TOWARD A SEARCH PERSPECTIVE ON ENTREPRENEURSHIP

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TOWARD A SEARCH PERSPECTIVE ON ENTREPRENEURSHIP

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ABSTRACT

Drawing on the behavioral theory of the firm, this dissertation examines the learning and searching processes in new ventures. This dissertation includes three essays, each focusing on one specific aspect of a search perspective on entrepreneurship. The first essay focuses on how new ventures learn from performance feedback in their pursuit of survival and growth, investigating the role of organizational attention in learning from performance feedback. The second essay focuses on R&D search under environmental jolts, investigating how environmental jolts affect new ventures’ R&D search behavior. The third essay focuses on technological search and market search in new ventures, investigating how new ventures allocate resources to the two types of search and how such resource allocation affects new venture performance. As a whole, these three essays draw on the behavioral theory of the firm to develop a search perspective on entrepreneurship.
The faculty listed below, appointed by the Dean of the Henry W. Bloch School of Management, have examined a dissertation titled “Toward a Search Perspective on Entrepreneurship,” presented by Yan Chen, candidate for the Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER 1
INTRODUCTION

Business organizations have an important role in our society, as they provide goods and services, employment opportunities, and business opportunities to people in the economy (Aldrich & Ruef, 2006; Scott, 1998). Business organizations, however, “do not burst onto the scene fully formed” (Aldrich & Ruef, 2006, p. 11). No matter large or small, they have their origins and roots in small and new ventures (Aldrich & Auster, 1986). In order to fully understand business organizations, we need to understand the nature and evolution of new ventures (Aldrich & Ruef, 2006). Given the important role of new ventures in our economy, this dissertation is focused on exploring the nature of new venture creation and entrepreneurial management.

A Search Perspective on New Ventures

What are the distinguishing characteristics of new ventures? Are new ventures just smaller versions of large businesses? We believe that new ventures are not just “smaller versions of large companies” (Blank, 2013a, p. 67). The lean startup literature has pointed out that, unlike established businesses that are primarily concerned with execution, new ventures are fundamentally concerned with search (Blank, 2013b, 2013a; Blank & Dorf, 2012; Osterwalder & Pigneur, 2010; Ries, 2011). In the early years of existence, new ventures generally lack well-established strategies, structures, processes, products, and customer relationships (Blank, 2013a; Stinchcombe, 1965). They experiment with different alternatives and search for a business model that may work
A business model describes the rationale of how an organization creates, delivers, and captures value” (Osterwalder & Pigneur, 2010, p. 14).

However, business models are not fully formed at the beginning of a new venture (Blank, 2013b, 2013a; Blank & Dorf, 2012; Osterwalder & Pigneur, 2010; Ries, 2011); they need to be discovered and explored (March, 1994; Simon, 1955). In the process of searching for a feasible business model, new ventures will gradually discover new information and develop new understanding. They will gradually learn more about the business opportunities that they are trying to exploit, more about other potential business opportunities, and more about viable business models to exploit business opportunities (McGrath, 2010; Mintzberg & Waters, 1985).

The process of discovering and establishing a feasible business model is not a certain, linear process. Instead, it is an uncertain, nonlinear process that involves learning, search, and discovery (Aldrich & Ruef, 2006; Nelson, 1991). It is fraught with false starts and dead ends. New ventures generally need course corrections in the search process (Ries, 2011). In this search process, new ventures learn from performance feedback; positive feedback suggests the promise of the chosen business model, while negative feedback suggests the need for change in the initial business model (Greve, 2003b; McGrath, 2010).

