

I controlled for several CEO characteristics. The variable *Age60* was coded as 0 if the CEO's age was 60 or below, or, the CEO's age minus 60 otherwise (Ocasio 1994). *CEO tenure*

was measured as the number of years since the CEO's appointment. *Outside CEO* was a dummy variable coded as 1 if the CEO had been employed less than three years prior to taking office. *Board tenure* was measured as the number of years the CEO served on the board before taking office. *Chairman CEO* was a dummy coded as 1 in a year when the CEO also held the position of board chairman. *Family CEO* was a dummy coded as 1 if the CEO was a member of the firm's founding family. Finally, *Finance CEO, Operation CEO*, and *Sales CEO* were dummies coded as 1 if the CEO's functional backgrounds were primarily in finance, manufacturing, and sales-marketing, respectively; CEOs outside these categories were collapsed into the reference group. I included these dummies to capture the shift in CEO backgrounds that may result from the rise of the shareholder-value logic (Ocasio and Kim 1999).

I also controlled for firm-level characteristics and regulatory environment. I included DT in year *t-1*. *Firm size* was measured as the natural logarithm of total assets and employees. *Sales growth* was measured as annual change in the firm's revenues between year *t* and year *t-1*. *Board size* was measured as the total number of directors on the board, as of the year when the CEO took office. *Outside director percentage* refers to the proportion of outside directors on the board, as of the year of the CEO's appointment. Directors were classified as outsiders if (1) they were not employees of the firm during the three preceding years and (2) they did not have familial relations to the CEO. *Institutional ownership* refers to the proportion of the firm's outstanding stocks held by institutional investors, as of the year of the CEO's appointment. In summing institutional shares, I excluded small investors holding less than one percent of the firm's stocks, because their motives for engaging in corporate affairs are indeterminate (Useem 1996). *Prior dismissal* refers to the cumulative number of each firm's experiences with CEO dismissal between 1984 and year *t-1*. I included this control to account for the firm-specific propensity to oust the CEO. Finally, *Sarbanes-Oxley Act* was a dummy coded as 1 if the sample period fell after 2002, when the Sarbanes-Oxley Act was enacted in the aftermath of major accounting scandals. This variable is relevant because the passage of that act had an impact on board composition and structure (Linck, Netter, and Yang 2009).

ANALYSIS. I used the Cox proportional hazard event history model, the most common approach for analyzing duration data (Singer and Willett 2003), to estimate the influence of the CEO's prior records of refocusing and downsizing on the relationship between poor performance and CEO dismissal. The Cox model is appropriate because I have complete information on the dates of CEO dismissal events, and I am interested in the magnitude and direction of the effects of observed covariates, controlling for time dependence (Blossfeld, Golsch, and Rohwer 2007). One important advantage of the Cox model over other parametric models is that one does not have to specify the role of the time in the analysis. However, while the Cox model is a popular method for circumventing problems of unknown probability distributions, it relies on the assumption that population hazard functions are proportional. Analysis of Schoenfeld residuals confirms that the CEO dismissal data do not violate this assumption.

To allow values of the covariates to vary over time, I broke each CEO's history into a sequence of firm-year spells in which the CEO was at risk of dismissal. Each of the annual spells was treated as right-censored, except for the spells that terminated in dismissal, and records of CEOs appointed before 1984 were coded as left-censored. The values of all time-varying covariates were updated at the beginning of each year for each firm. For model estimations, I used data on 316 CEOs with four annual spells or more because the past actions of CEOs with short tenures in the position would not be meaningfully observed (Wowak, Hambrick, and

Henderson 2011). These CEOs' tenure intervals were pooled into a dataset of 1,502 firm-year observations. To check for robustness, I estimated hazard models using 1,862 observations that encompassed the tenures of 360 CEOs with three annual spells or more.

Post-Dismissal Refocusing and Downsizing

MEASUREMENT. I analyzed two dichotomous measures of the firm's strategic changes following CEO dismissal. The first was coded as 1 if the firm decreased its employees by five percent or more between year *t* and *t-1*; the second was coded as 1 if the firm decreased its total tangible fixed assets by five percent or more between year *t* and *t-1*. I used dichotomous, rather than continuous, measures of employment downsizing and asset divestiture because they capture large-scale changes. Five percent decreases in employees and assets are likely to occur when managers deliberately pursue workforce downsizing and return to specialization (Budros 1997; Ahmadjian and Robbins 2005). In additional analyses, I used continuous percentage change in employees and tangible fixed assets.

The key independent variables included whether the predecessor CEO was dismissed, the successor CEO's tenure, and their interaction. *Predecessor CEO dismissal* was a dummy coded as 1 when predecessor CEOs involuntarily departed from their firms. *Successor CEO tenure* was measured as the number of years since appointment. As in the analysis of CEO dismissal, I controlled for CEO and firm-level characteristics. In addition, I controlled for EPS in year *t-1*. This is relevant because increasing stock price is an important motivation for managers to promote asset divestiture and employment downsizing (Budros 1997; Fligstein and Shin 2007). I included annual changes in DU and DR to account for the possibility that downsizing and asset divestiture followed the firm's de-conglomeration move. Finally, I included the cumulative number of each firm's experiences in employment downsizing (asset divestiture) between 1984 and year *t-1* to account for the firm-specific propensity to downsize (divest).

ANALYSIS. I used discrete-time event history methods (Allison 1984) to analyze the hazard of downsizing and asset divestiture in a given year from 1984-2007. The discrete-time event history analyses were appropriate because information on the exact timing of the downsizing (asset divestiture) was not available. I estimated the discrete-time hazard rate using a fixed-effects logit model. The fixed-effects model is relevant because the independent variables change over time within an organization and my primary interest is in the magnitude and direction of their impacts on strategic changes following CEO dismissal.

RESULTS

Table 1 presents descriptive statistics and correlation coefficients among the variables used in the analysis of CEO dismissal. Table 2 contains the results from the hazard rate models of CEO dismissal. Tables 3 presents the findings from the fixed-effects logit models of employment downsizing and asset divestiture.

[Tables 1 to 2 about here]

CEO Dismissal

In Table 2, Model 1 represents the baseline model that includes the control variables. In accordance with prior research, several control variables were significantly related to CEO dismissal. *Sales growth* had a significant negative impact on CEO dismissal at the .01 level; the hazard ratio for this variable was estimated to be exp(−.059×1)=.943. This indicates that each one-unit increase in the value of sales growth multiplied the rate of CEO dismissal by a factor of .943—that is, the increase led to a decrease in the dismissal rate by about 5.73 percent (100[exp(−.059×1)−1]). The negative and significant coefficient on *chairman CEO* indicates that CEOs assuming the board chairman position simultaneously faced a reduced risk of dismissal by about 69.58 percent (100[exp(−1.190×1)−1]) compared to those who were not. The *Sarbanes-Oxley Act* of 2002 was positively related to CEO dismissal, illustrating its impact on changes in corporate governance mechanisms.

The next four models present the main effects of the variables for firm performance and CEOs' prior records of strategic refocusing and downsizing. Model 2 adds the variable for firm performance measured as EPS in year *t-1*. Not surprisingly, CEOs with good performance enjoy high levels of job security. The coefficient estimate indicates that each one-unit increase in EPS led to decrease in the dismissal rate by about 6.20 percent (100[exp(−.064×1)−1]). This result offers additional support to the argument that poor performance is a proximate trigger for considering CEO dismissal. In Models 3 through 5, I included the variables for CEOs' prior pursuit of de-conglomeration (ΔDU), asset divestiture (ΔASSETS), and employment downsizing (ΔEMPLOYEES). The estimate for ΔDU was positive and significant, indicating that CEOs who previously promoted corporate conglomeration faced an increased risk of dismissal. Specifically, a one standard deviation increase in ΔDU led to an increase in the dismissal rate by about 28.18 percent (100[exp(1.217×.204)−1]). It appears that the pursuit of unrelated conglomerate diversification fell out of favor in the shareholder-value era. Meanwhile, the estimates for asset divestiture and downsizing were not significant, implying that the pursuit of firm growth in itself was not seen as problematic.

The remaining three models in Table 2 add interaction effects between firm performance and the three variables for the CEO's prior pursuit of refocusing and downsizing. I estimated these models to test the hypothesis that the likelihood of CEO dismissal would be less sensitive to poor performance when the CEO's past strategic actions conform to the shareholder-value logic. In Model 6, I included an interaction between EPS and ΔDU. The main effect of ΔDU remains positive and significant at the .001 level. The interaction coefficient estimate is negative and significant at the .05 level, indicating that the impact of poor performance on CEO dismissal was weaker for CEOs who focused their firms' operations on primary industry groups in conformity with the shareholder-value logic. Specifically, when the EPS was one standard deviation below the mean, a one standard deviation increase in ΔDU led to an increase in the dismissal rate by about 68.08 percent.[4]

In Model 7, I included an interaction between EPS and ΔASSETS. The main effect of ΔASSETS is not significant and its interaction effect is negative and significant, albeit at the marginal level. This result indicates that the impact of poor performance on CEO dismissal was diminished when the CEO had prior records of asset divestiture. Model 8 contains an interaction between EPS and ΔEMPLOYEES. The main effect of ΔEMPLOYEES is not significant, but its interaction term is negative and significant at the .05 level. This result indicates that poor performance had a diminished effect on CEO dismissal when the CEO had engaged in

[4] This estimate is calculated as 100×{exp[(2.225)×(.204)+(−.351)×(.204)×(−.913)]−1}.

downsizing of employees, in conformity with the shareholder-value logic. Specifically, when the EPS was one standard deviation below the mean, a one standard deviation increase in ΔEMPLOYEES led to an increase in the dismissal rate by about 8.12 percent. Consequently, these results suggest that while boards tended to dismiss CEOs during poor performance, they were more likely to do so when the CEO's past actions did not conform to the shareholder-value logic.

[Figure 2 about here]

Figure 2 offers a more systematic illustration of the interaction effects between firm performance and the CEO's prior records of refocusing and downsizing, using the coefficients in Models 6 through 8. The first plot (A) demonstrates the effect of EPS on the CEO dismissal rate at three different levels of ΔDU: one standard deviation above the mean, the mean, and one standard deviation below the mean. The horizontal axis represents EPS that ranges between three standard deviations below and above the mean; the vertical axis represents the CEO dismissal rate multiplier resulting from the interaction effect between EPS and ΔDU, holding all other variables fixed at their mean levels. The plot demonstrates the strong dependence of the performance effect on the CEO's prior pursuit of firm de-conglomeration. It illustrates that as EPS decreases, the predicted CEO dismissal rate increases most steeply for CEOs with one standard deviation above the mean ΔDU, but the increase for CEOs with one standard deviation below the mean ΔDU is relatively modest. Similarly, the second plot (B) illustrates that as EPS decreases, the dismissal rate multiplier of CEOs with one standard deviation above the mean ΔASSETS rises most steeply. The third plot (C) also shows that the impact of declining performance on CEO dismissal is most acutely felt by CEOs with one standard deviation above the mean ΔEMPLOYEES. Thus, these three plots clearly show that the relationship between poor performance and CEO dismissal is stronger for CEOs who have prior violation records of the shareholder-value logic during the three preceding years.

To check for robustness, I replicated Models 3 through 8 in Table 3 using data on 1,862 firm-year observations for 360 CEOs with three annual spells or more. Recall that I originally used data on 306 CEOs with four annual spells or more to capture the CEO's strategic orientation over the three preceding years. Now, I consider the CEO's past actions over the two preceding years. The results, reported in Appendix A, show that my findings are robust to this change.

Post-Dismissal Refocusing and Downsizing

Table 3 presents the results from the fixed-effects logit models predicting the probability of asset divestiture and employment downsizing. Models 1 through 3 show analyses of asset divestitures of 5 percent or more in a given year. The baseline model (1) includes the control variables and several of them are significantly associated with divesting. Coefficient estimates indicate that CEOs from outside the organization were more likely than CEOs from inside to divest. Firms with greater prior experiences with asset divestiture were less likely to divest assets. Firms tended to divest when their performance both in sales and EPS was poor. Larger firms were also more likely to divest. Finally, the firms with prior de-conglomeration moves were more likely to divest.

[Table 3 about here]

In Model 2, I added the variables indicating successor CEOs' tenure in years and whether or not predecessor CEOs were dismissed. The estimate for the main effect of successor CEO tenure was not significant. The estimate for predecessor CEO dismissal was positive and significant at the .01 level, indicating that newly appointed CEOs were more likely to divest assets when their predecessors were dismissed rather than orderly replaced. This result implies that the shareholder-value logic served to inform what the board expected from the successor CEO, thereby shaping the firm's strategic direction following dismissal. Model 3 includes the interaction between CEO tenure and predecessor CEO dismissal. The main effect of predecessor CEO dismissal was positive and significant and its interaction effect was negative and significant. This indicates that while new CEOs with dismissed predecessors tended to have a greater propensity to divest than other new CEOs, this was particularly so during their earlier times in office. Specifically, during their first year in the position, new CEOs with dismissed predecessors were more inclined than others to divest by about 148.93 percent.[5]

The other three models show analyses of employment downsizings of 5 percent or more. In the baseline model (4), coefficient estimates indicate that younger or outsider CEOs were more likely to downsize. Downsizings were also shown to be more frequent among firms with less prior experiences in employment reduction, poor performance in sales and EPS, or larger total assets. The coefficient on annual changes in DU was negative and marginally significant, indicating that downsizing tended to be promoted as a part of the firm's de-conglomeration efforts. Finally, firms with greater institutional ownership were more likely to downsize.

Model 5 includes successor CEO tenure and predecessor CEO dismissal. The positive and significant estimate for predecessor CEO dismissal indicates that CEOs were more likely to downsize when their predecessors were dismissed. In Model 6, the interaction between CEO tenure and predecessor CEO dismissal was negative and significant. This indicates that new CEOs with dismissed predecessors were more likely than others to downsize, especially earlier in their tenures. Together with the case of asset divestiture, this finding suggests that given that CEO dismissal occurred in situations of poor performance and CEOs' prior violations of the shareholder-value logic, newly appointed CEOs took office with a directional mandate to institute strategic changes that align with the logic.

Figure 3 graphs the significant interaction effect of CEO tenure and predecessor CEO dismissal on asset divestiture and downsizing, using the coefficients from Models 3 and 6. The horizontal axis represents the length of CEO tenure in years, ranging from zero to three standard deviations above the mean among CEOs with dismissed predecessors. The vertical axis represents the divestiture (downsizing) rate multiplier resulting from the interaction effect. Both plots demonstrate that new CEOs with dismissed predecessors were more likely than others to engage in asset divestiture and downsizing over most of the observed range of CEO tenure. Moreover, their propensity to divest and downsize was shown to decline as their tenures increased.

[Figure 3 about here]

[5] This estimate is calculated as $100\times\{\exp[(1.038)\times(1)+(-.126)\times(1)\times(1)]-1\}$.

Additionally, I conducted analyses of the continuous percentage change in tangible fixed assets and number of employees. Dichotomous measures of the 5 percent change were closer to the definition of divestiture (downsizing) as a discrete and relatively large-scale strategic change, but I analyzed continuous measures of change as a robustness check. The results, reported in Appendix B, are largely consistent with the discrete-time event history analyses. Note that the coefficients for the continuous measures are the reverse of those for the discrete measures of divestiture and downsizing.

CONCLUSION

This study provides a field-level account of the CEO dismissal process that links the dismissal event to higher-order institutional logics. It characterizes the dismissal event as a negative consequence of the CEO's prior records of violating prevailing logics, especially during poor firm performance. To verify this argument, I examined two outcome variables of CEO dismissal and post-dismissal strategic changes in the context of the rise of the shareholder-value logic among large U.S. public firms. The shareholder-value logic held that the firm's primary objective is to increase shareholders' interests, so strategic refocusing and employment downsizing were widely seen as appropriate and necessary to that end. Event-history analyses revealed that the impact of poor performance on CEO dismissal was weaker for CEOs who previously promoted strategic refocusing and downsizing, in conformity with the shareholder-value logic. They also showed that newly appointed CEOs had a greater propensity to refocus and downsize when their predecessors were dismissed rather than orderly succeeded. Consequently, these findings suggest that CEO dismissal represents a kind of activism exercised by the board to punish the incumbent leadership regime for violating prevailing institutional logics, especially during poor performance.

This study contributes to the institutional literature by validating the heretofore empirically neglected presumption that organizational leaders are punished for violating prevailing logics. Institutional researchers have established that executives can derive their power and authority from their ability to implement prevailing logics (Fligstein 1990; Thornton and Ocasio 1999; Zorn 2004). However, while these studies made it clear that interests, power, and politics in organizations are influenced by prevailing logics, their predominant focus on the homogeneity of patterns of executive power and control across firms has limited our understanding of the processes involved. Rather than demonstrating that organizational deviation from logics invites penalties, they tended to take the homogeneity as evidence that the deviation is counteracted and sanctioned. The present study fills this gap by establishing that boards are more likely to punish their underperforming CEOs with job loss when these CEOs' prior strategic decisions do not conform to prevailing logics. This finding suggests that institutional logics take on an imperative standing, such that their observed violations are negatively sanctioned.

This study also contributes to research on executive turnover by highlighting the importance of incorporating historical and environmental contexts into models of CEO dismissal. Previous studies have tended to investigate the phenomenon of CEO dismissal with a focus on intra-organizational conditions that can influence the relative strength of CEO power to directors, shareholders, and other senior executives (Boeker 1992; Zhang 2006; Shen and Cannella 2002). However, the influence of environmental factors on CEO dismissal has largely been overlooked

in research to date. The present study fills this gap in the literature by demonstrating the link between CEO dismissal and higher-order institutional logics. It suggests that the characteristics of prevailing logics constitute a critical contingency for the relationship between poor performance and CEO dismissal.

Finally, it complements research on the ex-post settling-up process by demonstrating that directors make decisions on CEO dismissal using their multi-period observations of the CEO's prior strategic decision-making. Previous research has emphasized the CEO's prior performance records as an important determinant of the settling-up process. For instance, CEOs with mediocre performance records are more likely to be punished by reduced compensation, increased risk of dismissal, and diminished employment prospects (Arthaud-Day et al. 2006; Semadeni et al. 2008; Wowak, Hambrick, and Henderson 2011). I expand this line of research by demonstrating that the likelihood of CEO dismissal becomes more sensitive to poor performance when there is evidence that the CEO has deviated from prevailing logics. This implies that when firms deviating from logics do not perform well, directors are more likely to attribute the performance problem to the current regime responsible for the deviation and consider ousting the CEO.

This study provides a foundation for further research on corporate elites. One natural extension of this study would be to examine other types of punishment that directors bestow on CEOs, such as lesser pay based on how well the CEO's past actions conform to prevailing logics. If board directors assess the CEO's future value to the firm based on his or her prior violation records, then it is likely that they may also place weight on such records when adjusting CEO pay. This study can be further extended to examine whether the stigma incurred by the CEO persists over time outside the firm. It is likely, for instance, that a CEO with violation records is not only punished with job loss, but continues to experience difficulties when seeking new employment opportunities in external labor markets. Moreover, it would be fruitful to examine the characteristics of successor CEOs—e.g., whether they are insiders or outsiders of the firm—in relation to their predecessors' actions. Research suggests that outside succession is frequently used when firms seek to break with the policies of previous CEOs (Finkelstein, Hambrick, and Cannella 2009). Given that organizational deviation from logics poses a serious legitimacy threat to the firm, predecessor CEOs associated with the deviation may be likely to be replaced by outsiders. Finally, it would also be interesting to examine the fates of board members within firms that deviate from logics. The CEO's violation of logics could be viewed as the result of laxity in organizational monitoring and control systems, so board directors may also incur stigma and be likely to experience a reduced chance of appointment both within and outside the firm.

TABLES AND FIGURES

Table 1. Means, standard deviations, and pairwise correlations

Variable		Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1	CEO dismissal	0.055	0.227											
2	Age60	2.186	3.335	-0.029										
3	CEO tenure	9.048	5.584	-0.009	0.477									
4	Outside CEO	0.113	0.316	0.044	-0.050	-0.066								
5	Board tenure	3.941	3.811	-0.008	0.060	-0.028	-0.287							
6	Chairman CEO	0.935	0.246	-0.068	0.085	0.116	-0.001	-0.013						
7	Family CEO	0.079	0.269	-0.005	0.102	0.330	-0.104	0.214	-0.054					
8	Finance CEO	0.168	0.374	0.017	-0.076	-0.046	0.059	-0.116	0.046	-0.085				
9	Operation CEO	0.322	0.467	-0.003	0.067	-0.155	-0.070	0.073	0.060	-0.201	-0.310			
10	Sales CEO	0.184	0.388	0.037	-0.103	-0.053	0.053	-0.027	-0.008	-0.113	-0.214	-0.328		
11	Sarbanes-Oxley Act	0.198	0.399	0.057	-0.105	-0.132	0.024	-0.172	-0.039	-0.027	0.021	-0.036	0.065	
12	Prior dismissal	0.298	0.575	0.029	-0.141	-0.267	0.179	-0.215	0.014	-0.001	0.005	-0.070	0.076	0.335
13	DT, t-1	0.698	0.541	-0.035	0.015	-0.058	-0.033	-0.004	0.184	-0.156	0.056	0.151	-0.177	0.031
14	Total assets logged	9.289	1.110	0.036	0.005	-0.178	0.009	-0.023	-0.010	-0.069	0.068	0.101	-0.005	0.301
15	Total employees logged	3.809	0.946	0.044	-0.080	-0.142	0.062	-0.008	0.112	-0.099	0.074	-0.002	0.038	0.066
16	Board size	13.181	3.881	0.005	-0.070	-0.180	-0.077	0.212	0.140	-0.198	-0.060	0.089	0.113	-0.054
17	Outside director percentage	69.557	18.256	0.065	-0.119	-0.351	0.129	-0.111	0.025	-0.269	-0.060	0.164	0.012	0.264
18	Institutional ownership	4.086	5.418	-0.040	-0.121	-0.177	0.039	-0.002	-0.051	-0.121	0.039	0.084	-0.103	0.224
19	Sales growth/10^3	1.325	5.043	-0.087	0.010	0.008	-0.026	0.000	-0.040	-0.006	0.017	0.059	-0.013	0.160
20	EPS, t-1	2.590	3.503	-0.086	0.009	-0.012	-0.019	0.055	-0.009	-0.045	-0.014	-0.011	0.032	-0.024
21	Percentage change in tangible fixed assets (ΔASSETS)	21.402	41.909	-0.062	0.014	0.105	0.020	-0.020	-0.205	0.160	-0.034	-0.038	-0.027	-0.062
22	Percentage change in employees (ΔEMPLOYESS)	7.284	44.900	-0.028	0.014	0.114	0.087	-0.070	-0.166	0.089	0.014	-0.093	-0.023	-0.003
23	Change in DU (ΔDU)	-0.006	0.204	0.035	0.065	0.088	0.006	-0.024	0.009	0.044	-0.054	0.033	0.001	-0.009
24	Change in DR (ΔDR)	0.001	0.138	0.016	-0.021	-0.071	0.030	0.031	0.003	0.017	0.028	-0.028	0.013	0.002

N=1,502 firm-year spells for 306 CEOs, 1984-2007

Variable		12	13	14	15	16	17	18	19	20	21	22	23
13	DT, t-1	-0.031											
14	Total assets logged	0.133	0.227										
15	Total employees logged	0.060	0.335	0.678									
16	Board size	-0.025	0.248	0.362	0.469								
17	Outside director percentage	0.293	0.109	0.247	0.271	0.245							
18	Institutional ownership	0.183	-0.090	-0.116	-0.248	-0.136	0.147						
19	Sales growth/10^3	0.032	-0.024	0.242	0.090	-0.005	-0.009	-0.006					
20	EPS, t-1	-0.028	0.087	0.119	0.131	0.137	-0.040	-0.041	0.083				
21	Percentage change in tangible fixed assets (ΔASSETS)	-0.088	-0.081	-0.010	-0.050	-0.207	-0.205	0.023	0.131	0.127			
22	Percentage change in employees (ΔEMPLOYESS)	-0.033	-0.132	-0.059	-0.076	-0.283	-0.182	0.037	0.139	0.048	0.605		
23	Change in DU (ΔDU)	-0.009	0.150	0.080	0.056	0.008	-0.038	-0.022	0.027	0.066	0.221	0.103	
24	Change in DR (ΔDR)	0.014	0.143	0.016	0.046	0.001	0.001	-0.006	0.023	0.024	-0.003	0.051	-0.116