Once we recognize the search nature of new ventures, we may start to reconsider the ways that we manage new venture creation. First, we may need to recognize the potential pitfalls in applying traditional tools from established businesses to new ventures
(Blank, 2013a). If the nature of new ventures is fundamentally different from that of established businesses, the tools that work for established businesses may not work for new ventures (see also Blank, 2013a; McGrath, 2010). As a result, we may need to develop tools and strategies that can effectively address the nature of new ventures. Second, we need to recognize that the process of searching for a feasible business model is fundamentally uncertain and is fraught with false starts and dead ends. Consequently, new ventures may need course corrections in the search process (Johnson, Christensen, & Kagermann, 2008; Ries, 2011). Third, we need to recognize the value of learning, feedback, and discovery in the search process (Aldrich & Ruef, 2006; McGrath, 2010; Nelson, 1991). During the search process, new ventures will gradually learn new information, acquire feedback on prior actions, and discover new opportunities or new possibilities. As a result, new ventures may need to revise their initial business models or even abandon their initial business models (Blank, 2013a; Mintzberg & Waters, 1985).

Given the importance of learning and search in the process of new venture creation, the behavioral theory of the firm offers the promise to serve as the theoretical foundation for the study of new venture creation. The behavioral theory of the firm recognizes that decision makers are boundedly rational and that the choice set for a decision is unclear or undefined. Before decision can be made, the choice set must be constructed and evaluated (Cyert & March, 1963, 1992; Gavetti, Greve, Levinthal, & Ocasio, 2012; Greve, 2003b). In addition, the behavioral theory of the firm also recognizes that boundedly rational decision makers do not maximize but satisfice. They form levels of aspiration and rely on performance feedback to distinguish things that are
working from things that are not working; they retain the things that are satisfactory and look for better alternatives when existing things are unsatisfactory (Cyert & March, 1963, 1992; Gavetti et al., 2012; Greve, 2003b).

**The Organization of the Dissertation**

This dissertation draws on the behavioral theory of the firm (Cyert & March, 1963, 1992; Gavetti et al., 2012; Greve, 2003b) to study the process of new venture creation from a search perspective. This search perspective recognizes the central roles of learning and search in new ventures. This dissertation includes three essays, each of which focuses on a specific aspect of a search perspective on entrepreneurship.

The first essay focuses on how new ventures learn from and respond to performance feedback. Performance feedback guides organizational action, and it focuses a new venture’s attention on areas where performance falls below aspiration (March & Simon, 1993, p. 4). In the first essay, we examine two types of performance feedback: performance feedback on size goal and performance feedback on survival goal. Consistent with the behavioral theory of the firm, results show that unsatisfactory size performance drives new ventures to search for ways to expand organizational size and achieve organizational growth. However, the pursuit of survival affects the pursuit of size. When survival chance falls below survival aspiration, new ventures divert attention from the pursuit of size to the pursuit of survival, resulting in a decline in organizational growth. We also find that the size of the new venture team affects how new ventures learn from and respond to performance feedback. As the size of the new venture team increases, attentional capacity and problem-solving capacity increase, enabling new
ventures to respond to performance feedback more effectively and to attend to multiple goals simultaneously.

The second essay focuses on R&D search under environmental jolts. R&D search is a prototypical type of organizational search; it enables new ventures to construct and evaluate technology alternatives. Extensive research has investigated R&D search under normal conditions; however, little is known about how environmental jolts affect new ventures’ R&D search behavior. As a severe environmental jolt, the 2008 financial crisis provides a natural experiment to study R&D search behavior under environmental jolts. We examine how environmental jolts moderate the impacts of situational and institutional factors on R&D search intensity. We find that environmental jolts make high-tech new ventures more responsive to social aspiration. We also find that, under normal circumstances, the distance from bankruptcy has an inverted U-shaped relationship with R&D search intensity; under environmental jolts, this inverted U-shaped relationship has a higher peak and stronger declines. The results also show that environmental jolts strengthen, rather than weaken, the impact of institutionalization on R&D search behavior.

The third essay focuses on how new ventures allocate resources to technological search and market search. Technological search and market search play critical roles in establishing a product-market fit in a new venture’s business model. We suggest that new ventures can rely on an unbalanced approach to allocating resources to organizational search. According to the unbalanced approach, new venture can allocate more resource to one type of search and less resource to the other type of search. They can emphasize one
type of search over the other type of search; however, they cannot ignore either type of search. The unbalanced approach takes into account the synergy between technological search and market search and the possibility of emphasizing one type of search over the other type of search.

As a whole, these three essays draw on the behavioral theory of the firm to develop a search perspective on entrepreneurship. These three essays examine the roles of performance feedback, environmental jolts, and resource allocation in the process of searching for a feasible business model. This search perspective contributes to our understanding of entrepreneurship in a few major ways. First, a search perspective is instrumental in revealing the fundamental differences between new ventures and established businesses. Unlike established businesses with established business models, new ventures need to search for a feasible and desirable business model (Blank, 2013a). However, business models are not fully formed at the beginning of a new venture; they need to be searched and explored. Second, a search perspective also recognizes the experimental nature and the iterative process of new venture creation (Blank, 2013a; Curley & Formica, 2013). It emphasizes the importance of learning from performance feedback and of adapting to new information in the entrepreneurial process. The search perspective on entrepreneurship will contribute to our understanding of the nature of entrepreneurial management and the process of new venture creation.
A central idea in the behavioral theory of the firm is that organizations do not maximize; instead, they satisfice (Cyert & March, 1992; March & Simon, 1993; Simon, 1997). They develop aspirations based on past performance, compare actual performance with aspirations, and take actions to improve performance when actual performance levels are lower than aspiration levels (Cyert & March, 1992; Greve, 2003b; March, 1994). Based on these ideas, prior studies have shown that performance relative to aspiration (i.e., performance feedback or attainment discrepancy) influences risk taking (Bromiley, 1991; Lim & McCann, 2014; March & Shapira, 1987, 1992; Shapira, 1995), organizational search (Billinger, Stieglitz, & Schumacher, 2014; Chen, 2008; Chen & Miller, 2007; Greve, 2003a; Levinthal & March, 1981; Vissa, Greve, & Chen, 2010), organizational change (Audia, Locke, & Smith, 2000; Greve, 1998), and other organizational actions (Greve, 2003b; Shinkle, 2012).

Although prior studies have provided some insights, they generally lack a strong interest in exploring the role of performance feedback in organizational growth. As an important exception, Greve (2008a) proposes a behavioral theory of firm growth. Building on the behavioral theory of the firm, Greve identifies size goal as an important organizational goal and finds that performance feedback on organizational size affects organizational growth, especially when performance goal is satisfied (see also Baum &
Locke, 2004; Wiklund & Shepherd, 2003). In this study, we focus on further extending these ideas into a behavioral model of new venture growth. We are especially interested in (1) how size goal affects new venture growth, (2) how survival goal affects the pursuit of size goal, and (3) how new venture team aids the pursuit of multiple organizational goals in new ventures.

New ventures provide an appropriate context for exploring these research questions. Organizational growth has always been an important topic in entrepreneurship research (Baum, Locke, & Smith, 2001; Coad, 2009; Eisenhardt & Schoonhoven, 1990; Gilbert, McDougall, & Audretsch, 2006; Greve, 2008a; Luttmer, 2011; Penrose, 1959), and it would be interesting to examine the role of performance feedback in organizational growth (Greve, 2008a). In addition, new ventures suffer from the liability of newness (Aldrich & Auster, 1986; Stinchcombe, 1965), which may affect the pursuit of organizational growth. Finally, new ventures are generally run by their owners and are less susceptible to agency problems and political consideration (Fang, Kim, & Milliken, in press; Miller & Chen, 2004), thus providing a desirable context to examine learning from performance feedback.

This study makes several unique contributions to the behavioral theory of the firm and the entrepreneurship literature. First, it contributes to the development of a behavioral theory of firm growth. Firm growth has been studied from many theoretical perspectives, including the resource-based view (Penrose, 1959) and the industrial organization economics (Coad, 2009). The behavioral theory of the firm, however, has not played a major role in shaping our understanding of firm growth. This study draws on Greve’s
(2008) pioneering model and extends this model in two major aspects. We incorporate the struggle for survival into the behavioral theory of firm growth; we explore the role of performance feedback in new venture growth when new ventures are struggling for survival in the early years of existence. We also further examine the role of the new venture team in facilitating the pursuit of multiple organizational goals in new ventures.