Table 2. Cox proportional hazard models of CEO dismissal

Variable	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8
Age60	-0.011	-0.004	-0.006	-0.006	-0.005	-0.010	-0.007	-0.010
	(0.040)	(0.039)	(0.040)	(0.039)	(0.039)	(0.040)	(0.039)	(0.040)
CEO tenure	-0.011	-0.009	-0.010	-0.008	-0.010	-0.010	-0.009	-0.013
	(0.047)	(0.048)	(0.049)	(0.048)	(0.048)	(0.049)	(0.049)	(0.050)
Outside CEO	0.380	0.428	0.381	0.471	0.445	0.489	0.423	0.392
	(0.349)	(0.354)	(0.355)	(0.349)	(0.357)	(0.353)	(0.351)	(0.356)
Board tenure	0.035	0.031	0.036	0.030	0.031	0.039	0.037	0.039
	(0.035)	(0.036)	(0.035)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Chairman CEO	-1.190**	-1.260***	-1.224***	-1.351***	-1.288***	-1.317***	-1.329***	-1.284***
	(0.366)	(0.367)	(0.355)	(0.369)	(0.365)	(0.353)	(0.358)	(0.354)
Family CEO	0.394	0.324	0.270	0.365	0.322	0.351	0.363	0.347
	(0.465)	(0.464)	(0.468)	(0.477)	(0.470)	(0.467)	(0.473)	(0.467)
Finance CEO	0.569	0.549	0.575	0.488	0.541	0.493	0.513	0.491
	(0.363)	(0.366)	(0.371)	(0.368)	(0.364)	(0.380)	(0.369)	(0.375)
Operation CEO	0.514	0.487	0.477	0.490	0.481	0.464	0.485	0.508
	(0.322)	(0.321)	(0.322)	(0.313)	(0.318)	(0.315)	(0.313)	(0.318)
Sales CEO	0.621+	0.653*	0.573+	0.636*	0.649*	0.575+	0.532	0.596+
	(0.334)	(0.328)	(0.338)	(0.324)	(0.327)	(0.329)	(0.333)	(0.332)
Sarbanes-Oxley Act	0.672*	0.659*	0.743*	0.576+	0.641*	0.629*	0.672*	0.672*
	(0.304)	(0.304)	(0.307)	(0.309)	(0.305)	(0.310)	(0.306)	(0.303)
Prior dismissal	1.005+	1.046+	0.994+	0.913	1.013+	0.749	0.835	0.997
	(0.588)	(0.602)	(0.575)	(0.598)	(0.611)	(0.560)	(0.566)	(0.609)
Prior dismissal squared	-0.610	-0.641	-0.603	-0.572	-0.623	-0.482	-0.511	-0.650
	(0.385)	(0.401)	(0.375)	(0.390)	(0.403)	(0.346)	(0.352)	(0.422)
DT, t-1	-0.238	-0.214	-0.346	-0.227	-0.225	-0.368+	-0.393+	-0.359
	(0.214)	(0.213)	(0.220)	(0.212)	(0.211)	(0.217)	(0.219)	(0.220)
Total assets logged	-0.288+	-0.272+	-0.310+	-0.263	-0.274+	-0.296+	-0.317*	-0.332*
	(0.161)	(0.162)	(0.163)	(0.161)	(0.161)	(0.161)	(0.160)	(0.161)
Total employees logged	0.351+	0.365+	0.378+	0.376+	0.380+	0.404*	0.437*	0.442*
	(0.207)	(0.207)	(0.204)	(0.202)	(0.204)	(0.205)	(0.201)	(0.198)
Board size	-0.015	-0.008	-0.005	-0.016	-0.013	-0.015	-0.017	-0.016
	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)	(0.041)	(0.041)	(0.041)
Outsider director percentage	0.019+	0.016	0.016	0.014	0.015	0.015	0.013	0.016
	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Institutional ownership	-0.059+	-0.055+	-0.057+	-0.052+	-0.053	-0.057+	-0.053+	-0.053
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.034)	(0.032)	(0.033)
Sales growth/10^3	-0.059**	-0.056**	-0.056**	-0.050**	-0.055**	-0.047*	-0.054**	-0.059**
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)
EPS, t-1		-0.064**	-0.067**	-0.058**	-0.062**	-0.069**	-0.050*	-0.092***
		(0.022)	(0.022)	(0.021)	(0.022)	(0.021)	(0.024)	(0.024)
Change in DR, t-1 to t-3 (ΔDR)			0.683			0.791	0.634	0.794
			(0.744)			(0.734)	(0.699)	(0.725)
Change in DU, t-1 to t-3 (ΔDU)			1.217*			2.225***	1.433**	1.415**
			(0.482)			(0.611)	(0.494)	(0.494)
Percentage change in tangible fixed assets, t-1 to t-3 (ΔASSETS)				-0.007+		-0.008*	-0.006	
				(0.004)		(0.004)	(0.004)	
Percentage change in employees, t-1 to t-3 (ΔEMPLOYESS)					-0.003	0.001		-0.001
					(0.006)	(0.005)		(0.005)
ΔDU × EPS						-0.351*		
						(0.156)		
ΔASSETS × EPS							-0.002+	
							(0.001)	
ΔEMPLOYESS × EPS								-0.003*
								(0.001)
Log pseudolikelihood	-367.62	-364.16	-361.87	-362.78	-363.94	-358.15	-358.74	-359.07

+ p<.10; * p<.05; ** p<.01; *** p<.001 (two-sided tests)

Notes: Numbers in parentheses are robust standard errors. Number of observations=1502; number of unique firms=119; number of unique CEOs=306, number of CEO dismissal events=82.

Table 3. Fixed-effects logit models of asset divestiture and employment downsizing

	5 percent decrease in total tangible fixed assets			5 percent decrease in number of employees		
Variable	**M 1**	**M 2**	**M 3**	**M 4**	**M 5**	**M 6**
CEO age	-0.028	-0.048*	-0.044*	-0.032*	-0.032*	-0.029+
	(0.018)	(0.024)	(0.024)	(0.014)	(0.018)	(0.018)
Outside CEO	0.775**	0.738**	0.709**	0.397*	0.314+	0.272
	(0.288)	(0.298)	(0.299)	(0.232)	(0.237)	(0.239)
Chairman CEO	-0.133	-0.196	-0.096	0.320+	0.336+	0.409+
	(0.325)	(0.330)	(0.336)	(0.245)	(0.249)	(0.251)
Family CEO	0.261	-0.196	-0.185	-0.300	-0.400	-0.399
	(0.707)	(0.746)	(0.741)	(0.438)	(0.468)	(0.470)
Finance CEO	-0.383	-0.434	-0.399	-0.024	-0.064	-0.015
	(0.310)	(0.315)	(0.317)	(0.242)	(0.243)	(0.245)
Operation CEO	-0.091	-0.013	-0.012	0.008	0.016	0.048
	(0.296)	(0.304)	(0.303)	(0.225)	(0.228)	(0.228)
Sales CEO	0.269	0.233	0.227	0.116	0.073	0.080
	(0.334)	(0.339)	(0.339)	(0.254)	(0.256)	(0.256)
Cumulative experience in 5% divestiture logged, 1984 to t-1	-2.153***	-2.278***	-2.244***			
	(0.318)	(0.325)	(0.325)			
Cumulative experience in 5% downsizing logged, 1984 to t-1				-1.662***	-1.719***	-1.710***
				(0.249)	(0.252)	(0.252)
Sales growth/10^3, t to t-1	-0.269***	-0.269***	-0.266***	-0.166***	-0.165***	-0.162***
	(0.036)	(0.036)	(0.036)	(0.023)	(0.023)	(0.023)
EPS, t-1	-0.076***	-0.076***	-0.072***	-0.084***	-0.082***	-0.078***
	(0.021)	(0.021)	(0.021)	(0.017)	(0.017)	(0.017)
Total assets logged, t-1	0.811***	0.876***	0.835***	0.654***	0.686***	0.649***
	(0.217)	(0.220)	(0.221)	(0.156)	(0.158)	(0.160)
Change in DU, t-1 to t-2	-1.085*	-1.170**	-1.179**	-0.629+	-0.661*	-0.668*
	(0.494)	(0.495)	(0.493)	(0.390)	(0.391)	(0.391)
Change in DR, t-1 to t-2	-0.998	-1.028	-1.057	0.454	0.455	0.419
	(0.670)	(0.674)	(0.669)	(0.527)	(0.529)	(0.530)
Board size	0.048	0.060	0.072*	0.029	0.030	0.037
	(0.042)	(0.043)	(0.043)	(0.031)	(0.031)	(0.031)
Outsider director percentage	-0.013	-0.014	-0.013	-0.001	-0.003	-0.003
	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)
Institutional ownership	-0.032	-0.028	-0.029	0.032*	0.032*	0.031*
	(0.022)	(0.022)	(0.022)	(0.018)	(0.018)	(0.018)
Successor CEO tenure		0.038	0.045*		-0.002	0.004
		(0.027)	(0.027)		(0.020)	(0.020)
Predecessor CEO dismissal		0.585**	1.038**		0.360*	0.768**
		(0.249)	(0.347)		(0.191)	(0.272)
Predecessor CEO dismissal × Successor CEO tenure			-0.126*			-0.107*
			(0.069)			(0.052)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1854	1854	1854	2107	2107	2107
Number of unique firms	110	110	110	100	100	100
Log likelihood	-460.93	-457.78	-456.03	-773.15	-771.20	-768.99

* p<.05; ** p<.01; *** p<.001 (one-sided tests)

Note: Standard errors are shown in parentheses. Of 131 firms in the sample, 31 firms were omitted in Models 1 through 3 because they have never had an asset divestiture of 5 percent or more; similarly, 18 firms were omitted because they have never experienced an employment downsizing of 5 percent or more.

Figure 1. Yearly counts of CEO dismissal (103) and orderly CEO succession (237), 1984-2007

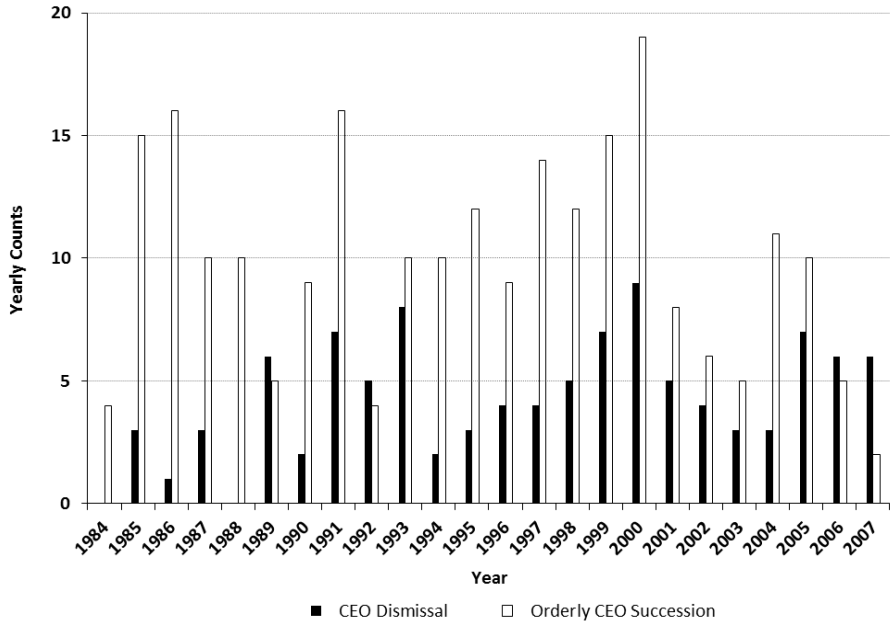
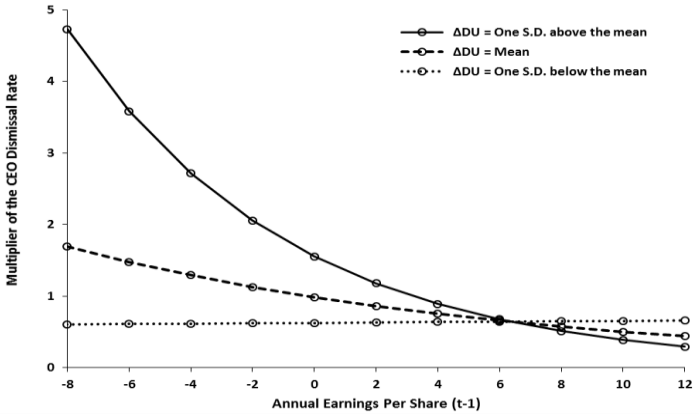
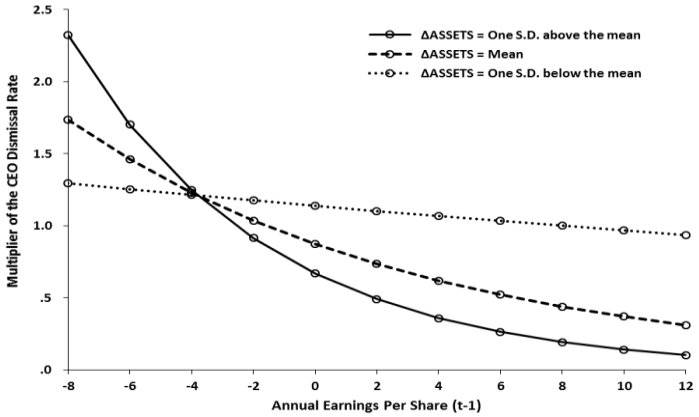


Figure 2. Interaction effects between firm performance and CEOs' prior records of strategic refocusing and downsizing on CEO dismissal based on models in Table 2

A. Strategic refocusing: Firm de-conglomeration, Model 6



B. Strategic refocusing: Asset divestiture, Model 7



C. Employment downsizing, Model 8

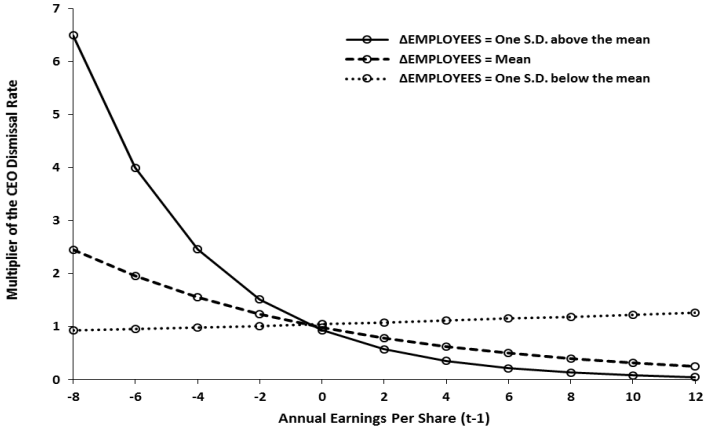
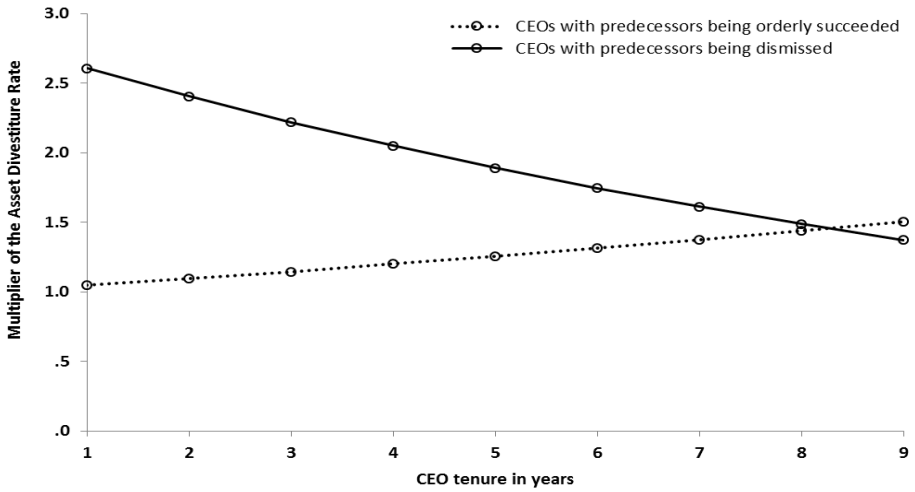
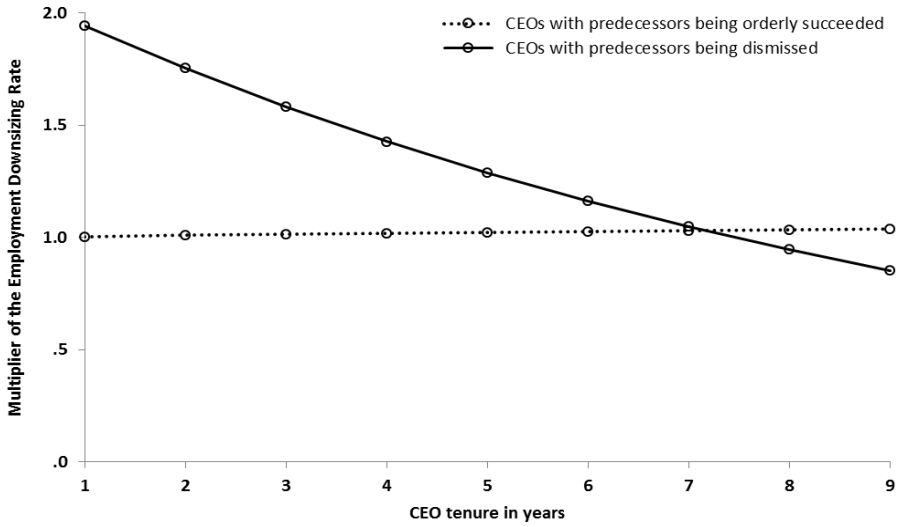


Figure 3. Post-CEO dismissal refocusing and downsizing based on models in Table 3

A. Asset divestiture of five percent or more, Model 3



B. Employment downsizing of five percent or more, Model 6



APPENDICES

APPENDIX A. Cox proportional hazard models of CEO dismissal

Variable	M 1	M 2	M 3	M 4	M 5	M 6
Age60	-0.005	-0.004	-0.004	-0.008	-0.007	-0.004
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
CEO tenure	-0.029	-0.029	-0.029	-0.029	-0.027	-0.029
	(0.049)	(0.049)	(0.049)	(0.049)	(0.048)	(0.049)
Outside CEO	0.322	0.370	0.340	0.386	0.340	0.223
	(0.333)	(0.332)	(0.332)	(0.334)	(0.327)	(0.341)
Board tenure	0.013	0.011	0.012	0.014	0.013	0.019
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Chairman CEO	-1.169***	-1.223***	-1.198***	-1.212***	-1.225***	-1.227***
	(0.317)	(0.319)	(0.319)	(0.314)	(0.315)	(0.319)
Family CEO	0.281	0.333	0.293	0.355	0.383	0.353
	(0.454)	(0.458)	(0.455)	(0.453)	(0.455)	(0.440)
Finance CEO	0.614+	0.578+	0.601+	0.599+	0.563	0.532
	(0.345)	(0.341)	(0.340)	(0.346)	(0.343)	(0.351)
Operation CEO	0.453	0.477	0.459	0.466	0.483	0.474
	(0.305)	(0.302)	(0.304)	(0.304)	(0.301)	(0.299)
Sales CEO	0.561+	0.582+	0.583+	0.565+	0.529+	0.611*
	(0.311)	(0.303)	(0.305)	(0.304)	(0.308)	(0.311)
Sarbanes-Oxley Act	0.405	0.349	0.374	0.342	0.407	0.335
	(0.302)	(0.299)	(0.299)	(0.299)	(0.294)	(0.303)
Prior dismissal	0.515	0.439	0.509	0.352	0.439	0.525
	(0.473)	(0.483)	(0.483)	(0.478)	(0.477)	(0.504)
Prior dismissal squared	-0.330	-0.293	-0.324	-0.257	-0.283	-0.370
	(0.274)	(0.274)	(0.279)	(0.262)	(0.262)	(0.311)
DT, t-1	-0.293	-0.250	-0.253	-0.306	-0.322	-0.293
	(0.206)	(0.203)	(0.202)	(0.203)	(0.206)	(0.206)
Total assets logged	-0.207	-0.200	-0.195	-0.205	-0.231	-0.233
	(0.150)	(0.150)	(0.150)	(0.149)	(0.150)	(0.151)
Total employees logged	0.427*	0.433*	0.432*	0.441*	0.509**	0.491**
	(0.191)	(0.189)	(0.191)	(0.189)	(0.192)	(0.188)
Board size	0.000	-0.005	-0.005	-0.003	-0.009	-0.007
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.036)
Outsider director percentage	0.009	0.009	0.009	0.009	0.007	0.011
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Institutional ownership	-0.028	-0.026	-0.026	-0.028	-0.028	-0.028
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.027)
Sales growth/10^3	-0.060***	-0.052**	-0.058***	-0.052**	-0.057**	-0.066***
	(0.017)	(0.018)	(0.018)	(0.018)	(0.017)	(0.016)
EPS, t-1	-0.071**	-0.064**	-0.068**	-0.068**	-0.051+	-0.117***
	(0.022)	(0.023)	(0.023)	(0.023)	(0.028)	(0.022)
Change in DR, t-1 to t-2	0.396			0.593	0.525	1.024
	(1.392)			(1.442)	(1.172)	(1.006)
Change in DU, t-1 to t-2	1.031			1.961*	1.300+	1.423*
	(0.710)			(0.833)	(0.745)	(0.695)
Percentage change in tangible fixed assets, t-1 to t-2		-0.009		-0.010	-0.009	
		(0.006)		(0.007)	(0.008)	
Percentage change in employees, t-1 to t-2			-0.003	0.000		0.003
			(0.008)	(0.001)		(0.005)
Change in DU × EPS				-0.386*		
				(0.167)		
Percentage change in tangible fixed assets × EPS					-0.003+	
					(0.002)	
Percentage change in employees × EPS						-0.005***
						(0.001)
Log pseudolikelihood	-438.13	-438.05	-438.86	-435.44	-433.81	-429.72

+ p<.10; * p<.05; ** p<.01; *** p<.001 (two-sided tests)

Notes: Numbers in parentheses are robust standard errors. Number of observations=1862; number of unique firms=124; number of unique CEOs=360, number of CEO dismissal events=94.

APPENDIX B. Fixed-effects models of continuous change in tangible fixed assets and number of employees

	Percentage change in total tangible fixed assets			Percentage change in number of employees		
Variable	**M 1**	**M 2**	**M 3**	**M 4**	**M 5**	**M 6**
CEO age	0.079	0.104	0.093	0.164**	0.266**	0.251**
	(0.070)	(0.097)	(0.098)	(0.065)	(0.094)	(0.093)
Outside CEO	-1.537	-1.071	-0.945	-1.750	-1.505	-1.344
	(1.332)	(1.244)	(1.203)	(1.588)	(1.553)	(1.525)
Chairman CEO	-0.678	-0.541	-0.792	-0.787	-0.383	-0.723
	(1.209)	(1.214)	(1.213)	(1.150)	(1.148)	(1.175)
Family CEO	3.148*	4.203*	4.128*	2.782	4.566*	4.477*
	(1.798)	(2.097)	(2.104)	(2.407)	(2.605)	(2.689)
Finance CEO	1.153	1.424	1.254	1.192	1.226	0.989
	(1.373)	(1.327)	(1.337)	(1.319)	(1.304)	(1.300)
Operation CEO	1.145	1.107	1.006	-0.594	-0.852	-0.989
	(1.346)	(1.268)	(1.272)	(1.399)	(1.393)	(1.380)
Sales CEO	-1.736	-1.468	-1.473	-1.181	-1.231	-1.234
	(1.412)	(1.425)	(1.433)	(1.740)	(1.713)	(1.726)
Cumulative experience in 5% divestiture logged, 1984 to t-1	-2.924*	-2.637*	-2.601*			
	(1.262)	(1.244)	(1.231)			
Cumulative experience in 5% downsizing logged, 1984 to t-1				0.948	1.091	1.121
				(1.267)	(1.252)	(1.244)
Sales growth/10^3, t to t-1	1.001***	1.006***	1.001***	0.811***	0.819***	0.812***
	(0.231)	(0.234)	(0.232)	(0.254)	(0.256)	(0.253)
EPS, t-1	0.490***	0.481***	0.470**	0.303**	0.304**	0.288**
	(0.154)	(0.151)	(0.150)	(0.106)	(0.106)	(0.103)
Total assets logged, t-1	-8.989***	-9.172***	-9.046***	-7.284***	-7.436***	-7.272***
	(1.261)	(1.267)	(1.265)	(1.270)	(1.224)	(1.210)
Change in DU, t-1 to t-2	2.220	2.519	2.528	0.511	0.724	0.722
	(2.159)	(2.174)	(2.177)	(1.842)	(1.852)	(1.863)
Change in DR, t-1 to t-2	-1.787	-1.989	-1.995	1.263	0.992	0.964
	(2.302)	(2.302)	(2.291)	(2.859)	(2.854)	(2.918)
Board size	-0.232	-0.241	-0.265	-0.362*	-0.395*	-0.427*
	(0.193)	(0.182)	(0.188)	(0.201)	(0.197)	(0.200)
Outsider director percentage	-0.045	-0.036	-0.038	0.048	0.044	0.042
	(0.036)	(0.037)	(0.036)	(0.041)	(0.041)	(0.040)
Institutional ownership	0.166	0.157	0.163	-0.195*	-0.220*	-0.213*
	(0.121)	(0.120)	(0.120)	(0.113)	(0.113)	(0.110)
Successor CEO tenure		-0.038	-0.063		-0.177	-0.211*
		(0.114)	(0.112)		(0.117)	(0.116)
Predecessor CEO dismissal		-2.789**	-4.524**		-1.705	-4.063**
		(0.986)	(1.706)		(1.041)	(1.610)
Predecessor CEO dismissal × Successor CEO tenure			0.453			0.616*
			(0.332)			(0.316)
Constant	85.468***	85.200***	85.711***	56.701***	53.019***	53.765***
	(13.018)	(12.750)	(12.733)	(11.689)	(11.492)	(11.418)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2170	2170	2170	2183	2183	2183
Number of unique firms	124	124	124	124	124	124
F	8.76***	10.07***	10.15***	4.43***	4.62***	4.60***

* p<.05; ** p<.01; *** p<.001 (one-sided tests)

Note: Robust standard errors are shown in parentheses. Outliers for which percentage changes in tangible fixed assets and employment <−100 or >100 were removed.