This study also contributes broadly to organizational learning from performance feedback. Although feedback on a single goal generally guides action, feedback on multiple goals may complicate action. The pursuit of multiple goals is a challenging endeavor (Ethiraj & Levinthal, 2009), and the difficulty may arise in part from attentional limitations (Simon, 1997), which force organizations to pay sequential, rather than simultaneous, attention to multiple goals (Cyert & March, 1992; Greve, 2008a). We propose that attentional capacity is not fixed but varies, depending on the size of the new venture team. We also suggest that a large new venture team is instrumental in the pursuit of multiple organizational goals because such a team can increase the efficiency in sequential problem solving, enabling new ventures to move quickly from one goal to another, and facilitate simultaneous problem solving through specialization, enabling new ventures to attend to multiple organizational goals at the same time. Exploring these ideas can expand our understanding of organizational learning from performance feedback and enrich the behavioral theory of new venture growth.
Hypotheses

Organizational Goal and Organizational Search

Organizations are goal-directed entities (Aldrich & Ruef, 2006; Barnard, 1938; Cyert & March, 1992; Scott, 1998). Organizational goals are common objectives that organizational participants attempt to achieve through organizational actions (Aldrich & Ruef, 2006; Barnard, 1938; Cyert & March, 1992; Scott, 1998). Because of bounded rationality, organizations generally do not maximize but satisfice (Simon, 1955, 1982, 1997). They form aspiration levels for organizational goals and choose courses of action that meet their aspiration levels (Cyert & March, 1992; Greve, 2003b; Simon, 1955). “An aspiration level represents the smallest outcome that would be deemed satisfactory by the decision maker” (Schneider, 1992, p. 1053). Organizational goals and aspiration levels for goal therefore guide the search for alternative courses of action and the pursuit of organizational goals (Simon, 1955, 1964, 1997).¹

¹ In the behavioral theory of the firm, goal and aspiration essentially mean the same thing (e.g., Bromiley & Harris, 2014; Mezias, Chen, & Murphy, 2002). But there are a few subtle differences between different concepts. First, goal dimension is different from goal level. A goal dimension is a desirable end that can be achieved through certain means, while a goal level is the level of aspiration for the goal dimension. Second, there are different types of aspiration, such as satisficing aspiration and striving aspiration (Labianca, Fairbank, Andrevski, & Parzen, 2009; Murphy, Mezias, & Chen, 2001). Satisficing aspiration level is the minimum satisfactory performance level for a particular goal dimension, while striving aspiration level is the desirable performance level for a particular goal dimension. We believe that these subtle differences are important to the further development of the behavioral theory of the firm, for a few major reasons. First, they help us clarify the meaning of organizational aspiration in the behavioral theory of the firm. The level of aspiration in this tradition generally refers to satisficing aspiration level, which is the lower bound of acceptable performance level; it helps judge whether performance is satisfactory or not. Satisficing aspiration level is updated frequently, while striving aspiration level is relatively stable. Second, these subtle differences may
Organizational aspiration plays a critical role in the behavioral theory of the firm. “Aspiration levels provide a computation mechanism for satisficing” (Simon, 1996, p. 30). Aspiration levels divide results into two categories: “good enough and not good enough” (March, 1994, p. 21). Performance relative to aspiration level is generally called performance feedback or attainment discrepancy (Lant, 1992; Lewin, Dembo, Festinger, & Sears, 1944). Attainment discrepancy allows organizations to evaluate their performance and to reevaluate their chosen courses of action (Fishbach & Finkelstein, 2012; Greve, 2003b). Once organizations achieve their aspiration levels, the results are good enough (Simon, 1996); satisfactory performance would reinforce existing courses of action (Greve, 2003b). When performance levels are lower than aspirations levels, however, organizations are dissatisfied; unsatisfactory performance may provide cues for organizational search, through which organizations explore alternative ways to improve organizational performance (Cyert & March, 1992; March & Simon, 1993).