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Essay 2

Categorization in Media Discourse, Identity Construction, and the Survival of Entrepreneurial Ventures

Key Words: Categorization; organizational identity; media discourse; cognitive relational networks; new organizational form; organizational mortality

INTRODUCTION

Newly founded firms typically face the challenge of establishing and projecting an identity in relevant audiences who control over material and symbolic resources in external environments. In contrast to established firms, young ventures have limited track records and resources (Lounsbury and Glynn 2001), inchoate organizational practices (Stinchcombe 1965), and little power to influence their surroundings (Fligstein 2001). These characteristics imply that young ventures have difficulty in reducing audiences' concerns about the answers to the question about what they are and do (Whetten 2006). This difficulty is particularly great when entrepreneurs seek a new organizational form that has not yet become legitimated. By definition, new forms do not have their prior examples, and their related patterns of activities do not fit established category systems (Romanelli 1991; Ruef 2000; Sine, Haveman, and Tolbert 2005). Not conforming to the category systems means being overlooked and ignored as unintelligible (DiMaggio and Powell 1983; Zuckerman 1999). As such, entrepreneurial ventures pursuing a not-yet-legitimate form lack attentive audiences and so face greater difficulty constructing a legitimate sense of organizational identity, thereby reducing their access to needed resources for survival (Aldrich and Fiol 1994; Baum and Oliver 1992).

The aim of this research is to investigate the cognitive underpinning of the identity construction of new entrepreneurial ventures pursuing a novel form. I suggest a basic condition facilitating audiences' sensemaking about the identity of organizations in an emerging population: the textual connectedness among population entrants preserved in relevant media outlets. This condition is the result of the accumulating media coverage about events involving multiple population entrants that positions them in cognitive relational networks (Kennedy 2008; Kennedy, Lo, and Lounsbury 2010). Given the cognitive limits of attention (Cyert and March 1963; Ocasio 1997), these networks can serve as frames of reference around which audiences identify who are comparable with whom and who are representative of a population. Highly inter-connected, or prominent, firms within the networks act as cognitive referents for their whole population. These firms are recognizable by audiences as similar to each other and different from all others, so that their common patterns of features and activities become categorically meaningful. As a result, audiences' perceptions of the identity of new entrepreneurial ventures can be at times attributions influenced by the firms' positions within cognitive networks in media discourse.

To demonstrate the importance of media coverage for inter-organizational networks in the identity construction of entrepreneurial ventures in an emerging population, I focus on the degree to which a firm is connected to its within-population competitors in media discourse, which is hypothesized to be associated with the firm's survival chances. I expect that new ventures are

more likely to survive obscurity when they occupy more central or prominent positions in cognitive networks. This means that highly inter-connected firms obtain survival benefits from a prominent position that signals their membership in a collective entity and so helps establish their market identity in audiences. In contrast, firms that remain rather isolated from the networks are likely to be ignored as intelligible, thereby confronting increased difficulty projecting their identity onto audiences. My empirical strategy for determining whether the prominence of a firm within cognitive networks of media coverage is associated with audiences' sensemaking about the firm's identity is to investigate whether the magnitude of the decreasing effect of network prominence on the failure rate is contingent on the degree to which the identity of the firm is ambiguous or unclear among audiences. When the identity of a firm is already established in audiences, audiences need not infer the firm's identity on the basis of its position in cognitive networks, and therefore the survival advantages that the firm can obtain from its network prominence will be minimal.

I situate my analysis in the South Korean population of semiconductor integrated-circuit (IC) design firms between 1994 and 2010. I document how the failure rate of IC-design firms is influenced by their positions within cognitive relational networks configured from media coverage for discourse across time. My empirical analyses focus on demonstrating that while the cognitive network prominence generally has a decreasing impact on the failure rate, the magnitude of this impact is contingent on the degree of the ambiguity about the firm's identity, measured in terms of age, size, and patent performance. The results show that high levels of cognitive network prominence lead to a lowered failure rate and this relationship is particularly strong for the firms that are younger and smaller, and have a smaller number of patents. Moreover, they show that the decreasing impact of cognitive network prominence on the failure rate is diminished as the population becomes matured. Overall, I show that media coverage for cognitive networks helps new entrepreneurial ventures establish a legitimate organizational identity by enabling them to get recognized as categorically meaningful.

THEORY AND HYPOTHESES

In their early stages of formation, new ventures typically suffer the lack of a clear or coherent identity among audiences, including competitors, customers, investors, analysts, and regulators. Organizational identity is imbued with value and incorporated as a competence, so that establishing and maintaining a legitimate identity is vital for organizations (Hannan and Freeman 1977; Whetten 2006). Because young ventures have short track records of performance (such as patent activity) by which audiences appraise their features, the firms' values and future prospects are highly uncertain, leading to a reduced access to resources necessary for their survival (Lounsbury and Glynn 2001). Young ventures also lack their capacity to provide products or services of consistent quality, reducing their chances of prosperity and survival (Hannan and Freeman 1984). Moreover, researchers suggested that since young ventures tend to be small, the liability of newness also means a liability of smallness (Baum 1996). The failure rate among small firms, relative to their larger counterparts, is generally high, partly because they do not have sufficient resources to withstand a sustained period of poor performance (Aldrich and Auster 1986; Boeker 1989). These problems pose an acute challenge for young or small ventures in establishing a legitimate sense of their identities in the minds of audiences to create and maintain steady resource flows from the environment.

This challenge is particularly great when young ventures pursue a new organizational form that has not yet established its legitimacy. During the emergent moments, new organizational forms are typically surrounded by considerable uncertainty about their economic viability, due to their engagement in untested technologies (Tushman and Anderson 1986; Sine, Haveman, and Tolbert 2005), unclear product or service concepts (Rosa et al. 1999; Hargadon and Douglas 2001), and ambiguous market boundaries (J. Porac and Rosa 1996; Santos and Eisenhardt 2005). As such, organizations pursuing those novel kinds of economic activity tend to escape public attention and suffer the problem of scant legitimacy among audiences. Therefore, the establishment of a legitimate identity which can enable organizations to acquire resources more easily (B. G. King, Clemens, and Fry 2010; Lounsbury and Glynn 2001; Navis and Glynn 2011; Wry, Lounsbury, and Glynn 2011), can be a particularly acute challenge for new entrepreneurial ventures using not-yet-legitimate forms.

When audiences are not confident of their ability to interpret the identity of a firm based on the firm's record of prior activities, they may rely on other sources of information about the firm. Research has suggested that news media (especially, specialized business newspapers) can provide a critical tool for sensemaking about a new organizational identity, as they provide a channel through which audiences can learn of organizations doing something novel (Hirsch 1986; Baum and Powell 1995; Nigam and Ocasio 2009; Jonsson and Buhr 2010; Strang and Meyer 1993; Davis, Diekmann, and Tinsley 1994; Hoffman 2002; Aldrich and Fiol 1994; Strang and Meyer 1993). As an institutional intermediary in markets, news media exercise control over the information available to audiences, and so direct audiences' attention toward certain issues and away from others. As a result, what news media direct attention to both reflects and shapes the ways audiences perceive as appropriate and desirable. Research found that news media can influence audiences' perceptions and understandings about organizations by disseminating information about them in large volume and by framing the information in a positive tenor (Hybels 1994; M. D. King and Haveman 2008; Deephouse 2000; Pollock and Rindova 2003; Ruef 2000; Schultz, Marin, and Boal 2014; Sine, Haveman, and Tolbert 2005; Perretti, Negro, and Lomi 2008; Hsu 2006a). These studies indicate that market stories published in news media have the power to influence an interpretive context in which audiences develop shared views about what a real organization is and does.

Categorization and Organizational Identity

New insights on the role of news media in the formation of an organizational identity stem from the recent work on sociocognitive categorization and its consequences for market actions and outcomes. In sociological inquiry, categorization is an ordinary social process through which similar entities (such as organizations of a form) are sorted into distinct cognitive categories whose associated meanings generate cultural belief systems, defining shared views about social reality (Durkheim and Mauss 1963; Zerubavel 1999; Berger and Luckmann 1967; Douglas 2002; Lamont and Molnár 2002; Mohr and Duquenne 1997). Scholars held that categorization is essential to human cognitions and perceptions of social groups because it serves a basic epistemic function of organizing and structuring people's knowledge about the social world (Mervis and Rosch 1981; Rosch and Lloyd 1978). Durkheim and Mauss (1963:4) suggested for the relevance of categories to market settings, arguing that economic life cannot be properly understood apart from actors' held category systems, which come both from actors' mental representations and from the social structures in which they reside.

This social constructionist notion has recently gained renewed attention from organizational sociologists who consider categories as an essential element of collective sensemaking among audiences about organizations of a particular form (Pólos, Hannan, and Carroll 2002; DiMaggio 1987; Hannan, Pólos, and Carroll 2007; Hsu, Negro, and Koçak 2010; McKendrick et al. 2003; Hannan 2010). This perspective posits that an organizational form exists only when audiences reach the consensus that its related activities are appropriate within a taken-for-granted system of social codes. It also suggests that the categorization process of similar organizations is fundamental to the development of shared understandings about a nascent form. When audiences recognize similarities among a set of organizations, attribute any significance to the similarities, and assign the organizational set a specific label (such as minivans and computer workstations), a new category is created. The collective identity of a category coheres around a prototype, i.e., the best representation of what it means to be accepted as a member of the category (Mervis and Rosch 1981). Once widely held, the expectation of the typical category member constitutes a social code for form identity that specifies diagnostic features of a form. Thus, audiences automatically assume that the bearers of the category label have the identity-consistent features (Hsu and Hannan 2005; Romanelli and Khessina 2005). In short, the establishment of a new form signifies the formation of form identity codes that depends on the categorization process through which organizations using the form are sorted into a distinct category to shape shared views about organizational reality.

As shared views about the kinds of organizations, categories exercise real power through the way they orient audiences towards default assumptions about the similarity, comparability, and relative value of organizations (Berger and Luckmann 1967; Ruef and Patterson 2009). In particular, categories articulate the similarities and differences among groups of organizations, and so provide an interpretive schema that allows audiences to see an organization in terms of the summary features of category membership rather than the attributes of individual organizations (Lamont and Molnár 2002; Lounsbury and Rao 2004). Audiences use category systems to navigate across markets. Categories with stable schema enable audiences to distinguish between social groups, for instance, industrial versus craft breweries (Carroll and Swaminathan 2000) and classical versus nouvelle cuisine chefs (Rao, Monin, and Durand 2003). Moreover, categories operate as a filter of market information, thus reducing environmental complexity and facilitating decision-makings. In particular, categorization of organizational groups represents the boundaries of markets and competition, enabling producers to identify their comparable rivals (J. F. Porac et al. 1995); customers to compare and evaluate products (Rosa et al. 1999); investors to forecast market valuations (Zuckerman 1999); and critics to classify products and firms (DiMaggio 1987). This means that where category systems are clearly defined, they constitute commonsense knowledge structure that sustains the orderly functioning of complex markets and industries (Fligstein 2001; Navis and Glynn 2010). In contrast, where categories are ambiguous, market uncertainty and volatility can result. Consequently, established market categories bring order and coherence to the complex organizational world.

In the meantime, the role of market categories in enabling comparisons and evaluations implies that organizations that fall neatly into pre-defined categories are considered as more legitimate, whereas those that do not are likely to be overlooked and suffer loss of legitimacy due to the lack of their comparability with other organizations (Elsbach and Kramer 2003; Hsu 2006b; Pólos, Hannan, and Carroll 2002). Of particular importance in this regard is Zuckerman's (1999, 2000) research on illegitimacy discounts in stock markets. He drew attention to category systems as taken-for-granted constructs, and documented devaluations of U.S. conglomerate

firms whose diversified business profiles did not conform to the classification schema established by securities analysts for sorting firms into reference groups. He showed that nonconforming firms tended to receive less media coverage from the analysts who specialize in the industries in which those firms operate, and this lack of analyst coverage undermined those firms' attractiveness to investors, leading to lowered valuations in stock markets. That is, analysts penalized organizations that "[stood] outside the field of comparison" (Zuckerman 1999, 1401). As a result of the selective coverage, conglomerate firms were forced to divest the business divisions that made their profiles ill-conform to analysts' held category schema. These observations suggest that organizations outside accepted categories are the hardest to understand and the most likely to be undervalued because they defy categorization.

Taken together, organizational research suggests that market categories are heuristic systems that provide cognitive resources for organizational comparisons and evaluations, and economic decision-makings. If audiences use established category systems as a reference point to sort, evaluate, and assign an identity to organizations (Hsu and Hannan 2005; Ruef and Patterson 2009), then this implies that the challenge that new entrepreneurial ventures confront in establishing a legitimate organizational identity among audiences consists in the possibility that they will not be readily categorized and so ignored as incomprehensible. From this consideration, there is a strong need for research illuminating what conditions can foster audiences' perceptions about the categorical distinction of organizations in an emerging population to better understand how a legitimate sense of a new organizational identity is constructed. In this research, I focus on examining how news media can enable entrepreneurial ventures pursuing a novel form to get recognized by audiences as constituting a distinct cognitive category.

Categorization in Media Discourse and Identity Construction

The significance of categories in guiding social comparisons for understanding an organization suggests a focal point for empirical research on the role of news media in the identity construction of new entrepreneurial ventures: textual linkages among the firms in media discourse (Zuckerman 1999; Kennedy 2005; Kennedy, Lo, and Lounsbury 2010). News media form ties between two or more firms of a form in texts by referencing those firms together. Kennedy (2005, 2008) suggested that as media coverage about inter-organizational relationships accumulates over time, the resulting cognitive networks help audiences make inferences about an emerging market by enabling market entrants to get categorized and attended. Given cognitive limitations and environmental complexities (Cyert and March 1963), media coverage for inter-organizational networks can provide opportunities for collective sensemaking through which audiences gain awareness of organizations using a novel form, share interpretations of their activities, and converge toward their collective identity (Nigam and Ocasio 2009). As organizations of a form are increasingly connected to each other in media discourse, audiences can more easily make cognitive judgments that the firms are of the same sort, and develop shared understanding about distinct identity features that make them worth categorizing and labeling. As a result, the formation of relational networks in media discourse can assist in legitimating an emerging population by shaping audiences' cognitive representations, mental models, of how the population is bounded and works.

If media coverage for market networks is effective in driving categorization of organizations of a form in discursive space, then it has an implication for their identity formation, especially because forming an identity depends on what other organizations around them are doing (Gioia, Schultz, and Corley 2000; Elsbach and Kramer 1996; Zuckerman 1999). Institutional research

suggested that organizations entering in an emerging population must strive to look like other organizations of their type to gain social acceptance (Pedersen and Dobbin 2006). Ecological research suggested that perceptions of similarity are important for new ventures to establish a legitimate identity, because they allow the firms to acquire legitimacy that comes from getting noticed as part of a growing population (Rao, Monin, and Durand 2003; B. G. King, Clemens, and Fry 2010). I propose that such perceptions become more likely when organizations in a population are highly connected to each other within market networks of media coverage. This means that the perceptions of audiences are directed to some shared features of organizations occupying relatively prominent positions in cognitive networks, and that there is some recognition of those features as embodying a distinct collective identity of a form. Consequently, media coverage for inter-organizational networks can provide a rich source of inferences about the identity of organizations in an emerging population.

Prominence in Cognitive Network and Organizational Survival

From this perspective, public perceptions of the identity of entrepreneurial ventures pursuing a novel form can be attributions influenced by the firms' position in cognitive networks of media coverage. Firms occupying central network positions are salient or prominent, and audiences can more easily engage in social comparisons for sensemaking about the firms' key features and activities. Therefore, when a new venture in an emerging population is highly connected to other population entrants in media discourse, the firm will obtain survival benefits from a prominent position that signals its membership in a collective entity and reduce ambiguity about its organizational identity. In contrast, the firms that are isolated from cognitive networks are likely to suffer lowered chances of survival because they defy categorization and so are likely to be overlooked as unintelligible. Together, these considerations lead to the following hypothesis:

HYPOTHESIS 1: The greater the cognitive prominence of the firm in relational networks of media coverage, the lower the failure rate of the firm.

If media coverage for inter-organizational networks influences the failure rate of firms in an emerging population by providing market information that audiences can utilize to make sense of a new organizational identity, then the degree to which the firms gain survival advantages from a prominent network position will be contingent on the amount of ambiguity about the identity of the firms. The reason for this is that audiences are more likely to rely on media-provided information to make sense of the identity of a firm, when they are not confident of their understandings about the firm's identity based on its record of prior activities (Pollock and Rindova 2003; Lounsbury and Glynn 2001). Therefore, when there is considerable ambiguity about a firm's identity among audiences, the cognitive network prominence should have a particularly strong impact on audiences' sensemaking about the firm's identity and its survival chances. In contrast, when the identity of a firm is already clear or coherent to audiences, the magnitude of the impact of cognitive network prominence in enhancing the firm's survival chances should be minimal, because there is little need to infer the firm's identity on the basis of its position in cognitive networks of media coverage. It is therefore expected that the greater the ambiguity about the identity of the firm, the stronger the impact of the firm's cognitive network prominence on its survival chances.

Researchers have suggested that the level of the ambiguity about a firm's identity declines with organizational age, size, and patent performance. The identity of young ventures, relative to

their older counterparts, tends to be ambiguous, because they have limited records of prior activity on which audiences understand the identity of the firms (Freeman, Carroll, and Hannan 1983). The identity of small ventures also tends to be ambiguous and unclear among audiences, because they have low level of attentional quality and publicly available information about them is scant (Aldrich and Auster 1986). Finally, the patent activity of a firm in a technology-intensive industry (e.g., semiconductor IC-design industry) is a critical element of the prior accomplishments of the firm (Cohen and Levinthal 1990). A firm's ability to patent new technologies is relevant because patent activity indicates the firm's engaged domain of competition, technological capabilities, and future prospects. Together, these considerations lead to the following hypotheses:

HYPOTHESIS 2a: The lowering impact of the firm's cognitive network prominence on the failure rate will be strong especially when the firm's patent performance is poor.

HYPOTHESIS 2b: The lowering impact of the firm's cognitive network prominence on the failure rate will be strong especially when the firm is young.

HYPOTHESIS 2c: The lowering impact of the firm's cognitive network prominence on the failure rate will be strong especially when the firm is small.

In the meantime, the survival advantages from being prominent in cognitive relational networks will be contingent on the degree to which a population become matured. This contingency of cognitive network prominence is portended by the notion that an organization can gain legitimacy as the number of organizations of its type (i.e., population density) increases to a certain point (Hannan and Freeman 1989). The large number of organizations active in a population implies that information about the form defining the population is widely available and audiences are familiar with the form's related activities. As a result, when the level of population density is high, audiences are less likely to utilize the network positions to infer the identity of population entrants, and thus the impact of cognitive network prominence in reducing the firm failure rate will become weak. In contrast, when the level of population density is low, the information channeled by news media may serve as a "second best" source for sensemaking about the identity of population entrants. Together, these considerations lead to the following hypothesis:

HYPOTHESIS 3: The lowering impact of the firm's cognitive network prominence on the failure rate will be strong especially when the level of population density is low.

DATA AND METHODS

Sample

The research analyzes organizational failure rates in the South Korean population of IC-design firms between 1994 and 2010, inclusive. My primary sources of information on the population are periodic publications from the South Korean government and industry associations. I began with government reports of the *Infrastructure Support for IT SoC Industry*

which were annually published between 2000 and 2010. These reports contain a list of IC-design firms registering government-funded support programs for the industry each year, along with information on their founding year, management, and work force. They were published by the Ministry of Information and Communication for the years 2000 to 2007, and the Ministry of Knowledge Economy for the years 2008 to 2010. I also used the *IT SoC Annual Reports* which were published by the ASIC-design Association for the years 1998-2003 and the IT-SoC Association for the years 2004 to 2010.[6] These reports contain information for member firms of the nation-side industry association, including founding year, management, and work force. Finally, I supplemented the archival data with 27 interviews of entrepreneurs, engineers, journalists, industry association representatives, and governmental officials. These interviews were used to identify the IC-design firms that were not covered by the annual reports and were active prior to 1998.

In this way, I constructed a list of 382 dedicated semiconductor producers specializing in IC design active during the study period. Figure 1 plots the distribution of population founding, failure, and density by years. The number of foundings (the vertical axis on the left) waxes and wanes throughout the time period, ranging from 1 to 61, with the high mark occurring in 2001. The vertical axis on the right represents population density, measured as the number of IC-design firms active at the beginning of each of the years in the series. From 4 firms in 1994, population density increased to the highest level of 261 in 2009. It is notable that only 3 firms were active prior to 1994. This observation scheme minimizes a research design flaw that arises from the left-truncation that excludes the early history of a population (Carroll and Hannan 2000).

[Figure 1 about here]

Model Specification

My dependent variable is yearly observation of IC-design firm failure rates. Following the convention in ecological research (Hannan and Freeman 1989), firm failure was defined as bankruptcy, cessation of operations, or withdrawal by an organization. Mergers were not defined as failures. To obtain the exact dates of firm founding and failure, I relied primarily on the NICE Information Service Co., Ltd, the largest provider of information on domestic companies in South Korea since 1988.[7] I complemented this information using the National Tax Service database.[8] Of 382 IC-design firms in the population, 131 resulted in failure prior to the end of the year 2010. As presented in Figure 1, the number of failures (the vertical axis on the left) ranges from 0 to 19 per period, with the high marks in 2005 and 2009.

Firm failures are analyzed using event history analysis (Allison 2010). I estimate the hazard rate of firm failure by specifying piecewise exponential models. Parametric estimates of the hazard rate require assumptions about the effect of time (in the present research, organizational age or tenure) on firm failure. I adopt the piecewise exponential specification that is the least restrictive of the available functional forms of duration dependence (Blossfeld, Golsch, and Rohwer 2012). This approach splits duration time (firm age in the present research) into pieces

[6] In 2004, the ASIC Design Association changed its name to the IT-SoC Association.
[7] NICE refers to National Information and Credit Evaluation. NICE database is available www.kisline.com.
[8] The National Tax Service database is available at www.nts.go.kr.

according to the tenure of the organization. The base rate of failure remains constant within each time piece, though these base rates can vary across pieces. As a result, the piecewise model allows the base failure rate to vary flexibly with firm age. My exploratory research on the population found the best fit using three break points in firm age, at 3, 6, and 9 years. The first segment includes firm failure events that occur within the first three years of tenure ($0 \leq \text{Age} < 3$). The second includes failure events occurring within the subsequent three years ($3 \leq \text{Age} < 6$), and so forth ($6 \leq \text{Age} < 9$ and $\text{Age} \geq 9$).

To incorporate time-varying covariates, I broke each firm's life history into a sequence of yearly spells in which the firm is at risk of failure. Each of the spells was treated as right-censored, except for the spells that terminate in failure prior to the end of 2010. The original set of IC-design firms was divided into a dataset containing individual cases of 2,772 spells for 382 firms. But this amount was reduced to 2,393 spells in analyses by the lag used for independent and control variables. For robustness check, I analyzed the failure rate using data on a sub-population of 238 firms (1,798 spells) that had received media coverage at least once during the study period. The results presented in the following section are all maximum-likelihood estimates.

Independent Variable

I analyze organization failure rates in relation to the cognitive prominence of a firm in relational networks of media coverage. I define a firm's cognitive network prominence as the degree to which the firm's position in cognitive networks makes it visible and salient to audiences. The greater level of a firm's cognitive network prominence implies that the firm's market identity is more clear and coherent to audiences. For statistical analysis, I measured each firm's cognitive network prominence in terms of the firm's degree score, or a count of the number of lines adjacent to the firm in a cognitive network. Highly inter-connected, or cognitively prominent, firms are those whose features and activities are viewed as typical or representative of their belonging population. When a new entrepreneurial venture is prominent in cognitive networks, it will gain survival benefits from the position that reduces audiences' concerns about what the firm is doing.

For each year, I calculated the cognitive network prominence of each IC-design firm as follows. To begin with, I organized data on relational news stories—that is, those stories that reference two or more IC-design firms together—as a two-mode affiliation network matrix, in which a set of firms (the first mode) are affiliated with a set of news stories (the second mode) over the one-year window of observation (Wasserman and Faust 2009, 291–343). In the two-mode network, firms are related to each other through their joint affiliation with news stories. To explore patterns of textual relations among IC-design firms, I converted the two-mode network matrix into a one-mode symmetric network matrix of firm-by-firm co-occurrences, i.e., a cognitive relational network matrix. The entry in each cell of the co-occurrence matrix is the frequency of co-occurrence between the firm on the row (i) and on the column (j). The elements of each co-occurrence matrix are zero if none of relational news stories containing firm i contains firm j. In such a model of textual relations, those firms that co-occur more frequently in relational news stories are more prominent in an cognitive network; they are viewed among audiences as more typical of their belonging population.

Having constructed the co-occurrence matrix for each year, I measured the cognitive network prominence of firm i (a node) as:

$$Cognitive\ Network\ Prominence_i = \sum_{j=1}^{N} d_{ij} * c_{ij} \quad (i \neq j;\ 1 \leq i \leq N),$$

where N is the total number of IC-design firms in a given year; d_{ij} is the number of co-occurrences between firm i and firm j, or the number of relational news stories containing both firms; c_{ij} is the co-occurrence (or similarity) ratio between firm i and firm j, or the number of relational news stories containing the two firms divided by the number of relational news stories containing either or both firms.[9] The product of d_{ij} and c_{ij} represents the value over the line between firm i and firm j. Although the number of co-occurrences (d_{ij}) itself can be a useful indicator of the strength of relation between a pair of firms, I weighted that number by the co-occurrence ratio (c_{ij}) to take into account how similar two firms in a pair are, based on their patterns of relation with other firms. For instance, two focal firms may always appear together in relational news stories, suggesting a high level of similarity in their activities. The co-occurrence ratio of a pair of firms is a maximal value of one when the relational news stories containing the one also contain the other, and less than one, otherwise. Then, the cognitive network prominence of a firm refers to the sum of the values attached to all lines that are incident with the firm. In analysis, I used the relative value of each firm's cognitive network prominence over the average cognitive network prominence among firms with non-zero degree score in each matrix.

The co-occurrence network was extracted from news stories published in the *Electronics Times*, a nation-widely distributed daily newspaper in South Korea. This newspaper is the single most prominent media outlet in electronics industries including the IC-design industry, and act as a critical information intermediary between IC-design firms and their potential audiences. I entered the name of each IC-design firm as key word into the *Electronics Times* online database available from January 1994, and retrieved all news stories referencing the firm. Then, I excluded news stories whose coverage was not mainly about the firm's business activities, such as an obituary notice. If a news story was repeated, I counted the original to exclude duplications. As a result, I found 2,486 news stories, of which 1,730 reference only a single firm and 756 reference two or more firms together. Figure 2 plots the distribution of those news articles by years. The number of relational news stories ranges from 0 to 112, with the high mark in 2005.

[Figure 2 about here]

AN ILLUSTRATION. Figure 3 presents the bipartite graph of the two-mode network of 16 IC-design firms and 11 relational news stories for the year 1999. In this graph, all lines are between the IC-design firms and relational news stories, implying that the firms are connected to each other though relational news stories. For instance, it is through their co-occurrence in "Story 6" that Tamul Multimedia Co., TLI, Inc., and Media Logic Co. are textually inter-connected. This bipartite graph can be transformed into the valued graph of the one-mode network of 16 IC-design firms, as depicted in Figure 4. The graph represents a non-directional valued relation between each pair of firms (nodes) in the population. Each line carries a value resulting from the multiplication of the number of co-occurrences between two firms (d_{ij}) by their co-occurrence ratio in relational news stories (c_{ij}). Then, a firm i's cognitive network prominence is defined as the sum of the values attached to all lines incident with the firm (d_{ij}*c_{ij}). I normalized each firm's

[9] This index refers to the Jaccard similarity ratio in collocation analysis.

cognitive network prominence by the average cognitive network prominence among the 16 firms, as presented in Table 1.

[Figure 3 about here]

[Figure 4 about here]

[Table 1 about here]

Control Variables

The models include two types of control variables: firm characteristics and measures of environmental conditions. For the firm-level controls, I used three variables of organizational age, size, and technological performance, which are indicative of the ambiguity about the identity of a firm. I included these controls as main effects and as interactions with the measure of cognitive network prominence to test if the lowering impact of cognitive network prominence on the failure rate is particularly strong for firms whose identity is unclear and ambiguous among audiences. I included a measure of technological performance, a year-updated count of the number patents assigned to a firm. Those firms that have issued a greater number of patents will be better able to signal their capacities to create future advances, and thereby they will be more likely to survive. Information on patents that IC-design firms accrued each year was obtained from the *Korea Intellectual Property Rights Information Service*.

Prior research has demonstrated some forms of age dependence in failure rates—for instance, the liability of newness (Freeman, Carroll, and Hannan 1983) and the liability of adolescence (Levinthal and Fichman 1988). To account for age dependence in failure rates, I estimated a piecewise exponential model with four firm age segments, as described above. Research also suggested for the liability of smallness—that is, smaller firms are more likely to fail. Firm size can be defined in terms of total sales (revenue), assets, or workforces. In this study, sales and assets were not used as a measure of firm size due to data availability. Sales data were available for a few IC-design firms that went public. Data on capital at the time of founding were available, but they were not used because a time constant measure of size can be problematic in event history analyses of firm failures (Rao 1994). I chose to measure firm size using the number of employees. Data on employment were available from various sources, in particular government reports, industry association reports, recruiting companies, industry directories, and the NICE Information Service. However, none of these sources contained employment information for all firms in the sample over the entire study period, and there was inconsistency in the reports. For the analysis, I averaged each firm's employment size among the reports containing the firm.

Research suggested that news media can influence the formation of impressions about firms by increasing audience exposure to information about them (Deephouse 2000; Pollock and Rindova 2003). By disseminating market information, news media can render otherwise invisible firms to be more familiar and comprehensible, thereby improving their reputation and survival chances. To account for this possibility, the models include the volume of media coverage each firm receives, measured as the logged cumulative number of news stories referencing the firm from 1994 to year t-1. I also included a dummy variable, which was coded as one if a firm is a

subsidiary of a larger firm. Subsidiaries' access to resources afforded by their parent firms is likely to improve their survival chances.

***ENVIRONMENTAL CONDITIONS*.** The models include several aggregate-level variables to control for changes in carrying capacity and industry structure. The first is population density, or the existing number of firms in the IC-design population. Studies found that population density has a non-monotonic U-shaped relationship with failure rates (Hannan and Freeman 1989; Hannan and Carroll 1992). When the number of firms is few, each additional entry enhances the legitimacy of the population, thus decreasing failures. As population membership grows further, however, competition for scarce recourses increases faster than legitimacy, increasing failures. To account for the joint effect of competition and legitimacy, I included both linear and squared terms for population density as controls. I also controlled for the number of prior foundings. Studies have suggested that foundings in one period affect failure rates in the succeeding period (Delacroix, Swaminathan, and Solt 1989). A surge of recent foundings can signal favorable conditions for the population and diminish failures, but beyond a certain point, subsequent increases in foundings are expected to introduce competition and increase failures. I included both linear and squared terms for prior foundings to allow rate dependence to be non-monotonic.

Moreover, I included GDP and the inflation rate to capture macro-economic conditions and business cycles. Data on these economic indicators were obtained from the *Economics Statistics System of the Bank of Korea*. I also controlled for the growth rate of the South Korean semiconductor industry, measured as percentage changes in the total amount of semiconductor export. Information was obtained from the *Korea International Trade Association*. Finally, I included period dummies to account for the possibility that historical and institutional changes influence failure rates. Specifically, I created four dummies for the years of 1999-2001, 2002-2004, 2005-2007, and 2008-2010. The first relates to the national economic depression caused by the 1998 Asian financial crisis. The second begins in 2001, when the Korean government declared the prepayment of IMF credit. The last period relates to the national economic depression during the global subprime mortgage crisis.

RESULTS

Table 2 reports the means, standard deviations, and correlations among the variables used in the analysis. Tables 3 and 4 contain the results from the piecewise exponential models. Models in Table 3 use the 2,393 observations for 382 IC-design firms; models in Table 4 use the 1,798 observations for 238 IC-design firms receiving media coverage at least once during the study period.

[Tables 2 and 3 about here]

Models 1 through 5 in Table 3 predict the effects of cognitive network prominence and its interactions with population density, patent performance, and firm age on IC-design firm failure rates without firm size being controlled. Some of controls are noteworthy. All models include four segments of firm age, which allow the baseline hazard to shift at three points of 3, 6, and 9

years. Because firm age represents the duration clock in the time-to-failure models, duration dependence in the failure rate is captured by the coefficients on the age segment variables in the piecewise model. In contrast to the liability of newness argument (Freeman, Carroll, and Hannan 1983), the negatively significant coefficient estimates for the age segments indicate that IC-design firm failure rates generally increased with age. This relationship may be due to the provision of the government's nurturing programs for newly established IC-design ventures. However, as expected, the coefficient on patent performance is negative and significant, indicating that firms with more patents tended to face a reduced failure rate.[10] The coefficient on cumulative media coverage is negative and significant in Model 1, indicating that media visibility improves firm performance and survival chances (Pollock and Rindova 2003). However, this effect becomes insignificant when the level of cognitive network prominence is included. The estimates for the linear and squared terms for population density and prior founding are not significant, but their signs are negative and positive as commonly observed in prior ecological research. This pattern of effects may be due to the short observation window and the fact that density dependence models for mortality are sensitive to specification (Hannan and Carroll 1992).

Model 2 adds the effect of cognitive network prominence. The estimated coefficient is negative and significant, indicating that firms in more prominent (central) positions in cognitive networks of media coverage were less likely to fail. Specifically, a one-unit increase in cognitive prominence led to a decrease in the failure rate by about 54.842 percent ($100\times[\exp(-.795\times1)-1]$). The addition of cognitive prominence improves model fit significantly over Model 1 (χ^2 difference=4.50; d.f.=1; $p<.05$). This significant effect on the failure rate is plotted in Figure 5. The horizontal axis represents the levels of relative cognitive prominence that range from zero to two standard deviations above the mean, and the vertical axis represents the failure rate multiplier resulting from the effect of cognitive prominence. I have not adjusted the intercepts by the estimates of the baseline hazard since my interest is in illustrating the lowering impact of cognitive prominence on the failure rate. The plot shows the strong dependence of organizational mortality on the level of cognitive network prominence. In particular, when cognitive network prominence is one standard deviation above the mean, the multiplier is approximately .419 ($\exp[-.795\times1.094]$); this means that the implied failure rate of IC-design firms is .416 times higher the rate that would hold if cognitive prominence is zero.

[Figure 5 about here]

Model 3 adds an interaction between cognitive network prominence and population density to test whether firms gain greater survival benefits from their high cognitive network prominence when population density is lower, or when the key identity features of the population are not settled. As hypothesized, the interaction coefficient is positive and significant, implying that media coverage for cognitive networks is effective in fostering audiences' sensemaking about the identity of new entrepreneurial ventures particularly during the periods when their belonging

[10] Specifically, the hazard ratio for patent performance was estimated to be $\exp(-1.024) = .359$ in Model 1. This means that each additional patent multiplied the failure rate by the factor of .359—that is, a one-unit increase in the patent variable led to a decrease in the failure rate by about 64.084 percent ($100\times[\exp(-1.024\times1)-1]$).

population has not yet become legitimated. Model fit improves significantly over Model 2 (χ^2 difference=7.05; d.f.=1; p<.01). Figure 6 illustrates the magnitude of the decline in the effect of cognitive prominence on IC-design firm failure rates across four different levels of population density. It plots the failure rate multiplier as cognitive prominence increases within each level of population density. Again, I have not adjusted the intercepts, because my primary interest is in the differential effect of cognitive density across the varying population density levels. The figure shows that the lowering impact of cognitive prominence on the failure rate multiplier is minimal at the highest level of population density. This means that the need for media-based sensemaking about organizations in an emerging population is low when the categorical identity features of population entrants already have already become recognizable by audiences.

[Figure 6 about here]

Models 4 add an interaction term for cognitive network prominence and patent performance to test whether firms gain greater survival benefits from a prominent position within cognitive networks particularly during the period when their identities are inchoate. As hypothesized, the interaction coefficient is positive and significant, indicating that firms with poor patent performance tended to gain greater survival benefits from increasing cognitive prominence. Model fit improves significantly over Model 2 (χ^2 difference=10.38; d.f.=1; p<.01). Figure 7 illustrates the strong dependence of the cognitive prominence effect on patent performance. It shows that the lowering effect of cognitive prominence on the failure rate is relatively strong for firms with zero patents.

In Model 5, I interacted the level of cognitive network prominence with the firm age segments to see how its effect on the failure rate varies across different age groups. Supporting my hypothesis, cognitive network prominence has the greatest effect on the failure rate for young firms. Figure 8 illustrates the magnitude of the decline in the effect of cognitive prominence on firm failure rates across four firm age segments. It plots the failure rate multiplier as cognitive prominence increase within each age period. It demonstrates that the effect of cognitive prominence on the failure rate multiplier drops most precipitously over the variable's range for very young firms (in the 0 to 3 age range). This implies that the lowering effect of cognitive prominence on the failure rate is contingent on organizational age.

[Figures 7 and 8 about here]

Models 6 through 10 are replications of the previous five models except for the addition of firm size as a control variable. In Model 6, the effect of firm size is negative and significant, indicating that smaller firms tended to face a greater risk of failure. This finding is consistent with the argument that small organizations are highly vulnerable to environmental selection. With the firm size effect controlled, the coefficient on cumulative media coverage is insignificant, implying that larger firms are more likely than smaller firms to receive media coverage (Schultz, Marin, and Boal 2014). The effects of other controls are identical to those observed in Model 1. The remaining three models reveal that the hypothesized effects of cognitive network prominence and its interactions with population density, patent performance, and firm age are robust to the inclusion of the firm size effect.

Finally, Model 11 adds an interaction between cognitive network prominence and firm size to test if firms gain greater survival benefits from the prominent network position when they are smaller. The interaction coefficient is negative and significant, indicating that the survival benefits of cognitive density diminish as firms become older. Model fit improves significantly over Model 7 (χ^2 difference=5.46; d.f.=1; p<= .05). Figure 9 illustrates the effect of cognitive prominence over the variable's range at three different levels of firm size: the mean size, the mean plus a standard deviation, and the mean plus two standard deviations. The figure demonstrates the significant effect of cognitive prominence and the dependence of the prominence effect on the size of the IC-design firm. The predicted failure rate multiplier is shown to decrease most steeply over the range of cognitive prominence for IC-design firms with mean-level size, but the decline is relatively modest for larger firms.

[Figure 9 about here]

In consequence, the results evidence that when a new entrepreneurial venture occupies a more prominent position within cognitive networks, the firm gains survival benefits from the position that allows audiences to make sense of its organizational identity. Moreover, the cognitive network prominence effect is particularly strong for firms whose identities are ambiguous and unclear to audiences. For robustness check, I replicated all models in Table 3 using data on the sub-population of 238 IC-design firms, which excludes 144 firms not receiving any media coverage during the study period. Recall that I previously used data on 382 IC-design firms. I examined the sub-population to see if the hypothesized effects of cognitive prominence and its interactions persist among IC-design firms visible in media discourse. The results are presented in Table 4. They indicate that the effects of controls are not substantially changed expect for the effect of media coverage volume. In Models 2 through 11, the main and interaction effects of cognitive prominence are generally consistent with the results from the full population.

[Table 4 about here]

CONCLUSION

This research considers that news media play an essential role in communication between organizations and audiences, and examines how the pattern of media coverage can influence audiences' perceptions about the identity of entrepreneurial ventures pursuing a novel organizational form. In particular, it focuses on media reports about the relationships among firms in a nascent population that position those firms in cognitive network communities and render them to be categorically meaningful. It proposes that organizations gain survival advantages from a prominent network position that signals their belongingness to a collective entity and help establish their market identity in audiences. This argument is tested in the in the South Korean population of IC-design firms. The results show that occupying a relatively prominent position within cognitive networks of media coverage generally leads to a lowered failure rate, and the magnitude of this impact is particularly great for firms whose identities are inchoate and ambiguous. They also show that the decreasing impact of cognitive network

prominence on the failure rate declines as the population becomes matured. These findings suggest that media coverage for cognitive networks has a bearing on collective sensemaking among audiences about the identity of new entrepreneurial ventures by enabling the firms to get noticed as constituting a cognitively distinct category.

This research contributes to the organizational ecology literature in two respects. First, my analysis of relational networks in media discourse shows that categorization is a critical mechanism through which news media influence the development of shared understandings about organizations doing something new. This has an implication for recent advances in ecological theory which suggest that the precondition for a new form to gain constitutive legitimacy is the presence of organizations which are cognitively recognizable by audiences as categorically similar to each other and distinct from all others (Pólos, Hannan, and Carroll 2002; Hannan, Pólos, and Carroll 2007). Researchers in this perspective opine that the legitimation of a new form is not an outgrowth of the form's population growth. Instead, an increase in population density can be effective in driving the legitimacy of a form only when organizations using the form acquire a categorically independent standing among audiences. However, there is scant research on how audiences can perceive the categorical distinction of entrepreneurial ventures entering in an emerging population. Examining this question is important particularly because organizations using a not-yet-legitimate form tend to be overlooked and marginalized. The present study fills this gap by showing that media coverage for relational networks fosters audiences' cognitive judgments of similarity among a set of new entrepreneurial ventures.

Second, this research shows that high level of prominence in cognitive networks confers survival advantages by enabling an organization to get noticed as representative of its claiming population. This has an implication for the ecological research that emphasizes perceived homogeneity and "contrast"—i.e., the degree to which a set of organizations stands out from its domain—as fundamental to the constitutive legitimacy of a new organizational form (Hannan, Pólos, and Carroll 2007; Kuilman and Wezel 2013). According to this perspective, some organizations are perceived by audiences as more representative than others of a population (Hannan 2010), and the population's contrast increases when it consists of a higher proportion of organizations that are highly representative. The present study complements this line of research by providing an insight into the process through which audiences perceive the internal homogeneity of an emerging population. It suggests that relational networks in media discourse serves as points of reference around which audiences identity who are comparable with whom and what features these comparables possess in common. Highly inter-connected firms are of particular importance in this regard, as they act as cognitive exemplars of the population.

TABLES AND FIGURES

Table 1. Cognitive network prominence of IC-design Firms, 1999

IC-design firm (*i*)		Cognitive network prominence$_i$ (a)	Average cognitive network prominence (b)	Relative cognitive network prominence$_i$ (a/b)
1	Tamul Multimedia Co.	2.000	2.011	.995
2	Logic Meca Co.	1.036	2.011	.515
3	Mac Telecom Co.	1.000	2.011	.497
4	Media Logic Co.	2.000	2.011	.995
5	Voiso Semiconductor Co.	1.000	2.011	.497
6	People & Technology, Inc.	1.143	2.011	.568
7	Seodu Logic, Inc.	3.143	2.011	1.563
8	Sola Electronics, Inc.	.536	2.011	.266
9	C & S Technology, Inc.	5.742	2.011	2.855
10	Aralion, Inc.	4.919	2.011	2.446
11	I-Chips Co.	.143	2.011	.071
12	ASIC Plaza Co.	2.269	2.011	1.129
13	Advanced Digital Chips, Inc.	3.143	2.011	1.563
14	Joohong Information & Communication Co.	.950	2.011	.472
15	Seodu Inchip, Inc.	1.143	2.011	.568
16	TLI, Inc.	2.000	2.011	.995

Table 2. Correlations and Descriptive Statistics of Variables

Variable		Mean	S.D.	1	2	3	4	5	6	7	8
1	Firm age	5.716	3.126								
2	Relative cognitive network prominence	0.278	0.816	0.13							
3	Patent	1.135	5.831	0.13	0.45						
4	Firm size	4.824	5.926	0.32	0.63	0.52					
5	Subsidiary	0.035	0.184	-0.03	-0.02	-0.01	0.09				
6	Cumulative media coverage logged	1.149	1.312	0.62	0.41	0.26	0.59	0.02			
7	Population density	206.782	54.915	0.41	-0.07	0.07	0.06	0.03	0.14		
8	Population density squared/1000	45.773	17.905	0.45	-0.08	0.07	0.06	0.02	0.13	0.98	
9	Prior foundings	25.057	9.780	-0.21	0.05	-0.02	-0.02	-0.01	-0.06	-0.45	-0.51
10	Prior foundings squared/1000	0.723	0.684	-0.19	0.05	-0.02	-0.01	0.00	-0.07	-0.46	-0.49
11	ICT market growth rate	11.965	15.731	-0.02	0.03	-0.01	-0.01	0.00	-0.01	-0.15	-0.15
12	GDP/1000	887.139	190.594	0.46	-0.08	0.07	0.06	0.02	0.12	0.91	0.97
13	Inflation rate	2.920	1.054	0.07	-0.02	-0.02	-0.02	-0.01	0.01	-0.04	0.03
14	Year 1999-2001	0.127	0.334	-0.29	0.03	-0.04	-0.03	-0.01	-0.11	-0.63	-0.66
15	Year 2002-2004	0.236	0.425	-0.17	0.03	-0.04	-0.03	0.01	-0.01	-0.16	-0.28
16	Year 2005-2007	0.285	0.451	0.06	0.00	0.04	0.03	0.01	0.05	0.24	0.22
17	Year 2008-2010	0.324	0.468	0.35	-0.07	0.03	0.03	0.01	0.06	0.55	0.66

(*Continued*)

Variable		9	10	11	12	13	14	15	16
10	Prior foundings squared/1000	0.96							
11	ICT market growth rate	0.23	0.28						
12	GDP/1000	-0.48	-0.44	-0.11					
13	Inflation rate	-0.41	-0.48	0.16	0.12				
14	Year 1999-2001	0.47	0.52	-0.18	-0.59	-0.25			
15	Year 2002-2004	0.02	-0.05	0.44	-0.38	0.16	-0.21		
16	Year 2005-2007	0.24	0.10	-0.02	0.12	-0.36	-0.24	-0.35	
17	Year 2008-2010	-0.55	-0.40	-0.23	0.77	0.32	-0.26	-0.38	-0.44

Notes: The sample is the 2,393 annual spells for 382 IC-design firms in 1994-2010.

Table 3. Maximum Likelihood Estimates of Piecewise Exponential Hazards Models of Organizational Failure: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994-2010

Variable	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6	MODEL7	MODEL8	MODEL9	MODEL10	MODEL11
Relative cognitive network prominence		-0.795*	-8.070*	-0.824*			-0.600*	-8.082*	-0.621*		-0.813*
		(0.375)	(2.917)	(0.367)			(0.346)	(2.723)	(0.343)		(0.403)
Relative cognitive network prominence × Pop. density			0.032*					0.033*			
			(0.012)					(0.011)			
Relative cognitive network prominence × Patent				0.103*					0.101*		
				(0.032)					(0.034)		
Relative cognitive network prominence × Age <3					-2.252*					-2.076+	
					(1.364)					(1.299)	
Relative cognitive network prominence × Age 3-6					-1.535*					-1.348*	
					(0.788)					(0.741)	
Relative cognitive network prominence × Age 6-9					-0.438					-0.241	
					(0.595)					(0.582)	
Relative cognitive network prominence × Age ≥9					-0.233					0.045	
					(0.452)					(0.372)	
Relative cognitive network prominence × Firm size											0.026*
											(0.011)
Firm size						-0.108*	-0.089*	-0.096*	-0.089*	-0.095*	-0.095*
						(0.053)	(0.053)	(0.053)	(0.053)	(0.054)	(0.054)
Patent	-1.024*	-0.989*	-0.989*	-1.013*	-0.986*	-0.961*	-0.947*	-0.944*	-0.972*	-0.941*	-0.945*
	(0.328)	(0.328)	(0.326)	(0.336)	(0.327)	(0.328)	(0.328)	(0.327)	(0.338)	(0.327)	(0.327)
Age: <3 years	-21.341*	-19.414*	-19.523*	-20.983*	-19.681*	-20.861*	-18.994*	-19.532*	-19.206*	-19.435*	-19.604*
	(1.645)	(1.684)	(1.760)	(1.652)	(1.725)	(1.602)	(1.668)	(1.765)	(1.667)	(1.718)	(1.674)
Age: 3-6 years	-20.514*	-18.634*	-18.732*	-20.203*	-18.911*	-20.025*	-18.193*	-18.717*	-18.405*	-18.643*	-18.804*
	(1.664)	(1.705)	(1.782)	(1.673)	(1.744)	(1.627)	(1.699)	(1.796)	(1.699)	(1.747)	(1.703)
Age: 6-9 years	-20.661*	-18.789*	-18.880*	-20.358*	-19.114*	-20.162*	-18.338*	-18.854*	-18.549*	-18.835*	-18.948*
	(1.678)	(1.705)	(1.782)	(1.675)	(1.745)	(1.633)	(1.693)	(1.791)	(1.694)	(1.740)	(1.699)
Age: ≥9 years	-20.208*	-18.398*	-18.497*	-19.968*	-18.735*	-19.766*	-17.977*	-18.496*	-18.190*	-18.492*	-18.590*
	(1.677)	(1.707)	(1.781)	(1.670)	(1.743)	(1.634)	(1.697)	(1.794)	(1.698)	(1.744)	(1.703)
Subsidiary	0.292	0.274	0.240	0.274	0.293	0.373	0.341	0.307	0.342	0.358	0.341
	(0.358)	(0.360)	(0.362)	(0.360)	(0.357)	(0.317)	(0.327)	(0.327)	(0.327)	(0.322)	(0.325)
Cumulative media coverage logged, 1994 to t-1	-0.167*	-0.084	-0.090	-0.083	-0.095	-0.033	0.001	0.002	0.002	-0.006	0.005
	(0.080)	(0.088)	(0.089)	(0.088)	(0.089)	(0.100)	(0.100)	(0.101)	(0.100)	(0.101)	(0.100)
Population density	-0.009	-0.006	-0.007	-0.005	-0.003	-0.002	-0.001	-0.003	-0.001	0.003	-0.000
	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)
Population density squared/1000	0.327+	0.307+	0.307+	0.306+	0.292	0.306+	0.295	0.299	0.294	0.276	0.293
	(0.239)	(0.239)	(0.239)	(0.238)	(0.239)	(0.239)	(0.239)	(0.239)	(0.239)	(0.239)	(0.238)
Prior foundings	-0.246	-0.238	-0.245	-0.237	-0.231	-0.244	-0.238	-0.248	-0.238	-0.229	-0.238
	(0.208)	(0.208)	(0.207)	(0.208)	(0.208)	(0.208)	(0.208)	(0.207)	(0.208)	(0.208)	(0.208)
Prior foundings squared	4.758+	4.607+	4.745+	4.600+	4.490+	4.730+	4.628+	4.808+	4.623+	4.466+	4.621+
	(3.415)	(3.410)	(3.400)	(3.409)	(3.412)	(3.409)	(3.405)	(3.398)	(3.405)	(3.408)	(3.405)
ICT market growth rate	-0.022	-0.021	-0.023	-0.021	-0.019	-0.020	-0.019	-0.022	-0.019	-0.017	-0.019
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
GDP/1000	-0.016*	-0.016*	-0.015*	-0.016*	-0.015*	-0.016*	-0.016*	-0.016*	-0.016*	-0.016*	-0.016*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Inflation rate	1.165*	1.122*	1.126*	1.121*	1.094*	1.168*	1.137*	1.147*	1.136*	1.100*	1.135*
	(0.615)	(0.616)	(0.615)	(0.616)	(0.616)	(0.614)	(0.614)	(0.614)	(0.614)	(0.614)	(0.614)
Year 1999-2001	16.102*	13.867*	14.245*	15.428*	13.969*	15.550*	13.470*	14.410*	13.675*	13.694*	14.069*
	(5.202)	(5.292)	(5.425)	(5.284)	(5.349)	(5.162)	(5.248)	(5.415)	(5.248)	(5.319)	(5.253)
Year 2002-2004	14.024*	11.828*	12.286*	13.389*	11.923*	13.368*	11.326*	12.355*	11.529*	11.538*	11.919*
	(5.639)	(5.711)	(5.817)	(5.701)	(5.759)	(5.635)	(5.706)	(5.838)	(5.706)	(5.769)	(5.710)

Year 2005-2007	13.098*	10.918*	11.304*	12.482*	11.056*	12.562*	10.504*	11.434*	10.709*	10.778*	11.094*
	(4.524)	(4.590)	(4.688)	(4.577)	(4.632)	(4.518)	(4.585)	(4.706)	(4.585)	(4.640)	(4.589)
Year 2008-2010	10.764*	8.698*	9.011*	10.267*	8.943*	10.355*	8.357*	9.187*	8.568*	8.781*	8.954*
	(2.999)	(3.019)	(3.060)	(3.002)	(3.030)	(3.010)	(3.038)	(3.084)	(3.038)	(3.053)	(3.041)
Log Pseudolikelihood	-262.43	-259.63	-257.34	-259.44	-258.29	-258.85	-257.38	-254.70	-257.19	-255.79	-257.09

+ p<.10; * p<.05 (one-tailed tests)

Notes: Robust standard errors of estimates are in parentheses. The Huber-White-sandwich estimator of variance, which clusters observations on organizations, is used to produce robust standard errors. The sample is the 2,393 annual spells for 382 IC-design firms and 131 failure events.