Organizations pursue not a single goal but multiple goals (Cyert & March, 1992; Greve, 2008a; Simon, 1997). Performance feedback is instrumental in the pursuit of a single organizational goal. The pursuit of multiple organizational goals, however, makes it difficult to learn from performance feedback (Ethiraj & Levinthal, 2009), because different organizational goals are competing for organizational attention and resources.

help us better learn from and communicate to other goal theories. The concept of goal in goal-setting theory is more related to striving aspiration than to satisficing aspiration, since goal-setting theory suggests that goals should be difficult, specific, and clear (Locke & Latham, 1990).
When performance feedback reveals shortfalls in multiple organizational goals, what do organizations do?

Recognizing bounded rationality and attentional limitations, the behavioral theory of the firm suggests that sequential attention is a mechanism through which organizations attend to multiple organizational goals (Cyert & March, 1992; Greve, 2008a). According to the theory, “[o]rganizations resolve conflict among goals, in part, by attending to different goals at different times” (Cyert & March, 1992, p. 166). Similarly, Kahneman (1973, p. 201) notes that, “[w]hen the demands of two tasks cannot be adequately satisfied, one is typically selected and the other is delayed or abandoned.” Sequential attention arises from attentional limitations, which result from limited attentional capacity, bottleneck resources, and interference among different goals (Kahneman, 2011; Pashler & Johnston, 1998).

When different organizational goals are competing for organizational attention, how do organizations sequence their attention? Prior research suggests that the sequence of organizational attention is determined, in part, by the importance and urgency of goals (Greve, 2003b, 2008a). When organizations fail to attain high-priority goals, the pursuit of those goals may override the pursuit of other goals (Fishbach, Friedman, & Kruglanski, 2003), causing organizations to focus their attention on high-priority goals and choose courses of action that are conducive to the attainment of high-priority goals.

Although all organizations face attentional limitations, the limits may not be homogeneous across new ventures. The attentional capacity of a new venture is determined in part by the new venture team. A larger new venture team is associated with
fewer attentional limitations. Through specialization in information processing and decision making, a new venture team can, to some extent, mitigate the attentional limitations of individual decision makers (Barnard, 1938; Simon, 1997). Therefore, we argue that attentional capacity varies across new ventures, depending on the size of the new venture team (Hinsz, Tindale, & Vollrath, 1997). Large new venture teams enable new ventures to attend to organizational problems more effectively and to pay attention to more problems simultaneously.

Size Goal and Attention to Growth

Size goal refers to a new venture’s aspiration level for organizational size. Organizational size can be indicated by sales revenue (Cyert & March, 1992; Greve, 2003b). Prior studies have suggested that size goal is an important organizational goal for new ventures (Cyert & March, 1992; Eisenhardt & Schoonhoven, 1990; Greve, 2008a) and that new ventures learn from performance feedback in their pursuit of organizational size (Greve, 2008a). Performance feedback on organizational size provides important information on a new venture’s progress: growth in sales revenue indicates progress, while declines signal problems (Blank, 2013a). New ventures pay attention to sales revenue and learn from performance feedback on sales revenue.

Attainment discrepancy is performance relative to aspiration level (Lant, 1992; Washburn & Bromiley, 2012). Attainment discrepancy can either be in the nonnegative domain or the negative domain. When the sales revenue of a new venture is equal to or

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2 There are other measures of organizational size, such as the number of employees. We follow prior studies in choosing sales revenue as our measure of organizational size (Eisenhardt & Schoonhoven, 1990; Greve, 2008a).
larger than the aspiration level, attainment discrepancy is in the nonnegative domain, and the new venture is satisfied with its size performance and may not seek further actions to expand size (Greve, 2003b). Furthermore, positive attainment discrepancy in size reflects goal fulfillment and thus may shift organizational attention from the pursuit of organizational size to the pursuit of other organizational goals (Fishbach & Finkelstein, 2012).