Table 4. Maximum Likelihood Estimates of Piecewise Exponential Hazards Models of Organizational Failure: Sub-population of 238 Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994-2010

Variable	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6	MODEL7	MODEL8	MODEL9	MODEL10	MODEL11
Relative cognitive network prominence		-0.774*	-7.333*	-0.802*			-0.617*	-7.498*	-0.642*		-0.789*
		(0.378)	(2.831)	(0.380)			(0.354)	(2.700)	(0.356)		(0.418)
Relative cognitive network prominence × Popu. density			0.029*					0.030*			
			(0.012)					(0.011)			
Relative cognitive network prominence × Patent				0.144*					0.145*		
				(0.038)					(0.038)		
Relative cognitive network prominence × Age <3					-1.861+					-1.762+	
					(1.145)					(1.100)	
Relative cognitive network prominence × Age 3-6					-1.346*					-1.206*	
					(0.727)					(0.693)	
Relative cognitive network prominence × Age 6-9					-0.579					-0.417	
					(0.687)					(0.668)	
Relative cognitive network prominence × Age ≥9					-0.269					-0.024	
					(0.483)					(0.406)	
Relative cognitive network prominence × Firm size											0.022*
											(0.013)
Firm size						-0.089*	-0.066	-0.075+	-0.066	-0.072+	-0.072+
						(0.054)	(0.053)	(0.053)	(0.053)	(0.054)	(0.054)
Patent	-1.476*	-1.441*	-1.437*	-1.504*	-1.440*	-1.419*	-1.407*	-1.401*	-1.471*	-1.403*	-1.405*
	(0.409)	(0.409)	(0.406)	(0.413)	(0.408)	(0.408)	(0.409)	(0.406)	(0.413)	(0.408)	(0.409)
Age: <3 years	-21.095*	-21.022*	-19.759*	-21.645*	-20.394*	-19.525*	-20.183*	-18.703*	-20.331*	-19.989*	-19.049*
	(1.790)	(1.831)	(1.971)	(1.748)	(1.897)	(1.820)	(1.847)	(2.008)	(1.848)	(1.913)	(1.858)
Age: 3-6 years	-20.270*	-20.303*	-19.018*	-20.927*	-19.704*	-18.723*	-19.459*	-17.951*	-19.609*	-19.297*	-18.328*
	(1.822)	(1.855)	(1.982)	(1.724)	(1.908)	(1.850)	(1.877)	(2.025)	(1.874)	(1.931)	(1.882)
Age: 6-9 years	-20.191*	-20.252*	-18.952*	-20.877*	-19.704*	-18.651*	-19.409*	-17.884*	-19.559*	-19.299*	-18.277*
	(1.809)	(1.856)	(1.981)	(1.772)	(1.903)	(1.838)	(1.866)	(2.017)	(1.866)	(1.920)	(1.871)
Age: ≥9 years	-19.974*	-20.122*	-18.818*	-20.749*	-19.604*	-18.499*	-19.307*	-17.773*	-19.459*	-19.235*	-18.177*
	(1.866)	(1.920)	(2.031)	(1.815)	(1.956)	(1.900)	(1.926)	(2.071)	(1.920)	(1.975)	(1.932)
Subsidiary	0.366	0.358	0.308	0.357	0.362	0.460	0.424	0.375	0.424	0.430	0.422
	(0.423)	(0.421)	(0.423)	(0.421)	(0.418)	(0.390)	(0.399)	(0.397)	(0.399)	(0.394)	(0.397)
Cumulative media coverage logged, 1994 to t-1	-0.054	0.053	0.044	0.055	0.038	0.074	0.121	0.121	0.123	0.110	0.123
	(0.102)	(0.115)	(0.116)	(0.116)	(0.116)	(0.132)	(0.133)	(0.134)	(0.133)	(0.133)	(0.134)
Population density	0.026	0.029	0.027	0.029	0.034	0.033	0.034	0.031	0.034	0.040	0.034
	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)	(0.077)	(0.076)
Population density squared/1000	0.172	0.148	0.148	0.147	0.127	0.154	0.141	0.144	0.139	0.114	0.139
	(0.258)	(0.259)	(0.259)	(0.259)	(0.259)	(0.259)	(0.259)	(0.259)	(0.259)	(0.260)	(0.259)
Prior foundings	-0.145	-0.136	-0.148	-0.135	-0.127	-0.148	-0.141	-0.155	-0.140	-0.128	-0.140
	(0.234)	(0.234)	(0.233)	(0.234)	(0.235)	(0.233)	(0.233)	(0.232)	(0.233)	(0.235)	(0.234)
Prior foundings squared	2.906	2.742	2.946	2.727	2.571	2.971	2.831	3.089	2.817	2.606	2.825
	(3.834)	(3.835)	(3.819)	(3.835)	(3.850)	(3.828)	(3.827)	(3.814)	(3.827)	(3.847)	(3.829)
ICT market growth rate	0.003	0.004	0.001	0.004	0.006	0.004	0.005	0.001	0.005	0.008	0.005
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.043)	(0.042)
GDP/1000	-0.017*	-0.016+	-0.016+	-0.016+	-0.016+	-0.018*	-0.017*	-0.017+	-0.017*	-0.017+	-0.017*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Inflation rate	0.903+	0.852	0.862	0.849	0.813	0.926+	0.880	0.898+	0.877	0.831	0.878
	(0.697)	(0.698)	(0.696)	(0.698)	(0.699)	(0.695)	(0.696)	(0.694)	(0.696)	(0.697)	(0.696)
Year 1999-2001	14.134*	13.690*	12.775*	14.294*	12.791*	12.518*	12.908*	11.914*	13.038*	12.370*	11.765*
	(5.516)	(5.628)	(5.897)	(5.584)	(5.700)	(5.491)	(5.586)	(5.898)	(5.583)	(5.662)	(5.593)
Year 2002-2004	12.462*	12.103*	11.317*	12.714*	11.205*	10.719*	11.209*	10.348+	11.344*	10.655+	10.061+
	(6.404)	(6.498)	(6.709)	(6.489)	(6.567)	(6.430)	(6.501)	(6.745)	(6.499)	(6.587)	(6.508)

Year 2005-2007	12.614*	12.271*	11.381*	12.884*	11.438*	10.994*	11.450*	10.462*	11.588*	10.994*	10.297*
	(5.160)	(5.246)	(5.440)	(5.225)	(5.303)	(5.183)	(5.244)	(5.470)	(5.243)	(5.314)	(5.252)
Year 2008-2010	12.297*	12.061*	11.046*	12.681*	11.381*	10.764*	11.275*	10.134*	11.421*	11.032*	10.127*
	(3.451)	(3.482)	(3.569)	(3.433)	(3.501)	(3.496)	(3.508)	(3.607)	(3.507)	(3.532)	(3.513)
Log Pseudolikelihood	-150.95	-148.28	-146.42	-147.91	-147.47	-148.66	-147.14	-144.93	-146.77	-146.12	-147.00

+ p<.10; * p<.05 (one-tailed tests)

Notes: Robust standard errors of estimates are in parentheses. The Huber-White-sandwich estimator of variance, which clusters observations on organizations, is used to produce robust standard errors. The sample is the 1,798 annual spells for 238 IC-design firms and 80 failure events.

Figure 1. Population Founding, Failure, and Density: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994-2010

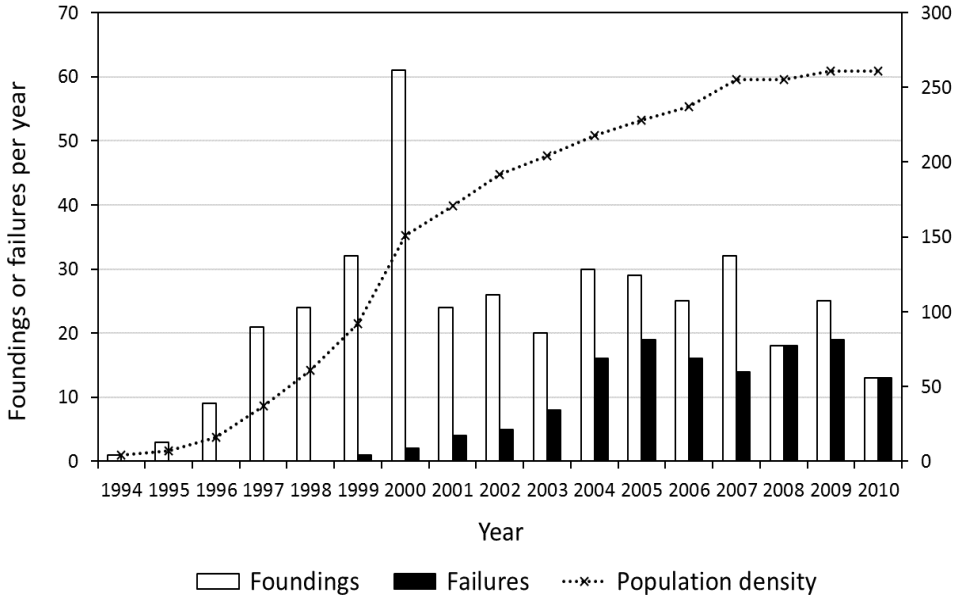


Figure 2. Yearly Counts of Newspaper Articles Referencing Semiconductor Integrated-Circuit (IC) Design Firm(s) in South Korea, 1994-2010

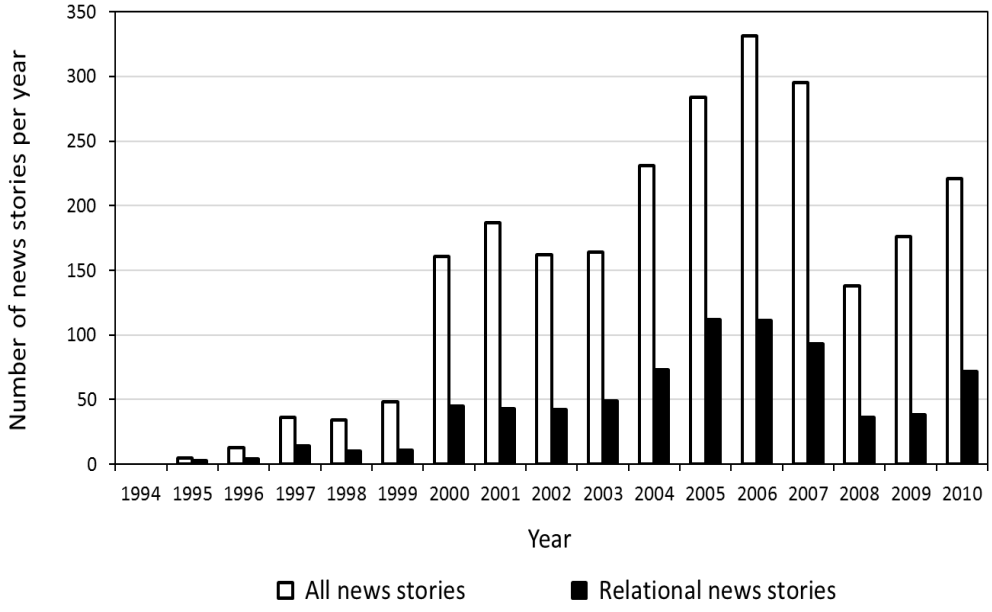


Figure 3. Bipartite Graph of Affiliation Network of 16 IC-design Firms and 11 Relational News Stories, 1999

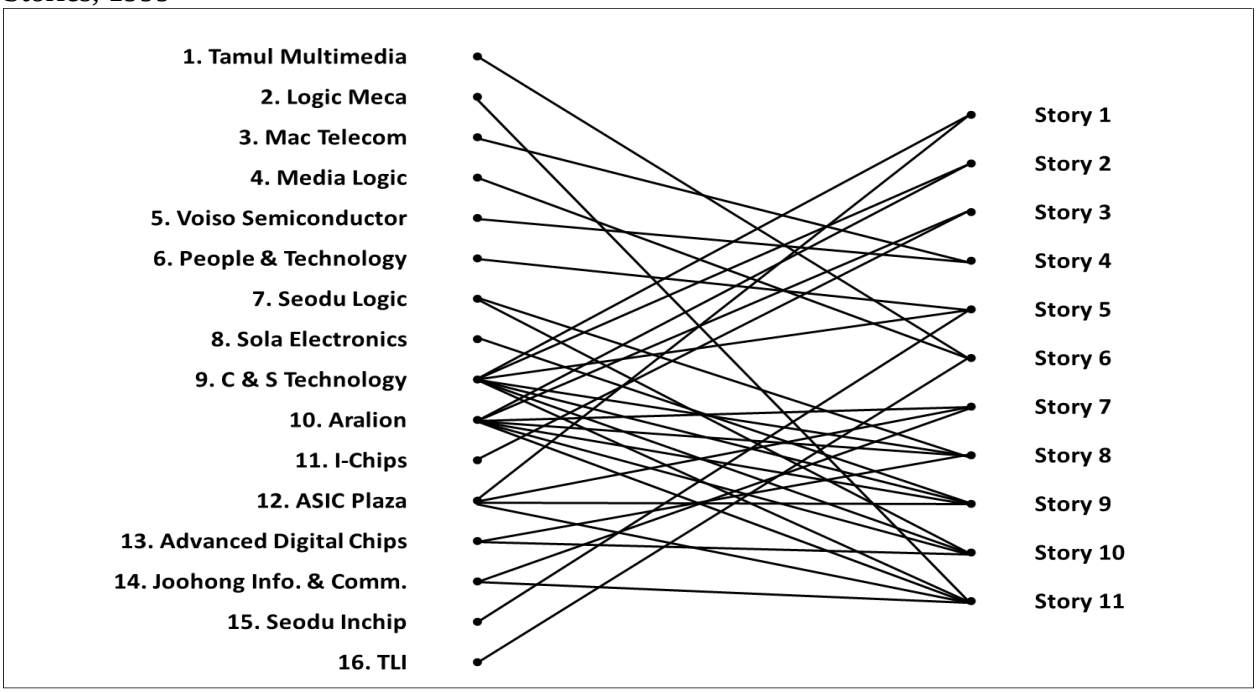
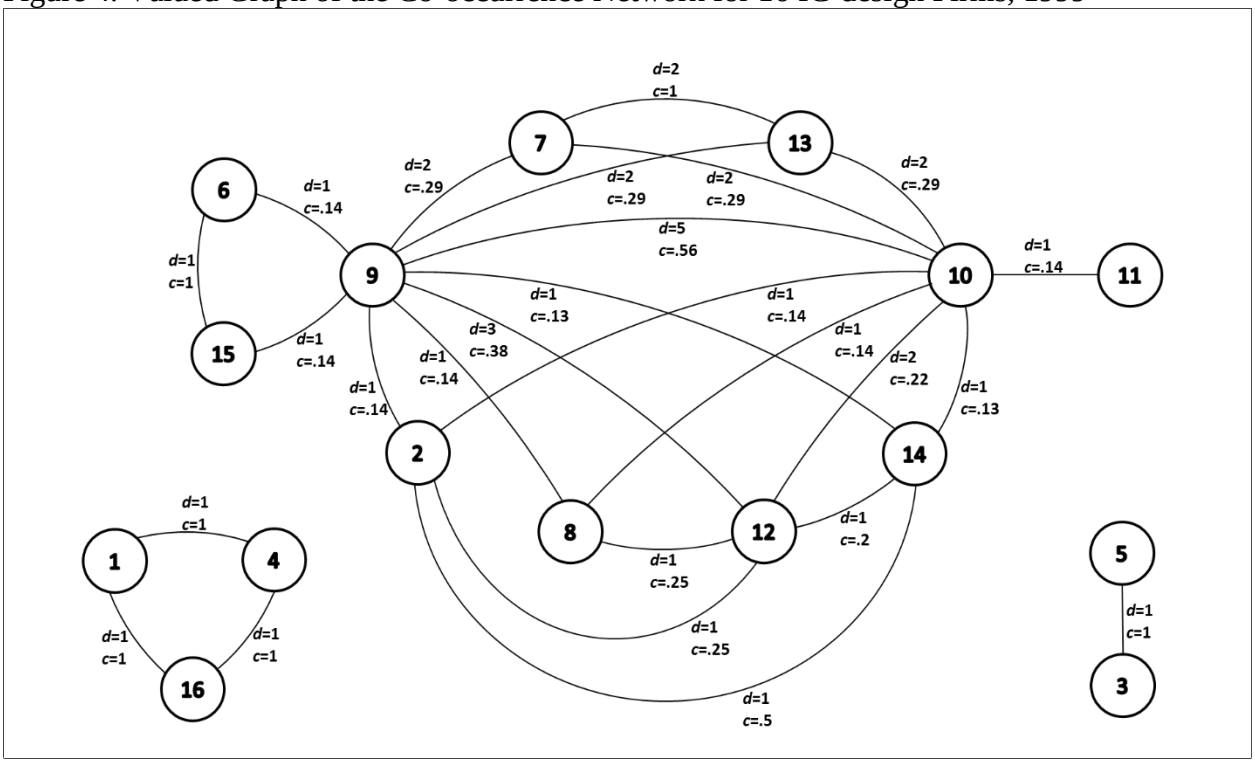


Figure 4. Valued Graph of the Co-occurrence Network for 16 IC-design Firms, 1999



Notes: d refers to the number of co-occurrences between two firms (i.e., the number of relational news stories containing both firms); *c* refers to the co-occurrence ratio between two firms (i.e., the number of relational news stories containing both firms divided by the total number of relational news stories containing either or both firms.)

Figure 5. Effect of Relative cognitive network prominence on Failure Rate, Model 2

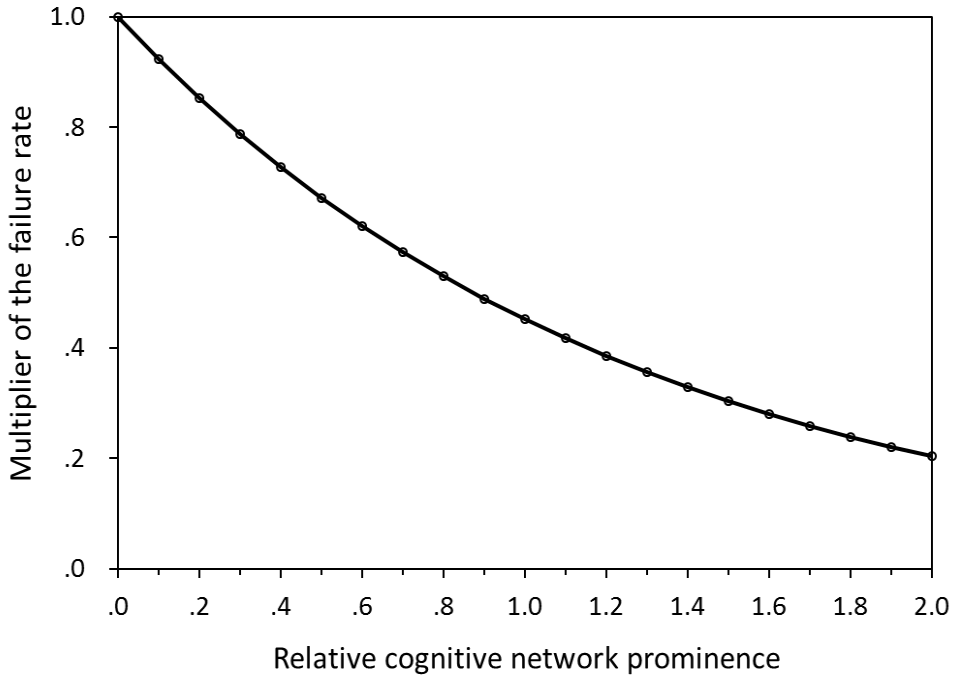


Figure 6. Effect of Relative cognitive network prominence on Failure Rate at Different Population Densities, Model 3

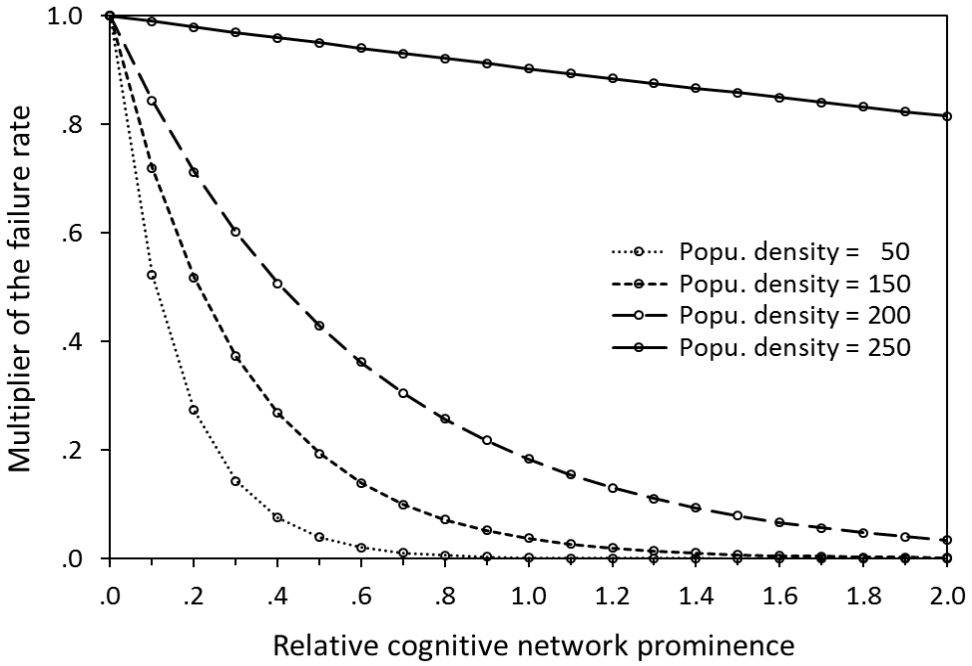


Figure 7. Effect of Relative cognitive network prominence on Failure Rate at Different Patents, Model 4

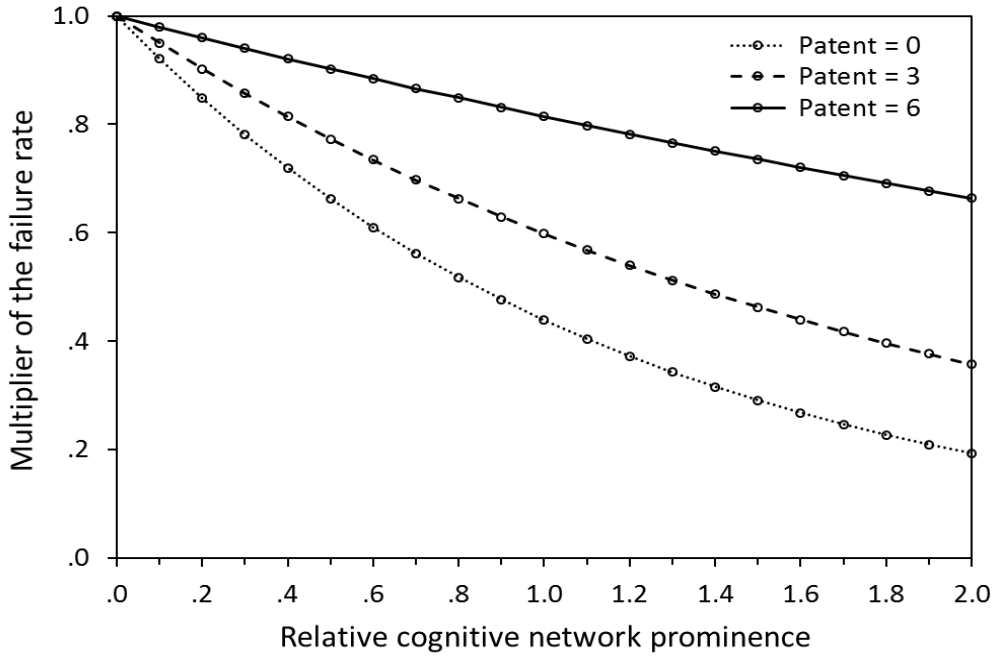


Figure 8. Effect of Relative cognitive network prominence on Failure Rate at Different Ages, Model 5

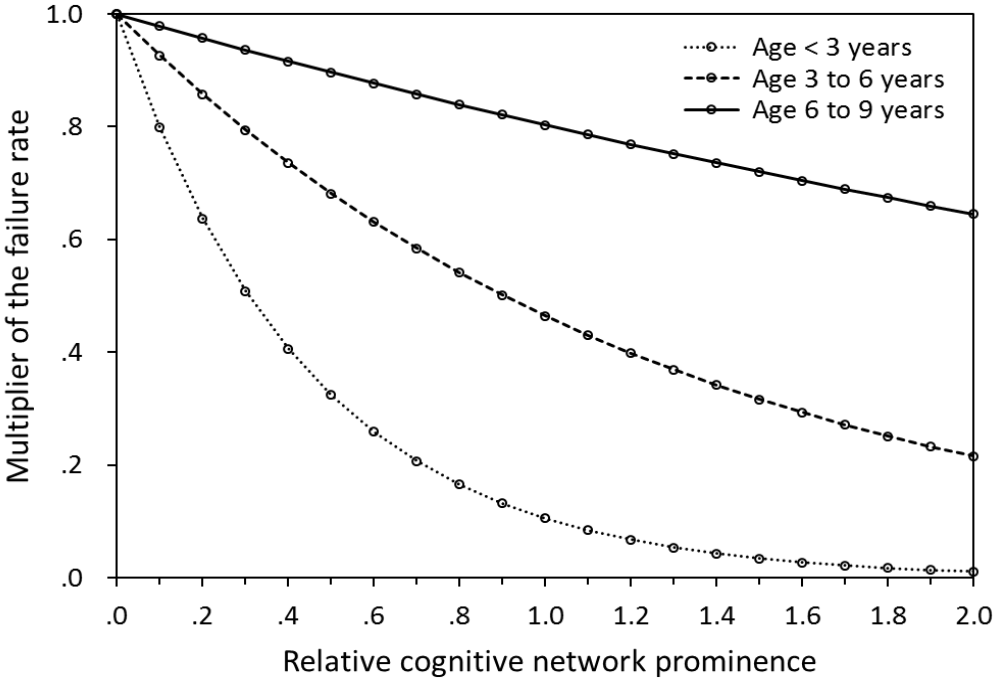
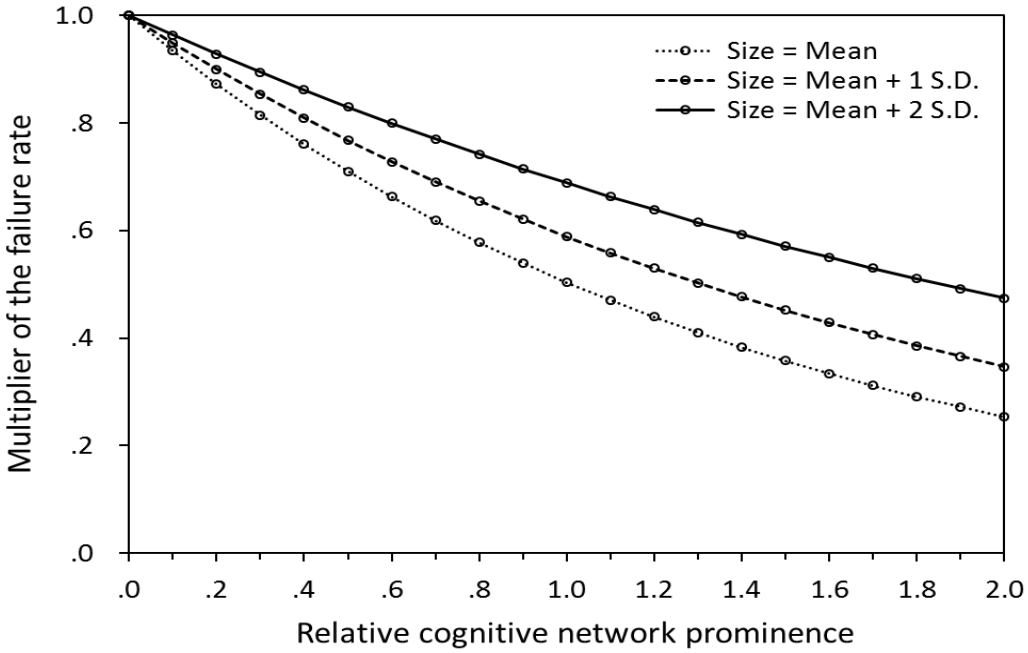


Figure 9. Effect of Relative cognitive network prominence on Failure Rate at Different Sizes, Model 11



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Essay 3

Categorical Legitimation: Media Coverage for Market Networks and Organizational Founding and Failure in the South Korean Population of Semiconductor Integrated-Circuit (IC) Design Firms, 1994-2010

Key Words: Categorization; legitimation; organizational form identity; media discourse; network; population dynamics

INTRODUCTION

New organizational forms are important carriers of social and economic change (Schumpeter 1934; Nelson and Winter 1982), but explaining how they emerge and become established as a taken-for-granted element of market structures poses an acute challenge. During the early stages, new forms are typically surrounded by considerable uncertainties, which are associated with their engagement in unproven technologies (Sine, Haveman, and Tolbert 2005), unclear product definitions (Rosa et al. 1999), and ambiguous market categories (Porac and Rosa 1996). These new forms therefore tend to escape the attention of the publics and suffer the problem of scant legitimacy, so that organizations using them face a difficulty attracting public attention and acquiring resources from the external environment (DiMaggio and Powell 1983; Hannan and Freeman 1989; Meyer and Rowan 1977; Pfeffer and Salancik 2003). In turn, this difficulty discourages further organizational foundings and increase failures, hampering the emergence of a new organizational form.

Contemporary organizational theory suggested two different kinds of legitimation process affecting the emergence of a new form. Institutional theory emphasized how key institutional actors, such as regulatory bodies and industry associations, can assist in the emergence of a new form. Theorists suggested that those powerful actors' approvals of a new form confer sociopolitical legitimacy and thus reduce uncertainties about the form's viability (Aldrich and Fiol 1994; DiMaggio and Powell 1983; Scott 1995). However, research found that such external approvals are a necessary but not sufficient condition for the constitutive legitimation of a new form (McKendrick and Carroll 2001; Dobrev, Ozdemir, and Teo 2006). Meanwhile, ecological theory held that as the number of organizations using a particular form (population density) increases to a certain level, the form gains constitutive legitimacy, or a taken-for-granted status (Hannan and Freeman 1989; Hannan and Freeman 1977; Hannan and Carroll 1992). In applying the density dependence model, researchers often counted the number of organizations in an industry across time. However, recent ecological work found that not all organizations in a population equally contribute to the population's legitimation (Kuilman and Li 2009; Pólos, Hannan, and Carroll 2002; Hannan 2010), and that legitimacy emanates from the proliferation of organizations which are viewed as "real" members of the population (McKendrick et al. 2003; Negro, Hannan, and Rao 2010). These considerations present a conundrum to researchers concerned with constitutive legitimation, especially because organizations using a novel, so illegitimate, form tend to be overlooked and ignored. There is a clear and strong need for research illuminating the conditions that enable organizations of a form to get noticed as "really" belonging to the population to which they claim membership.

This inquiry is of particular pertinence to the recent advances in organizational theory that have stressed the importance of sensemaking among relevant audiences in explaining how a new form becomes established (Hannan, Pólos, and Carroll 2007; Hsu, Negro, and Koçak 2010; Pólos, Hannan, and Carroll 2002; Rao, Monin, and Durand 2003; Ruef 2000). These studies characterized the emergence of a new form as the development of a social code for the form's collective identity. They suggested that the codification of form identity depends on the ability of audiences to screen and sort similar organizations into a distinct cognitive category identifiable by a specific label, such as microbrewers and trade unions. When audiences reach consensus on what it means to be a member of a category, this category gains social identity that would eventually coalesce into a code for a legitimated organizational form (McKendrick et al. 2003; Navis and Glynn 2010; Hsu and Hannan 2005). A logical corollary of this line of argument is that the legitimation of a new form cannot occur if organizations using the form are not recognized by audiences as constituting a distinct category. That is, a population of organizations that are more clearly perceivable as categorically similar to each other and different from all others will have higher chances of promoting the establishment of a new form. From this reasoning, examining what conditions foster the cognitive process of similarity-clustering of organizations promises to shed light on how new forms survive public indifference and become legitimated.

To improve an understanding of the constitutive legitimation process, this research explores the patterns of textual linkages among organizations of a nascent form preserved in relevant media outlets, which are proposed to influence audiences' sensemaking about the categorical identity features of the form's population. Two literatures are particularly relevant: discourse and institutionalization (Hirsch 1986; Baum and Powell 1995; Ruef 2000; Phillips, Lawrence, and Hardy 2004; Deephouse 2000; Gamson and Modigliani 1989; Rao 1998), and socio-cognitive research on markets (Lounsbury and Glynn 2001; Wry, Lounsbury, and Glynn 2011; Navis and Glynn 2010; Kennedy 2008; Kennedy 2005). Building on these studies, I examine the founding and failure rate of organizations within an emerging population with regard to the degree to which audiences perceive the population as possessing categorical standing. The categorical standing of a population is operationalized as *cognitive association density*, which I define in terms of each population entrant's connectedness to other entrants within cognitive market networks configured from media coverage for discourse across time. As the level of cognitive association density increases, or as the connections among population entrants in market networks become dense, audiences can more easily make a cognitive judgment that they are of the same sort, and develop a shared understanding about distinct identity features (or prototypes) that make them worth categorizing and labeling. I measure the effects of cognitive association density on the organizational founding and failure rate based on the assumption that legitimating a new form becomes more likely when there is a core categorical prototype of the form's population.

I developed and tested hypotheses on cognitive association density and founding and failure rates in the South Korean population of integrated-circuit (IC) design firms from January 1994 to December 2010. This observation scheme covers the population's almost entire history since its beginning; prior to 1994, three IC-design firms were founded. The results show that the measure of association density forms an inverted U-shaped relationship to founding rates and a U-shaped relationship to failure rates. This implies that initial increases in association density help legitimate the population by enabling audiences to make sense of the categorical identity features of population entrants. However, such legitimating effects disappear as association density

further increases, implying that the need for the media-based sensemaking is low when audiences are already aware of the population's categorical singularity. Instead, intense competition for public attention develops, because the media-based categorization direct audiences' attention to organizations which are central, or prominent, in cognitive market networks. Moreover, this research found that the legitimating effects spill over to decrease the failure rate of the organizations which are rather detached from cognitive market networks. Overall, I show that media coverage for discourse helps legitimate a new form by positioning organizations using the form as constituting a cognitive network structure, thereby enabling audiences to make sense of their categorical identity features.

THEORY AND HYPOTHESES

Categorization and the Legitimacy of a New Organizational Form

Legitimation has been a cornerstone of organizational theories seeking to explain how a new form becomes established (Aldrich and Fiol 1994; Hannan and Freeman 1989; Scott 1995). The concept of legitimacy is multi-dimensional in nature, but theorists generally view that taken-for-grantedness is "the most powerful source of legitimacy identified to date" (Suchman 1995, 583). Research has suggested that constitutive legitimacy improves a form's chances of prosperity and survival by deflecting any skeptical view about the form's purpose and operations and facilitating resource flows from the environment into the form's population (Glenn R. Carroll and Hannan 2000; Haveman and Rao 1997; Ruef 2000). In particular, Hannan and Carrol (1992: 36) argued that "The capacity to mobilize potential members and resources increases greatly when those who control resources take the organizational form for granted."

Recent theoretical advances in this direction have considered the legitimation of a new form a collective process that depends on sensemaking among audiences (e.g., investors, journalists, regulators) about the key common identity features of organizations using the form (Hannan, Pólos, and Carroll 2007; Hsu, Negro, and Koçak 2010; McKendrick et al. 2003; Pólos, Hannan, and Carroll 2002; Rao, Monin, and Durand 2003). From this perspective, an organizational form comes into existence when audiences develop shared perceptions and understandings about what features of organizations are appropriate and desirable within a taken-for-granted system of social codes. Social codes imply both cognitive recognition and punitive standing (Hsu and Hannan 2005). If organizations operate in a highly legitimated population, then they are subject to social scrutiny by audiences who consider their activities in terms of an identity code that applies to the form defining the population. Organizations that conform to audiences' held codes can more easily acquire material and symbolic resources, improving their survival chances; those that deviate from audiences' expectations face difficulty in maintaining access to environmental resources (Zuckerman 1999). In consequence, it is through audiences' perceptions and sanctions that an organizational form emerges and persists over time.

This audience-centered approach of a form suggests examining the legitimation process with a focus on what audiences perceive when they see an organization. Of particular importance in this regard is McKendrick and colleagues' research on form evolution among disk array producers (McKendrick and Carroll 2001; McKendrick et al. 2003). They developed the idea of "perceptual focus" as the basis for linking individual organizations' identities to the development of a form's collective identity among audiences. They opined that a new form's legitimacy does not increase, as is often assumed in ecological research, with the total number of organizations

using the form (population density), but rather it emanates from increases in the number of organizations with perceptually focused identities (such as *de novo* producers). Specifically, they keenly observed that producers in the disk array market did not represent an organizational form, even though there was an expected S-shaped growth trajectory of population density. They ascribed this problem to the fact that many of producers derived their primary identities from other activities—that is, their organizational identities were not perceptually focused on disk array activities. They argued that the proliferation of such (*de alio*) producers with diffuse identities reduced the internal homogeneity of the disk array population, hampering the development of the collective identity associated with the category of a disk array producer.

In a similar vein, Hannan, Polos, and Carroll (2007) developed the concept of "contrast" that refers to the degree to which a population stands out against its neighboring populations in the eyes of audiences. This concept builds on the idea that organizations are not necessarily either full members or outsiders to a population, but they may have only partial membership in the sense that audiences perceive them as "kind of" members (Hannan 2010). In particular, organizations may have varying grades of population membership ranging from zero (outsider) to one (full member); contrast is defined as the average grade of non-zero members. A population with high contrast means that the population contains a high proportion of organizations that are highly typical of the population (Hsu, Negro, and Koçak 2010). Research suggests that the homogeneity of a population strengthens the development of a shared understanding about the key identity features of the form defining the population (Kuilman and Li 2009; Bogaert, Christophe, and Carroll 2010). Translated to McKendrick's research on the disk array market, this suggests that a population with higher contrast consists of a higher proportion of organizations with focused identities, or *de novo* producers. Such a population is more visible and focused and more accurately perceivable by audiences, so that it has higher chances of promoting the establishment of a new form. Taken together, these studies suggest that the legitimation of a new form depends on the ability of audiences to screen and sort organizations claiming the form into a distinct cognitive category.

This reasoning leads to a need to reconsider the argument of linking legitimation to population density—or the number of organizations of a particular form. Specifically, increases in population density cannot assist in legitimating a new form unless organizations using the form are perceived by audiences as categorically similar to each other. That is, population density growth can contribute to legitimation only when audiences perceive the presence of a set of similar organizations with categorical distinctions. When the number of organizations classified under a given category increases to some ceiling, audiences converge in the use of a meaningful label for the category and the category's collective identity becomes a social code for an organizational form that tells diagnostic features of a legitimate member of the form—for instance, classical versus nouvelle cuisine chefs (Rao, Monin, and Durand 2003) and industrial versus craft breweries (Glenn R. Carroll and Swaminathan 2000). So viewed, a critical task for understanding how a new form becomes legitimated is to examine what conditions can enable audiences to perceive a set of organizations as possessing a categorically different standing.

Media-based Sensemaking of the Categorical Standing of an Emerging Population

To improve an understanding of the legitimation process of a new form, this research focuses on the role of news media as institutional agents in the social construction of legitimacy and examines how media coverage for discourse can influence the categorical distinction of organizations in an emerging population. Scholars in social sciences have conceived that news

media provide a critical medium through which audiences make sense of something unfamiliar or unexpected in the social world (Gamson et al. 1992; Gamson and Modigliani 1989; Hirsch 1986; Scheufele and Tewksbury 2007; Schudson 1989; Searle 1995; Tuchman 1978). According to these studies, news media are an interesting source of collective sensemaking as they scrutinize and emphasize a particular dimension of the environment and influence the extent to which people attend to that dimension (McCombs and Shaw 1972). As such, news media not only serve as a neutral pathway for the distribution of information, but they also affect people's perceptions and understandings about the world. Consequently, news media have the power to shape an interpretive context in which social reality is constructed.

Grounded in the idea that media coverage shapes social reality, organizational scholars have viewed that news media are important intermediaries between organizations and their potential audiences and suggested that audiences' perceptions of legitimacy about an organization or a group of organizations are attributions influenced by the media-provided information (Aldrich and Fiol 1994; Perretti, Negro, and Lomi 2008; Rao, Monin, and Durand 2003; Baum and Powell 1995; Deephouse 2000). Prior research emphasized two primary mechanisms through which news media help legitimate a new organizational form. First, news media bring visibility and recognition to a new form by disseminating information about its principles in large volume (Ruef 2010; Sine, Haveman, and Tolbert 2005; Perretti, Negro, and Lomi 2008). Second, they frame such information in positive or negative terms, providing visible public expressions of approval or disapproval (Lamertz and Baum 1998; Pollock and Rindova 2003; Rao, Greve, and Davis 2001). These the media-based legitimation processes were demonstrated for various empirical settings, such as the legitimation of hostile takeover activities (Hirsch 1986), the deinstitutionalization of the multi-divisional conglomerate form (Davis, Diekmann, and Tinsley 1994), the emergence of the biotechnology industry (Hybels, 1994), and the proliferation of foreign banks in Shanghai (Kuilman and Li 2009). These studies suggest that media coverage for discourse is an important explanation for the development of shared views about what a real organization is and does.

In this research, I stress that news media can also aid in legitimating a new organizational form by enabling organizations using the form to get clustered into a recognizable cognitive category. Such media's role is portended by socio-cognitive research on markets, suggesting that audiences rely on market stories told in public media outlets to understand the identity of new entrepreneurial ventures (Navis and Glynn 2010; Lounsbury and Glynn 2001; Wry, Lounsbury, and Glynn 2011; Kennedy 2005). Importantly for large-scale studies, Kennedy (2005, 2008) suggested looking to news stories covering multiple within-market competitors to see how new market categories are constructed. He argued that media co-mentions can influence public recognition of an emerging market by embedding market entrants in cognitive market networks, thereby enabling them to get categorized and counted. In his research on the market for computer workstations, Kennedy (2008) showed that media co-mentions helped early market entrants to survive obscurity by connecting them to a certain number of competitors. This implies that getting embedded into cognitive market networks is consequential for organizational performance, because it allows organizations in a nascent market to acquire legitimacy that arises from becoming members of a growing population.

If media coverage for market networks is effective in helping not-yet-legitimate organizations to get counted and survived, then it has an implication for the legitimation of new organizational forms, especially because organizations of a novel form tend to escape public attention and have scant legitimacy. In particular, given cognitive limitations and environmental

complexities, market networks in media discourse can serve as cognitive frames of reference around which audiences identify who are belonging to a population and what features population entrants exhibit in common. As such, they help audiences make sense of key identity features shared among population entrants, shaping perceptions of the categorical standing of the population. A set of organizations occupying relatively central positions in market networks are important for three mutually reinforcing reasons. First, highly inter-connected organizations are salient or prominent among other population entrant, and audiences can more easily identify their shared patterns of features and activities. That is, they help create perceptions that a new category of organizations is emerging. Second, they have high "cue validity" among audiences (Rosch and Lloyd 1978), and thus they provide a rich source of inferences about a core prototype that specify what it means to be members of a category (Navis and Glynn 2010). Third, audiences' recognition of categorical prototypes implies boundaries and rules for inclusion or exclusion that give a category social meaning (Zuckerman 1999; Wry, Lounsbury, and Glynn 2011). Consequently, the boundaries of an emerging category appear within media coverage for inter-organizational networks which supplies a potent cognitive anchor for sensemaking about the social identity of the category.

These considerations suggest that audiences can more easily recognize the internal homogeneity and categorical distinction of organizations in a population, when population entrants are highly connected to each other in media discourse, or when the level of cognitive association density is high. This means that the perceptions of audiences are directed to some common features shared among prominent organizations in market networks and that there is some recognition of this commonality as a distinct categorical identity that might eventually constitute a social code for an organizational form. Research has established that legitimating a new form becomes more likely when organizations using the form are recognizable by audiences as categorically similar to each other and different from all others (Hannan, Pólos, and Carroll 2007; Pólos, Hannan, and Carroll 2002; Dobrev, Ozdemir, and Teo 2006; Navis and Glynn 2010; Wry, Lounsbury, and Glynn 2011). Given this, if cognitive association density has a bearing on public perceptions of the categorical standing of organizations in an emerging population, then it should moderate population dynamics by affecting the organizational founding and failure rates.

Cognitive Association Density and Organizational Founding and Failure

During the early phase of a population's growth, core practices of population entrants are inchoate and boundaries for membership are unsettled, so that there is a strong need for sensemaking among audiences about what the population is and does. Such collective sensemaking will be facilitated by the increase in cognitive association density—referring to the degree to which population entrants are inter-connected in cognitive market networks. Increases in association density will enable population entrants to get categorized and attended, thereby fostering the creation of shared understandings about their categorical identity features. Therefore, as association density initially increases, it will exert the legitimating effect on the population, increasing founding rates and decreasing failure rates.

However, the relationship between association density and legitimacy may not increase monotonically for two reasons. First, the need for the media-based sensemaking about an emerging population will be diminished when the population has already become recognizable as categorically distinct. That is, audiences will no longer rely on media coverage for market networks to understand organizations using a new form when their key identity features are known. Second, as association density reaches high levels, intense competition among

population entrants for the attention of audiences will develop. The competition arises because the media-based categorization will focus audiences' attention on highly inter-connected, or prominent, organizations in cognitive market networks. These salient organizations will enjoy advantages over their counterparts with lower centrality in maintaining resource acquisitions. Therefore, high-level increases in association density will reduce the availability of resources for those organizations isolated from market networks and potential entrants, thereby increasing failures and discouraging foundings. Together, these considerations lead to the following hypotheses on association density and founding and failure rates:

HYPOTHESIS 1: Organizational founding rates will rise with low-level increases in the level of cognitive association density (or the degree to which organizations of a particular form are inter-connected within cognitive market networks), but decline with high-level increases.

HYPOTHESIS 2: Organizational failure rates will decline with low-level increases in the level of cognitive association density (or the degree to which organizations of a particular form are inter-connected within cognitive market networks), but rise with high-level increases.

Research has suggested that the legitimacy of some representative organizations of a population leads other organizations gaining legitimacy as well, improving their access to environmental resources (Baum and Oliver 1992; McKendrick et al. 2003; Ruef 2000; Dobrev, Ozdemir, and Teo 2006; Kuilman and Li 2009). In particular, Baum and Oliver's (1992) research on Toronto day care centers (DCCs) in 1971 to 1989 compared the failure rates of DCCs with and without formal relations to established institutions in the environment. They showed that, as a growing number of DCCs became connected to these institutions, the legitimacy of DCCs with institutional linkages spilled over to reduce the failure rates of DCCs that remained detached from the institutional environment. This finding indicates that, as the DCC population became more embedded into its institutional environment, detached DCCs obtained survival benefits from being a member of the legitimated population. Moreover, McKendrick et al. (2003) showed that the legitimacy of disk array producer population emanated principally from increases in the density of *de novo* producers with focused identities (or producers whose identities were exclusively associated with a disk array category), and that such population-level legitimacy spilled over to enhance survival chances of all disk array producers.