Unlike nonnegative attainment discrepancy, negative attainment discrepancy in size activates size goal (Dijksterhuis & Aarts, 2010). Negative attainment discrepancy in size indicates unsatisfactory size performance and the existence of organizational problems. It directs a new venture’s attention to organizational size and triggers organizational search for ways to reduce the gap between performance and aspiration (Cyert & March, 1992; Dijksterhuis & Aarts, 2010; Greve, 2003b). Directed by size goal, new ventures allocate organizational resources to growth-oriented initiatives, motivate and sustain efforts in the pursuit of organizational growth, and evoke organizational knowledge and capabilities that are related to the pursuit of organizational size (Locke & Latham, 1990; Locke & Latham, 2002). We therefore hypothesize:

Hypothesis 2.1. The more a new venture was below its size aspiration in the previous time period, the more it will grow in the current time period.

Survival Goal and Attention to Survival

Although growth is what most new ventures aspire for, they first need to fight against the liability of newness and survive (Aldrich & Auster, 1986; Altman, 2013; Stinchcombe, 1965). New ventures generally incur substantial costs before they are
certain about their revenue streams, exposing them to high levels of mortality risk (Blank, 2013a; Blank & Dorf, 2012). Growth and survival are both important to new ventures.

But what is the relationship between a new venture’s size goal and its survival goal? Are they two points on the same goal dimension? Or do they belong to different goal dimensions? We believe that size goal and survival goal belong to different goal dimensions (see also Sapienza, Autio, George, & Zahra, 2006). ³ To achieve growth, a new venture may take actions to increase its sales revenue; those actions may incur substantial costs and could either increase or decrease the chance of survival (Sapienza et al., 2006). To increase the chance of survival, however, a new venture needs to pay attention to both revenue and costs, ensuring its ability to keep resource exchange in balance (Aldrich & Ruef, 2006; Simon, 1997). Therefore, increases in size do not necessarily translate into increases in the chance of survival, and thus growth and survival should be modeled as two related but distinct organizational goals (Sapienza et al., 2006).

Survival chance reflects a new venture’s distance from bankruptcy, and thus survival goal is a new venture’s aspiration level for the distance from bankruptcy. The

³ Although profit goal and survival goal can be modeled on the same continuum (March & Shapira, 1992), size goal and survival goal belong to different dimensions. Survival is the point at which new ventures can maintain resource exchange in balance. Profit is the amount of surplus in resource exchange. Survival chance generally improves as profit increases, since profit (i.e., the difference between revenue and cost) results from surplus in resource exchange. Consequently, profit goal and survival goal can be modeled on the same continuum, in which the survival point is the point where revenue equals cost (March & Shapira, 1992). However, size goal is concerned only with revenue, without attention to costs. Increase in size does not guarantee improvement in survival chance. Therefore, size goal and survival goal should be modeled as different goals.
further a new venture is from bankruptcy, the higher its chance of survival is.\footnote{Survival is generally modeled as a binary outcome variable in the literature; firms either survive or not survive. Inspired by March and Shapira (1992), recent studies started to recognize the benefits of modeling survival as the distance from bankruptcy (Chen & Miller, 2007; Miller & Chen, 2004). By so doing, we are able to further study survival not only as an outcome but also as an aspiration.} Attainment discrepancy in survival is the difference between survival performance and survival aspiration. Attainment discrepancy can be either in the nonnegative domain or in the negative domain. Nonnegative attainment discrepancy indicates satisfactory survival performance, while negative attainment discrepancy reveals potential survival-related issues and direct organizational attention to organizational survival. Negative attainment discrepancy in survival implies that a new venture is not satisfied with its current distance from bankruptcy and triggers the new venture to search for ways to improve its chance of survival and increase its distance from bankruptcy. Negative attainment discrepancy focuses a new venture’s attention on the pursuit of organizational survival, and the pursuit of survival may affect the pursuit of organizational size.\footnote{Limited attentional capacity results in selective attention. Selective attention implies that information that is not directly related to goal pursuit may be ignored (Dijksterhuis & Aarts, 2010; Pashler, 1999).}