Drawing on these studies, I propose that while the legitimating effect of association density can generally enhance the survival chances of all organizations in a population, the magnitude of the survival benefits will be contingent on the degree to which an organization is central in cognitive market networks. Organizations with higher centrality are more conducive to the legitimacy of the population they belong to, because they come to be identified as the key advocates of prototypical practices. However, organizations that are isolated from the market network may actually benefit the most from the legitimation driven by increases in association density. Highly inter-connected organizations are more visible and prominent to the eyes of audiences, so they have legitimacy of their own as individual entities. As such, these organizations are less likely than their counterparts with low centrality to depend on their membership in a legitimated population for attracting audience attention. In the meantime, organizations in the fringe are likely to suffer the lack of legitimacy of their own due to lower visibility and category typicality. Therefore, as association density increases at low level, the

resulting improvement of population legitimacy will spill over to provide the greatest survival benefits with population entrants isolated from market networks. Together, these considerations lead to the following hypothesis of failure rates.

HYPOTHESIS 3: The legitimating effect of cognitive association density (or the degree to which organizations of a particular form are inter-connected within cognitive market networks) in reducing organizational failure rates will be greater for organizations whose positions in cognitive market networks are less central.

METHODS

Sample

I started data collection by identifying the South Korean population of semiconductor IC-design firms between January 1994 and December 2010. I relied on three sources of information. The first is the Korean government's annual reports of the *Infrastructure Support for IT SoC Industry* between 2000 and 2010, inclusive. They contain the names of IC-design firms which used the government-supported IC-design devices in a given year. These reports were published by the *Ministry of Information and Communication* for the years 2000 to 2007 and by the *Ministry of Knowledge Economy* for the subsequent years. The second is the IC-design industry association's annual reports of the *IT SoC Annual Report*, between 1998 and 2010, inclusive. They contain basic information on association members, including company names, managers, founding dates, employment, and revenue. These reports were published by the *ASIC Design Association* for the years 1998 to 2003 and by the *IT-SoC Association* for the subsequent years.[11] Finally, I supplemented the archival data with 27 interviews of founders (14), engineers (6), journalists (3), industry association representatives (2), and government officials (2).

Consequently, I constructed a list of 382 IC-design established in South Korea during the study period. Figure 1 plots the historical distribution of population founding, failure, and density. The vertical axis on the right represents the number of IC-design firms which are operating at the beginning of each of the quarters in the series. From 4 firms in the first quarter of 1994, the population density of IC-design industry increased to the highest level of 267 in the third quarter of 2009. Note that only 3 firms were operating prior to 1994, the starting year of this research. This observation scheme allows the minimization of research design flaws, especially left-truncation that excludes the early history of a population (Glenn R. Carroll and Hannan 2000, 218–19).

[Figure 1 about here]

Dependent Variables

I examined two organizational outcomes, organizational founding and failure rates. Founding rates are quarterly observation for the years 1994 to 2010; this gives 68 observations. Following previous studies (Glenn R. Carroll and Hannan 2000; Aldrich and Ruef 2006), I define a firm founding as the creation of a new legal entity. Meanwhile, failure rates are yearly

[11] In 2004, the ASIC Design Association changed its name to the IT-SoC Association.

observation for the same period. I broke each organization's history into a sequence of yearly spells in which the organization is at risk of failure. Each of the yearly spells was treated as right-censored, except for the spells that terminate in failure. Specifically, of 382 IC-design firms in my sample, 131 firms failed prior to the end of calendar year 2010; the remaining 251 firms were censored on the right on December 31, 2010. In consequence, the histories of these sample firms provide 2,772 firm-year spells. I obtained information on the dates of IC-design firm founding and failure primarily from NICE Information Service Co., Ltd, a provider of information on Korean companies since 1988.[12] I also used the National Tax Service database to gather information on the failure dates.[13] Figure 1 plots the frequency of IC-design firm foundings and failures by quarters. The number of foundings ranges from 0 to 26 per period, with the high mark occurring in the second quarter of 2000. The number of failures increased in the mid-2010s and peaked at 9 in the first quarter of 2008.

Independent Variable

I analyze organizational founding and failure rates in relation to the level of cognitive association density (CAD), defined as the sum of individual organizations' average degree score (ADS) for a given period. These measures were calculated in one-year observation window as follows:

$$\mathrm{CAD}_t = \sum_{i=1}^{n} \mathrm{ADS}_{it} = \sum_{i=1}^{n} \left(\frac{\sum_{j=1}^{v} d_{ijt}}{v_{it}} \right)$$

where n is the number of firms operating in year t (population density), v_{it} is the number of news articles mentioning firm i (media coverage volume), and d_{ijt} is the number of firms mentioned together with firm i in news article j. Each firm's average degree score measures the degree to which the firm is connected to its within-market competitors in media discourse. It reflects the position of a firm within cognitive market networks. Firms in more central positions are viewed as more typical, or representative, of a market category (Kennedy 2005; Kennedy 2008; Hsu, Negro, and Koçak 2010). If none of news articles cover a firm together with its competitors, then the firm's average degree score becomes 0—that is, the firm is completely isolated from cognitive market networks. Firms with higher average degree scores can be regarded as possessing more "perceptually focused identities" (McKendrick et al. 2003; McKendrick and Carroll 2001). In this light, a firm's average degree score captures how conducive the firm is to the constitutive legitimation of its belonging population. Throughout the analyses, the normalized value of average degree score was used to compute cognitive association density. I normalized average degree score by dividing it by the maximum; this normalization makes each firm's average degree score range from 0 to 1. To test for the hypothesized non-monotonic effects of association density on founding and failure rates, I modeled this measure as a quadratic form, i.e., linear and squared association density.

I computed the measure of average degree score using news articles appeared in the *Electronics Times*, a nation-widely distributed daily newspaper in South Korea. The *Electronics Times* is the single most prominent media outlet in electronics industries, including semiconductor IC-design. News articles published by the *Electronics Times* are online accessible from the beginning of 1994. I retrieved 2,486 articles that mentioned the names of one or more IC-design firms from January 1, 1994 to December 31, 2010. Of these articles, 1,730 covered a

[12] NICE stands for National Information and Credit Evaluation. The database of NICE Information Service Co. is available at www.kisline.com.

[13] The database of the National Tax Service is available at www.nts.go.kr.

single IC-design firm and 756 covered multiple IC-design firms together. Figure 2 plots the distribution of news articles and association density by years. From 0 in 1994, the number of news articles covering multiple IC-design firms increased to the highest level of 112 in 2005. The measure of association density waxes and wanes throughout the time period, ranging from a low of 0 in 1994 to a high of approximately 20 in 2010. The zero in association density means that none of IC-design firms were perceived by audiences as belonging to the population they claim membership.

[Figure 2 about here]

Control Variables

The models of IC-design firm founding and failure rates include controls for time-changing economic conditions. First, I controlled for the growth rate of information and communication technology (ICT) product markets, measured as percentage change in the amount of ICT product export. This is relevant because the development of the IC-design industry was largely a function of the growth of ICT markets. I obtained this information from the *Korea International Trade Association*.[14] Second, I controlled for the growth rate of real GDP and the inflation rate to capture macro-economic conditions and business cycles. I obtained information on economic indicators from the *Economic Statistics System of the Bank of Korea*.[15] Third, I controlled for the possibility that important historical and institutional changes might influence founding and failure rates. I created four dummy variables for the periods of 1999-2001, 2002-2004, 2005-2007, and 2008-2010. The first period effect relates to the 1998 Asian financial crisis which was accompanied by the national economic recession, restructuring of the Korean semiconductor industry (merger of the two largest semiconductor firms, Hyundai and LG), and public policies for stimulating the IC-design industry. The second relates to the collapse of stock markets in South Korea; the last represents economic recession during the global subprime mortgage crisis.

I also controlled for demographic processes among IC-design firms. First, I included linear and squared terms of population density (the number of active IC-design firms in a period) to capture the joint effect of legitimacy and competition. Research has suggested that that population density has a non-monotonic effect on organizational founding and failure rates (Hannan and Freeman 1989). When population density is low, each additional instance of the form enhances the legitimacy of the form's population, thereby encouraging further foundings and decreasing failures. As population membership expands further, however, competition for resources increases faster than legitimacy, which in turn discourages foundings and increases failures. This perspective predicts that the number of IC-design firms operating will form an inverted U-shaped relationship to founding rates and a U-shaped relationship to failure rates. Second, I included the number of prior foundings and its square. Research suggests that foundings in one period affect founding and failure rates in the succeeding period (Delacroix and Carroll 1983; Delacroix, Swaminathan, and Solt 1989; Ranger-Moore, Banaszak-Holl, and Hannan 1991). A surge of recent foundings of an organizational form can signal favorable conditions for the form, encouraging further foundings and reducing failures.

[14] Available at http://stat.kita.net/stat/kts/use/UseIndustrialImpExpList.screen

[15] Available at http://ecos.bok.or.kr

In the analysis of firm failure rates, I controlled for several firm-level characteristics as well as macro-economic and demographic variables. First, organizational age was measured as the number of years since founding. Researchers have shown strong age dependence in failure rates from different perspectives, for example, the liability of newness (Stinchcombe 1965; Hannan and Freeman 1984), the liability of adolescence (Levinthal and Fichman 1988), and the liability of obsolescence (Baum 1989). Second, organizational size was measured as the logged number of employees. Large firms are expected to face a decreased risk of failure (Hannan and Freeman 1989). I obtained information on work force primarily from the *NICE Information Service*. I complemented this information using industry association annual reports. Third, firm performance was measured as the number of patents issued by a focal firm for each year. I obtained information on patents from the *Korea Intellectual Property Rights Information Service*.[16] Fourth, the variable of subsidiary was a dummy coded 1 if a firm was a subsidiary, and 0, otherwise. Finally, I included the variable of media coverage volume, measured as the number of news articles covering a focal firm for each year. The values of all time-changing covariates were updated at the beginning of each year for each firm.

Model Specification

Founding Rates

In the analysis of foundings, the dependent variable is the aggregate number of IC-design firms founded in South Korea in each calendar quarter (i.e., at three-month intervals) between 1994 and 2010. Because this variable is a count measure (i.e., a non-negative integer), Poisson regression is the obvious choice for model specification (Hannan and Freeman 1989). However, a likelihood-ratio test shows a significant evidence of overdispersion—that is, the variance for the count data on organizational founding exceeds its mean—implying that Poisson models are inappropriate. This problem can cause the standard errors to be deflated artificially, leading to overstatement of levels of statistical significance (Ranger-Moore, Banaszak-Holl, and Hannan 1991; Baum and Oliver 1992). In consequence, I used negative binomial regression estimates based the quarterly observations during the period of study.

Failure Rates

In the analysis of failures, the unit of analysis is the individual IC-design firm. The dependent variable of firm failure is a dummy, which takes a value of 1 for the year when IC-design firms were disbanded or sought bankruptcy protection, and 0 otherwise. From the date of founding onward, IC-design firms are at risk of failure. I modeled the failure rate using $h(t)$, the instantaneous rate of failure (the hazard). The hazard rate of an IC-design firm failure is defined as:

$$h(t) = \lim_{\Delta t \to 0} \left(\frac{\Pr(t, t + \Delta t | t)}{\Delta t} \right),$$

where $\Pr(t, t + \Delta t | t)$ is the probability of failure in the time interval $(t, t + \Delta t)$, given that the IC-design firm was still operating at time t. By taking the limit of the probability of failure within the time interval over Δt, it is possible to estimate $h(t)$.

To estimate the effects of the predictor variables on the hazard rate, I used piecewise exponential hazards models. Piecewise exponential models represent a popular strategy that splits the time-axis into discrete time-pieces defined by researchers (Glenn R. Carroll and Hannan 2000, 136–38; Barron, West, and Hannan 1994; Hiatt, Sine, and Tolbert 2009; G. R.

[16] Available at http://eng.kipris.or.kr/enghome/main.jsp

Carroll et al. 2009). These models do not require strong parametric assumptions of a constant failure rate over the study period; instead, they allow the hazard rate to change at multiple time intervals (Blossfeld, Golsch, and Rohwer 2012). This approach assumes that the baseline rate of failure remains constant within each interval but can vary in an unconstrained manner across intervals. My exploratory research on the population of IC-design firms found the best fit using three break points in organizational age, at 3, 6, and 9 years. The first segment includes failure events that occur within the first three years of tenure ($0 \leq \text{Age} < 3$). The second segment include events occurring within the subsequent three years of tenure ($3 \leq \text{Age} < 6$), and so forth ($6 \leq \text{Age} < 9$ and $\text{Age} \geq 9$). These time pieces provide the baseline model for failure analysis of the IC design population—that is, the piecewise exponential model generates a period-specific constant (a y-intercept) for each designated time interval of the model.

The variables in the models change over time. To incorporate time-varying covariates, I broke each firm's life history into a sequence of yearly spells win which the firm is at risk of failure. Each of the spells was treated as right censored, except for the spells that terminate in failure. Of 382 firms in my sample, 131 firms resulted in disbanding prior to the end of calendar year of 2010; the remaining 251 firms were right censored on December 31, 2010, or on the date they were acquired. The original set of IC design firms was divided into a dataset containing individual cases of 2,772 spells (firm-years). But this amount was reduced to 2,393 spells for 382 firms in analyses by the lag used for time-changing covariates. The results reported in the following section are maximum-likelihood estimates. All models were estimated in Stata.

RESULTS

Cognitive Association Density and Firm Founding Rate

Table 1 presents means, standard deviations, and correlations among the variables used in the analysis of IC-design firm founding rates. Table 2 presents the results of negative binomial regression models of founding rates using quarterly observations. It displays coefficient estimates and robust standard errors in the parentheses. Model 1 is a baseline model that includes controls for environmental conditions. Some of these controls had a significant influence on founding rates in the IC-design population. The estimates for macro-economic conditions indicate that increase in ICT product export led to increase in founding rates, whereas increase in GDP led to decrease in founding rates. The number of prior foundings had an inverted U-shaped relationship to founding rates, as expected. This implies that increase in prior founding activities encouraged further founding activities in the IC-design population, but this effect was attenuated after a surge of new entrants because the resources for other potential entrants might be depleted.

[Table 1 about here]

[Table 2 about here]

[Figure 3 about here]

Model 2 adds the linear and squared terms for population density. In consistence with prior research, the estimated coefficients indicate that population density had an inverted U-shaped

relationship to the founding rate of IC-design firms. The first-order estimate is significant, positive, and between 0 and 1; this indicates that the founding rate is a decreasing positive function of population density. That is, initial increases in the number of extant IC-design firms had legitimating effects on the founding rate at low levels. Meanwhile, the second-order estimate is significant and negative; this indicates that further increases in population density had competitive effects on the founding rate at high levels. This quadratic curve peaked at the point of approximately 140.24 ($.023/[2\times(-.082]\times10^3$), whereby competition began to suppress founding rates. These results provide an additional support for the density-dependence theory that legitimation dominates competition at low density but this effect reverses as the number of organizations in the established population increases.

Models 3 through 5 test the hypothesis that cognitive association density should have an inverted U-shaped relationship to the founding rate of IC-design firms. In model 3, I added the linear and squared terms for cognitive association density, while omitting population density and its square. The first-order coefficient represents the effects of increases in the constitutive legitimacy of the IC design population. Its estimate is significant, positive, and between 0 and 1; this indicate that increases in cognitive association density stimulated foundings of new IC-design firms at a decreasing rate when cognitive association density was low. Meanwhile, the second-order coefficient represents the effects of increases in competition for public attention. Its estimate is significant and positive; this indicates that further increases in cognitive association density suppressed foundings of new IC-design firms when cognitive association density was already high. The estimated non-monotonic (positive changing to negative) effect of cognitive association density on founding rates peaked at approximately 15.25 ($.122/[2\times(-.004)]$), which fell within the observed range.

In model 4, I added both population density, cognitive association density, and their squared terms. With cognitive association density controlled, the estimated coefficients for population density and its square became insignificant and they were notably decreased in size compared to those in model 2. Meanwhile, even after controlling for population density effects, the coefficients for cognitive association density and its square continued to form an inverted U-shaped relationship to founding rates, albeit at the marginal level. However, the standard errors for the cognitive association density estimates were somewhat inflated compared to those in model 3.

I thus re-estimated model 4 omitting the squared term for population density, as shown in model 5. The omission of the squared term did not significantly reduce the fit of the model ($\chi^2=1.76$, Δd.f.=1, $p=.18$). In other words, the quadratic specification of population density is not preferable over the monotonic specification. In model 5, the estimate for population density is negative and significant. This implies that, with cognitive association density controlled, the legitimating effects of population density disappeared, and population density had only competitive effects on founding rates. Meanwhile, the estimates for cognitive association density were not substantively changed. Figure 3 illustrates that the quadratic curve peaked at approximately 16.25 ($.195/[2\times(-.006)]$) which fell within the observed range. At its peak, the multiplier is about 5.33; this means that the implied founding rate is about 5.33 times higher the rate that would hold if none of IC-design firms were textually linked to each other in the industry (i.e., zero cognitive association density).

In consequence, these results indicate that media coverage for cognitive association density had a significant influence on the founding rate of IC-design firms independent of population density. Increases in cognitive association density encouraged organizational founding activities

within the IC-design population when there were few textual links among population members, but suppressed founding activities when cognitive association density was already high. Meanwhile, when modeled with cognitive association density, the legitimating effects of population density were diminished, and its relationship to founding rates became more competitive. This suggest that the observed increase in the founding rate of IC-design firms following the low-level increase in population density was to a large extent accounted for by the increase in cognitive association density.

[Table 3 about here]

[Table 4 about here]

Cognitive Association Density and Firm Failure Rate

Table 3 summarizes the variables used in the analysis of IC-design firm failure rates. Table 4 presents the results of maximum-likelihood estimation of piecewise exponential models of the failure rates using the yearly data. Models 1 through 4 test whether cognitive association density forms a U-shaped relationship to failure rates within the IC-design population (Hypothesis 2). Models 1 and 2 are baseline models for the effects of population density and cognitive association density on the failure rate of IC-design firms, respectively. All models include firm age segments, historical periods, measures of macro-economic conditions, firm characteristics, and prior foundings. In model 1, the first-order and second-order estimates for population density are not significant, but their signs (negative and positive, respectively) are consistent with the commonly observed U-shaped relationship to the failure rate in previous research (Hannan and Freeman 1989; Glenn R. Carroll and Hannan 2000).

Model 2 shows baseline estimates for the effects of cognitive association density on IC-design firm failure rates. The estimated coefficients for cognitive association density provide a partial support for the prediction that it should have a U-shaped relationship to failure rates. The first-order estimate is negative and significant; this indicates that low-level increases in cognitive association density have legitimating effects on failure rates. The second-order estimate is positive and significant, indicating that high-level increases in cognitive association density have competitive effects on failure rates. The quadratic curve turns up at 15.31 (−.796/[2×.026]), which fell within the observed range of cognitive association density. When cognitive association density is 15.31, the multiplier is approximately .0023; this means that the implied failure rate of IC-design firms is .0023 times higher the rate that would hold if cognitive association density was 0 in the industry.

In model 3, I added population density, cognitive association density, and their squared terms. After controlling for cognitive association density, the first-order estimate for population density remained insignificant and the second-order estimate approached significance (p<.10) in a positive direction. With population density effects controlled, meanwhile, cognitive association density was shown to have a U-shaped relationship to failure rates at the marginal level. However, the standard errors for cognitive association density estimates were somewhat inflated compared to those in model 2. Thus, I re-estimated model 3 omitting the squared term for population density, as shown in model 4; this omission did not reduce the fit of the model (χ^2=2.31, Δd.f.=1, p=.13). In model 4, The cognitive association density estimates were significant; the curve peaked at 15.42 (−.802/[2×.026]). Meanwhile, the population density

estimate moved in a positive direction although not significant. It appears that when modeled with cognitive association density, population density had only competitive effects on the failure rate.

Taken together, the results suggest that media coverage for cognitive association density mattered for the legitimacy of IC-design population independent of population density. Low-level increases in cognitive association density decreased failure rates, but increases to high levels increased failure rates. The estimated non-monotonic effect (negative changing to positive) of cognitive association density on failure rates strongly parallels the results for the founding analysis.

[Figure 4 about here]

Models 5 and 6 test the prediction that the legitimation of the IC-design population driven by increases in cognitive association density spills over to increase the survival chances of firms isolated from cognitive market network (Hypothesis 3). They contain the linear and squared terms for cognitive association density and their interactions with average degree score. These interactions are included to see whether the cognitive association density effects on the failure rate vary according to the level of average degree score. Again, the problem of multicollinearity arises in model 5. I thus re-estimated the model omitting population density, as presented in model 6; this omission did not reduce the fit of the model (χ^2=.61, Δd.f.=1, p=.43). Figure 4 offers a systematic illustration of the interaction effect of cognitive association density and average degree score at different levels of both variables, using the estimated coefficients in model 6. The figure demonstrates the effect of cognitive association density over the variable's range at three different levels of average degree score: zero, the mean, and a standard deviation above the mean. The failure rate of firms with zero average degree scores is shown to decline most steeply as cognitive association density increases at low level, and the decline for firms with the mean level is relatively modest. However, low-level increases in cognitive association density did not lead to decline in the failure rate of firms a standard deviation above the mean. The results suggest that IC-design firms of little prominence in cognitive market networks most benefited from the legitimation of the entire population that accompanied low-level increases in cognitive association density. This finding is noteworthy given that such isolates gained no direct network prominence benefit from the increasing cognitive association density.

Some of organizational and environmental control variables are shown to have a significant influence on failure rates of IC-design firms. In contrast to the liability of newness argument (Freeman, Carroll, and Hannan 1983), the estimates for the four age segments indicate that the failure rate of IC-design firms generally increased with age. However, in accordance with prior research, the failure rate was shown to decrease with firm size, measured as the logged number of employees. The estimate for patent performance indicates that firms issuing a greater number of patents faced the lowered risk of failure. Specifically, the estimate for patent performance in Model 1 indicates that each additional patent multiplies the failure rate by a factor of .40 (exp[–.924×1])—that is, a one-unit increase in the variable leads to a decrease in the failure rate by approximately 60 percent (100×[exp(–.924×1)–1]). Meanwhile, the estimates for both prior founding and population density are not significant, but their signs are consistent with the commonly observed U-shaped relationship (Hannan and Freeman 1989; Glenn R. Carroll and Hannan 2000). The negative coefficient on media coverage volume is not significant; however, it

becomes significant with firm size omitted ($p<.05$, not presented). This implies that larger firms are more likely than smaller firms to receive media coverage (Schultz, Marin, and Boal 2014).

[Table 5 about here]

To check for robustness, I replicated Models 1 through 6 in Table 4 using data on 1,798 firm-year observations for a sub-population of 238 IC-design firms. This sub-population excludes 134 firms that had not received any media coverage from the *Electronics Times* during the study period. Recall that I originally used data on the full population of 382 firms. Now I consider the effects of cognitive association density on the failure rate among those firms that had been visible in media discourse. The results are reported in Table 5. They indicate that the effects of control variables are not substantially changed in all models. In Models 2 through 4, the coefficients on the linear and squared terms for cognitive association density are negative and positive as predicted, but they are marginally significant ($p<.10$). Meanwhile, the estimates for the interaction terms in Models 5 and 6 are consistent with the results from the full population, implying that IC-design firms in isolation most benefited from the legitimation effect of low-level increases in cognitive association density.

CONCLUSION

This research proposed that the legitimation of a new organizational form is a culturally mediated process that can be facilitated or impeded depending on the content and structure of market stories told in relevant media outlets. Building on the notion that media coverage for discourse provides a critical cognitive tool for making sense of the wider environment, I suggested a basic condition fostering audiences' sensemaking about organizations of a new form: the degree to which these organizations are inter-connected within cognitive market networks, which I labeled cognitive association density. This condition is the result of repeated media coverage about interactions among organizations of a form over time and accounts for the formation of shared understandings about their categorical identity features that would eventually constitute a social code for the form. The legitimating effects of cognitive association density were demonstrated through the analyses of organizational founding and failure rates in the South Korean population of semiconductor IC-design firms in 1994 to 2010. Consequently, media coverage for inter-organizational relationships helps legitimate an emergent population by shaping audiences' cognitive representations, or mental models, of how the population is bounded and works, thus enabling audiences make sense of related organizational activities.

My analysis of market networks in media discourse provides evidence that news media are influential institutional agents in the construction of form legitimacy as they help connect organizations using not-yet-legitimate forms to audiences. This has an important implication for ecological theory. In particular, legitimation can be driven not only by membership expansion of a population (or population density); its origin is also to be found in media coverage for market networks among population entrants. Recent ecological theory has placed the perceptions of audiences squarely at the center of the legitimation process, positing that organizations and audiences co-evolve (Hannan, Pólos, and Carroll 2007; Pólos, Hannan, and Carroll 2002; Hsu and Hannan 2005; Zuckerman 1999). This perspective emphasizes that legitimation depends on

the ability of audiences to classify organizations of a form into a distinct category—that is, if audiences are unaware of the categorical distinction of those organizations, the increase in population density will not be effective in driving legitimacy. In this light, my analysis contributes to the audience-centered approach of a form by revealing the condition affecting audiences' perception of the categorical standing of an emerging population.

This research also contributes to the literature of cultural entrepreneurship by suggesting a potential way through which entrepreneurs legitimate their new ventures to audiences who possess critical resources (Lounsbury and Glynn 2001; Navis and Glynn 2010; Navis and Glynn 2011). According to this literature, new entrepreneurial ventures are typically unknown to audiences and they can acquire legitimacy and audiences' support by creating identity stories that address questions about who they are and what they do. My analysis of cognitive market networks suggests that new entrepreneurial ventures can increase their chances of gaining legitimacy and support by creating stories that position them as constituting a distinct category along with their potential competitors. These stories can help new ventures establish their market identities through social comparisons, thus making their ongoing projects more plausible and comprehensible to audiences.

TABLES AND FIGURES

Table 1. Correlations and Descriptive Statistics of Variables in Founding Analyses

Variable		Mean	S.D.	1	2	3	4	5	6	7
1	Founding, t	5.78	4.33							
2	Year 1999-2001	0.18	0.38	0.43						
3	Year 2002-2004	0.18	0.38	0.06	-0.21					
4	Year 2005-2007	0.18	0.38	0.15	-0.21	-0.21				
5	Year 2008-2010	0.18	0.38	-0.12	-0.21	-0.21	-0.21			
6	ICT market growth rate	4.00	11.79	0.03	-0.07	0.07	-0.02	-0.09		
7	GDP growth rate	2.21	5.50	-0.14	0.02	0.00	-0.04	-0.05	0.58	
8	Inflation rate	3.24	1.42	-0.43	-0.43	-0.08	-0.36	0.00	-0.07	-0.04
9	Ratio of associative articles	0.28	0.17	0.48	0.57	-0.02	-0.12	0.17	-0.01	-0.12
10	Prior founding	5.74	4.37	0.62	0.44	0.00	0.18	-0.06	0.01	0.02
11	Prior founding squared	51.74	93.89	0.51	0.42	-0.07	0.05	-0.08	0.08	0.05
12	Population density	148.22	98.96	0.22	-0.15	0.22	0.42	0.54	-0.10	-0.07
13	Population density squared, divided by 10^3	31.62	26.87	0.10	-0.28	0.11	0.43	0.64	-0.09	-0.06
14	Cognitive association density	10.11	6.90	0.20	-0.20	0.28	0.40	0.40	-0.10	-0.07
15	Cognitive association density squared	149.09	146.17	0.10	-0.28	0.24	0.37	0.39	-0.04	-0.03

(*Continued*)

		8	9	10	11	12	13	14
9	Ratio of associative articles	-0.44						
10	Prior founding	-0.42	0.49					
11	Prior founding squared	-0.28	0.37	0.90				
12	Population density	-0.46	0.28	0.30	0.10			
13	Population density squared, divided by 10^3	-0.37	0.17	0.18	0.02	0.97		
14	Cognitive association density	-0.41	0.11	0.27	0.07	0.89	0.85	
15	Cognitive association density squared	-0.36	-0.02	0.14	0.01	0.77	0.76	0.95

Note: The sample consists of 68 quarterly observations for the period 1994-2010.

Table 2. Maximum Likelihood Estimates of Negative Binomial Regression Models of Organizational Founding: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994 to 2010

Variable	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5
Year 1999-2001	0.467+	-0.587	-0.048	0.101	0.682
	(0.347)	(0.645)	(0.361)	(0.709)	(0.584)
Year 2002-2004	0.408+	-0.557	-0.297	0.274	0.828
	(0.288)	(0.790)	(0.357)	(0.897)	(0.795)
Year 2005-2007	0.401+	-0.091	-0.387	0.768	1.122
	(0.310)	(0.978)	(0.405)	(1.106)	(1.079)
Year 2008-2010	0.126	0.172	-0.643+	0.869	0.949
	(0.261)	(1.048)	(0.416)	(1.146)	(1.137)
ICT market growth rate	0.012*	0.012*	0.015**	0.014**	0.015**
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
GDP growth rate	-0.032**	-0.029**	-0.033**	-0.028*	-0.028*
	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)
Inflation rate	-0.014	-0.104	-0.090	-0.058	-0.015
	(0.075)	(0.086)	(0.071)	(0.087)	(0.079)
Ratio of associative articles	0.612+	0.427	0.980*	0.916+	1.211*
	(0.443)	(0.505)	(0.550)	(0.613)	(0.554)
Prior founding	0.135***	0.105**	0.106*	0.087*	0.091*
	(0.043)	(0.044)	(0.049)	(0.048)	(0.048)
Prior founding, squared	-0.003**	-0.003*	-0.003+	-0.002+	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Population density		0.023**		0.007	-0.008+
		(0.009)		(0.012)	(0.005)
Population density squared divided by 10^3		-0.082**		-0.045+	
		(0.033)		(0.034)	
Cognitive association density			0.122*	0.139*	0.195**
			(0.059)	(0.083)	(0.076)
Cognitive association density squared			-0.004*	-0.004+	-0.006*
			(0.002)	(0.003)	(0.003)
Constant	0.657*	0.746*	0.696*	0.436	0.306
	(0.394)	(0.383)	(0.374)	(0.411)	(0.405)
Wald chi squared	75.00***	85.51***	83.03***	96.92***	92.77***
Degree of freedom	10	12	12	14	13

+ p<.10; * p<.05; ** p<.01; *** p<.001 (one-tailed tests)

Notes: Numbers in parentheses are robust standard errors. The sample consists of 68 quarterly observations for the period 1994-2010.

Table 3. Correlations and Descriptive Statistics of Variables in Failure Analyses

Variable		Mean	S.D.	1	2	3	4	5	6	7	8	9
1	Firm age	5.72	3.13									
2	Year 1999-2001	0.13	0.33	-0.29								
3	Year 2002-2004	0.24	0.42	-0.17	-0.21							
4	Year 2005-2007	0.28	0.45	0.06	-0.24	-0.35						
5	Year 2008-2010	0.32	0.47	0.35	-0.26	-0.38	-0.44					
6	ICT market growth rate	11.97	15.73	-0.02	-0.18	0.44	-0.02	-0.23				
7	Inflation rate	2.92	1.05	0.07	-0.25	0.16	-0.36	0.32	0.16			
8	Number of patents	1.14	5.83	0.13	-0.04	-0.04	0.04	0.03	-0.01	-0.02		
9	Number of employees (logged)	1.52	0.62	0.37	0.00	0.01	0.02	-0.02	0.00	-0.03	0.34	
10	Subsidiary	0.04	0.18	-0.03	-0.01	0.01	0.01	0.01	0.00	-0.01	-0.01	0.08
11	Media coverage volume	1.69	5.34	0.20	-0.02	-0.01	0.07	-0.04	-0.03	-0.05	0.56	0.55
12	Average degree score	1.13	2.31	0.12	-0.02	0.07	-0.03	-0.05	0.07	0.02	0.12	0.40
13	Prior founding	25.06	9.78	-0.21	0.47	0.02	0.24	-0.55	0.23	-0.41	-0.02	0.01
14	Prior founding squared divided by 10^3	0.72	0.68	-0.19	0.52	-0.05	0.10	-0.40	0.28	-0.48	-0.02	0.01
15	Population density	206.78	54.92	0.41	-0.63	-0.16	0.24	0.55	-0.15	-0.04	0.07	0.01
16	Population density squared divided by 10^3	45.77	17.90	0.45	-0.66	-0.28	0.22	0.66	-0.15	0.03	0.07	0.00
17	Cognitive association density	14.87	4.95	0.28	-0.53	0.21	0.01	0.30	0.39	0.13	0.03	0.01
18	Cognitive association density squared	245.68	147.81	0.26	-0.44	0.18	-0.09	0.33	0.46	0.24	0.02	0.00

(*Continued*)

		10	11	12	13	14	15	16	17
11	Media coverage volume	-0.01							
12	Average degree score	0.00	0.29						
13	Prior founding	-0.01	-0.01	0.04					
14	Prior founding squared, divided by 10^3	0.00	-0.02	0.04	0.96				
15	Population density	0.03	0.02	-0.07	-0.45	-0.46			
16	Population density squared, divided by 10^3	0.02	0.01	-0.07	-0.51	-0.49	0.98		
17	Cognitive association density	0.02	-0.02	0.05	-0.17	-0.17	0.62	0.58	
18	Cognitive association density squared	0.01	-0.03	0.06	-0.23	-0.20	0.50	0.49	0.97

Note: The sample consists of 2,393 firm-year spells for 382 IC-design firms in 1994-2010.

Table 4. Maximum Likelihood Estimates of Piecewise Exponential Hazards Models of Organizational Failure: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994 to 2010

Variable	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6
Age: <3 years	-21.902***	-18.933***	-19.132***	-19.424***	-19.287***	-18.405***
	(1.011)	(0.990)	(1.575)	(1.465)	(1.587)	(1.044)
Age: 3-6 years	-20.999***	-18.030***	-18.235***	-18.533***	-18.396***	-17.495***
	(1.041)	(1.044)	(1.603)	(1.507)	(1.640)	(1.121)
Age: 6-9 years	-21.108***	-18.123***	-18.357***	-18.625***	-18.491***	-17.592***
	(1.033)	(1.018)	(1.573)	(1.488)	(1.615)	(1.089)
Age: ≥9 years	-20.768***	-17.754***	-17.962***	-18.258***	-18.155***	-17.250***
	(1.030)	(1.055)	(1.600)	(1.516)	(1.650)	(1.120)
Year 1999-2001	15.842***	13.614***	29.403**	12.850***	13.192***	14.204***
	(4.380)	(1.684)	(10.818)	(2.205)	(2.187)	(1.711)
Year 2002-2004	16.590***	17.899***	35.536**	16.522***	16.959***	18.913***
	(4.770)	(3.272)	(12.999)	(4.151)	(4.139)	(3.264)
Year 2005-2007	15.138***	17.501***	32.194**	15.882***	16.033***	18.366***
	(4.041)	(3.106)	(11.401)	(4.317)	(4.328)	(3.102)
Year 2008-2010	12.374***	16.739***	25.687**	14.620**	14.471**	17.585***
	(3.269)	(2.705)	(8.574)	(4.741)	(4.819)	(2.695)
ICT market growth rate	-0.045+	-0.065*	-0.167*	-0.063*	-0.070**	-0.072**
	(0.029)	(0.029)	(0.076)	(0.029)	(0.029)	(0.029)
Inflation rate	0.541	-0.027	0.773+	0.154	0.214	-0.069
	(0.471)	(0.178)	(0.586)	(0.377)	(0.401)	(0.179)
Number of patents	-0.924**	-0.914**	-0.924**	-0.914**	-0.903**	-0.904**
	(0.323)	(0.323)	(0.324)	(0.323)	(0.322)	(0.323)
Number of employees, logged	-0.668**	-0.682**	-0.665**	-0.679**	-0.710**	-0.715**
	(0.234)	(0.232)	(0.232)	(0.233)	(0.236)	(0.236)
Subsidiary	0.387	0.375	0.375	0.375	0.376	0.374
	(0.309)	(0.309)	(0.308)	(0.309)	(0.302)	(0.303)
Media coverage volume	-0.076	-0.075	-0.076	-0.074	-0.076	-0.077
	(0.072)	(0.072)	(0.071)	(0.072)	(0.067)	(0.068)
Average degree score (ADS)	0.013	0.010	0.010	0.010	-2.981+	-2.800*
	(0.046)	(0.046)	(0.045)	(0.046)	(1.829)	(1.691)
Prior founding	-0.186	-0.044	-0.446+	-0.090	-0.122	-0.049
	(0.174)	(0.086)	(0.271)	(0.121)	(0.130)	(0.087)
Prior founding squared, divided by 10^3	3.253	1.726	7.829*	2.536	3.221+	1.936
	(2.841)	(1.540)	(4.251)	(2.134)	(2.293)	(1.554)
Population density	-0.049		-0.204+	0.011	0.017	
	(0.059)		(0.142)	(0.020)	(0.022)	
Population density Squared, divided by 10^3	0.226		0.677+			
	(0.216)		(0.445)			
Cognitive association density		-0.796*	-0.586+	-0.802*	-0.980*	-0.967*
		(0.428)	(0.441)	(0.433)	(0.433)	(0.426)
Cognitive association density squared		0.026*	0.023*	0.026*	0.031*	0.032*
		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Cognitive association density × Degree score					0.396*	0.377*
					(0.216)	(0.202)
Cognitive association density squared × Degree score					-0.013*	-0.012*
					(0.006)	(0.006)
Log pseudolikelihood	-257.4	-256.3	-255.0	-256.2	-251.2	-251.5

+ p<.10; * p<.05; ** p<.01; *** p<.001 (one-tailed tests)

Notes: Numbers in parentheses are robust standard errors. The Huber-White-sandwich estimator of variance, which clusters observations on organizations, is used to produce robust standard errors. The sample is the 2,393 firm-year spells for 382 IC-design firms and 131 failures.

Table 5. Maximum Likelihood Estimates of Piecewise Exponential Hazards Models of Organizational Failure: Sub-population of 238 Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994 to 2010

Variable	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6
Age: <3 years	-22.256***	-21.500***	-20.602***	-21.030***	-18.833***	-18.976***
	(1.320)	(1.128)	(1.876)	(1.834)	(1.907)	(1.151)
Age: 3-6 years	-21.286***	-20.548***	-19.639***	-20.065***	-17.870***	-18.015***
	(1.375)	(1.243)	(1.819)	(1.844)	(1.956)	(1.305)
Age: 6-9 years	-21.136***	-20.379***	-19.488***	-19.894***	-17.712***	-17.858***
	(1.367)	(1.199)	(1.801)	(1.835)	(1.935)	(1.259)
Age: ≥9 years	-20.969***	-20.179***	-19.269***	-19.693***	-17.567***	-17.713***
	(1.394)	(1.261)	(1.843)	(1.891)	(1.997)	(1.309)
Year 1999-2001	15.156***	16.536***	35.118**	17.098***	15.884***	15.853***
	(4.114)	(2.428)	(14.326)	(2.875)	(2.831)	(2.463)
Year 2002-2004	16.579***	21.234***	43.192**	22.312***	21.421***	21.301***
	(4.774)	(4.529)	(17.354)	(5.420)	(5.399)	(4.521)
Year 2005-2007	16.000***	20.765***	40.016**	22.036***	20.745***	20.591***
	(4.023)	(4.295)	(15.232)	(5.530)	(5.559)	(4.305)
Year 2008-2010	14.890***	19.737***	33.712**	21.401***	19.745***	19.521***
	(3.433)	(3.716)	(11.286)	(5.804)	(5.962)	(3.708)
ICT market growth rate	-0.026	-0.068*	-0.185*	-0.070*	-0.081*	-0.081*
	(0.034)	(0.038)	(0.102)	(0.038)	(0.038)	(0.037)
Inflation rate	0.269	0.134	0.656	-0.015	0.041	0.067
	(0.532)	(0.233)	(0.736)	(0.447)	(0.490)	(0.235)
Number of patents	-1.383***	-1.369***	-1.376***	-1.368***	-1.359***	-1.359***
	(0.400)	(0.399)	(0.401)	(0.400)	(0.395)	(0.395)
Number of employees, logged	-0.580*	-0.586*	-0.570*	-0.590*	-0.641*	-0.641*
	(0.304)	(0.298)	(0.299)	(0.300)	(0.308)	(0.307)
Subsidiary	0.449	0.437	0.438	0.438	0.427	0.427
	(0.386)	(0.388)	(0.386)	(0.389)	(0.381)	(0.381)
Media coverage volume	-0.066	-0.065	-0.067	-0.065	-0.067	-0.067
	(0.068)	(0.068)	(0.067)	(0.068)	(0.063)	(0.064)
Average degree score (ADS)	0.022	0.020	0.019	0.020	-2.733+	-2.750+
	(0.047)	(0.046)	(0.045)	(0.046)	(1.753)	(1.681)
Prior founding	-0.095	-0.109	-0.469+	-0.073	-0.115	-0.122
	(0.199)	(0.116)	(0.361)	(0.146)	(0.163)	(0.118)
Prior founding squared, divided by 10^3	1.513	2.592	7.830+	1.960	2.873	2.989+
	(3.247)	(2.092)	(5.605)	(2.593)	(2.863)	(2.114)
Population density	-0.029		-0.242+	-0.009	-0.002	
	(0.065)		(0.186)	(0.023)	(0.025)	
Population density Squared, divided by 10^3	0.103		0.730			
	(0.239)		(0.579)			
Cognitive association density		-0.835+	-0.597	-0.837+	-1.115*	-1.115*
		(0.544)	(0.560)	(0.541)	(0.540)	(0.540)
Cognitive association density squared		0.027+	0.025+	0.028+	0.037*	0.037*
		(0.018)	(0.018)	(0.018)	(0.017)	(0.017)
Cognitive association density × Degree score					0.375*	0.376*
					(0.209)	(0.202)
Cognitive association density squared × Degree score					-0.012*	-0.012*
					(0.006)	(0.006)
Log pseudolikelihood	-148.0	-146.8	-146.0	-146.7	-141.7	-141.7

+ p<.10; * p<.05; ** p<.01; *** p<.001 (one-tailed tests)

Notes: Numbers in parentheses are robust standard errors. The Huber-White-sandwich estimator of variance, which clusters observations on organizations, is used to produce robust standard errors. The sample is the 1,798 firm-year spells for 238 IC-design firms and 80 failures.

Figure 1. Population Founding, Failure, and Density: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994-2010

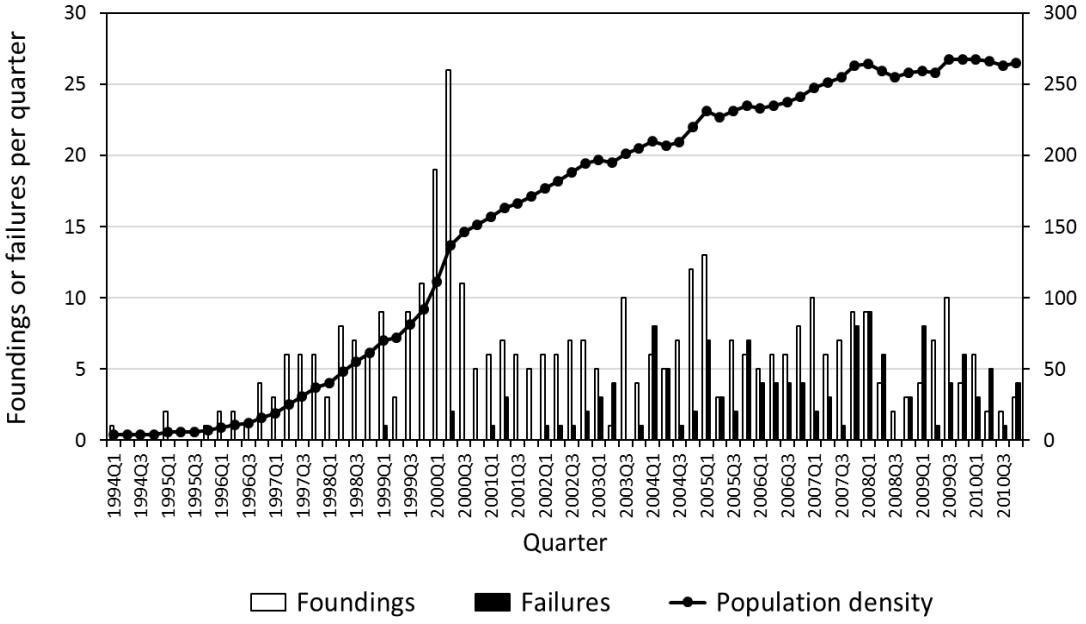


Figure 2. Distribution of Newspaper Articles and Cognitive Association Density (CAD): Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994-2010

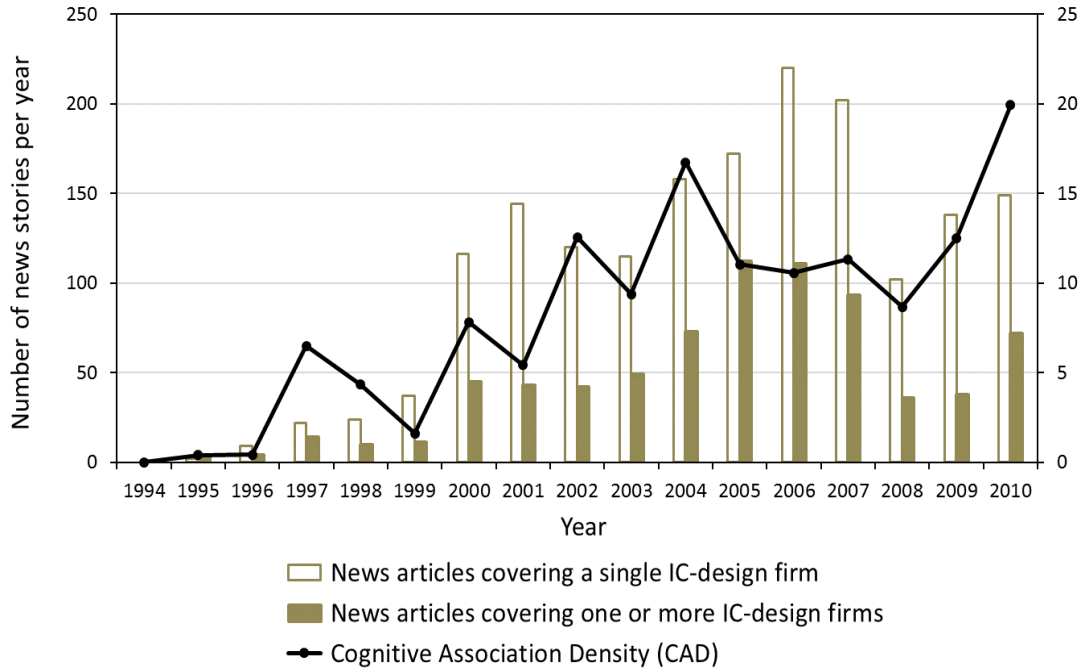


Figure 3. Effect of Cognitive Association Density (CAD) on the Multiplier of the Founding rate: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994-2010 (Model 5)

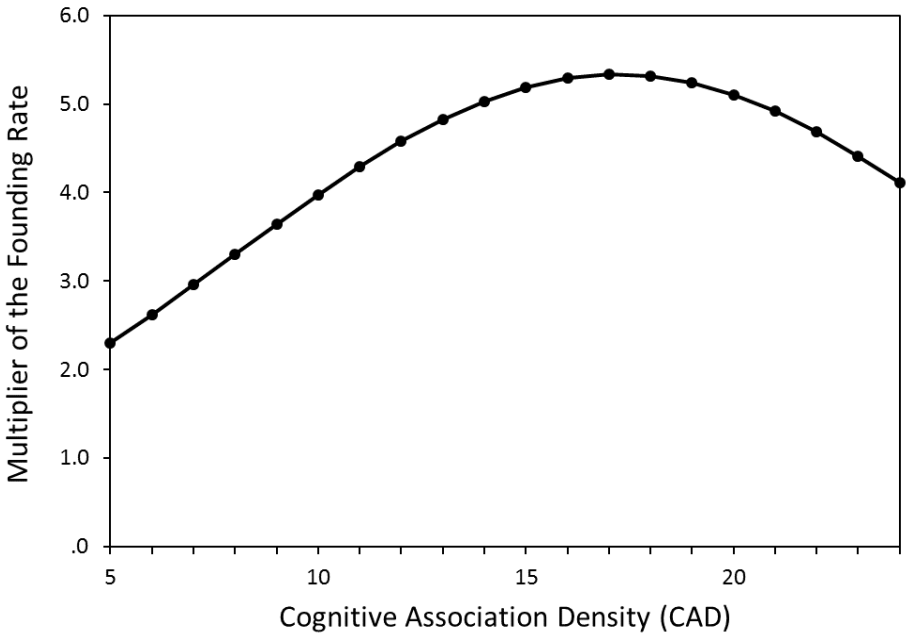
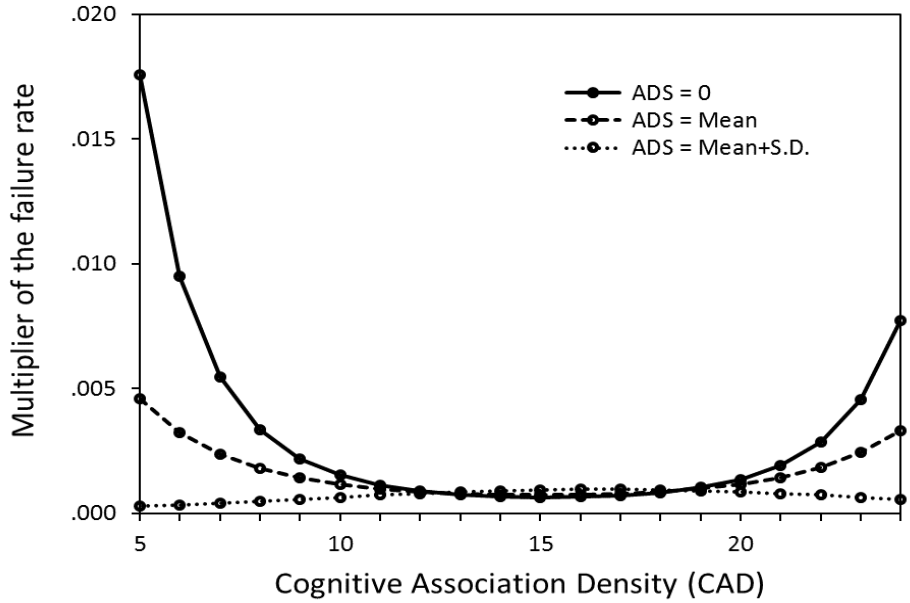


Figure 4. Interaction Effect of Cognitive Association Density (CAD) and Average Degree Score (ADS) on the Multiplier of the Failure Rate: Semiconductor Integrated-Circuit (IC) Design Firms in South Korea, 1994 to 2010 (Model 6)



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