The focus of attention on survival affects the selection of the stimulus set and the selection of response set (Kahneman, 1973). First, survival-related stimuli become salient when new ventures face negative attainment discrepancy in survival. The more a new venture attends to organizational survival, the more organizational attention is consumed in the pursuit of organizational survival (Kahneman, 1973; Simon, 1997). Because attentional capacity is limited, only spare attentional capacity is allocated toward other
tasks, such as the pursuit of organizational size (Kahneman, 1973, 2011). As new ventures pay more attention to survival, they will pay less attention to growth (Kahneman, 1973, 2011).

Second, the focus of attention on survival also affects the choice of organizational action (Kahneman, 1973; Ocasio, 1997). When organizational attention is focused on organizational survival, new ventures are concerned with chance of survival and become risk adverse (Audia & Greve, 2006; March & Shapira, 1987, 1992). When survival performance falls below survival aspiration, they may tighten organizational control and conserve organizational resources in order to improve their chances of survival (Staw, Sandelands, & Dutton, 1981). They may start to cut costs and divest assets (Robbins & Pearce II, 1992; Trahms, Ndofor, & Sirmon, 2013). Under extreme conditions of financial distress, they may also consider debt restructuring, asset sales, and infusion of new external funding (Altman & Hotchkiss, 2006; Senbet & Wang, 2010). Although these courses of action may improve the chance of organizational survival, they may not be conducive to organizational growth, as organizational growth requires new ventures to take actions to increase sales revenue. We therefore hypothesize:

Hypothesis 2.2. The more a new venture was below its survival aspiration in the previous time period, the less it will grow in the current time period.

Multiple Organizational Goals and Divided Attention

Organizational goals direct the allocation of attention, driving new ventures to attend to information related to goal pursuit and filter out irrelevant information (Dijksterhuis & Aarts, 2010). However, the activation of multiple organizational goals
complicates the allocation of organizational attention. The difficulty results in part from attentional limitations. When new ventures allocate attention to one organizational goal, the organizational attention given to other organizational goals is reduced (Kahneman, 1973; Pashler, 1994). Because of attentional limitations, we expect that new ventures would have difficulty in dealing simultaneously with two organizational goals. Simultaneous attention to two goals results in divided attention (Pashler, 1999), which may result in declined organizational performance.

Furthermore, prior studies suggest that survival goal takes priority over other organizational goals (Aldrich & Auster, 1986; Greve, 2008a; March & Shapira, 1992). When multiple organizational goals compete for organizational attention, high-priority goals, such as survival goal, may claim more organizational attention than other goals. Therefore, when a new venture faces survival problems, survival goal may claim a large portion of organizational attention, leaving meager organizational attention for the pursuit of size goal.

Multiple active goals may not only compete for organizational attention but also call for different courses of action, resulting in interference between different courses of action (Pashler, 1994). When new ventures face attainment discrepancies in both size goal and survival goal, size goal and survival goal may call for different organizational actions. For instance, size goal may focus organizational attention on expanding sales revenue in order to accelerate organizational growth, whereas survival goal may focus organizational attention on cutting costs in order to keep resource exchange in balance.
Therefore, multiple active organizational goals may complicate how new ventures respond to performance feedback (Ethiraj & Levinthal, 2009). We therefore hypothesize:

Hypothesis 2.3. The relationship between performance feedback on size and organizational growth is weakened by performance feedback on survival.

New Venture Teams

Founders are of critical importance to new ventures: they make critical decisions, mobilize resources, and solve problems (Klotz, Hmieleski, Bradley, & Busenitz, 2014; Sine, Mitsuhashi, & Kirsch, 2006). For new ventures, we believe that large new venture teams are associated with expanded attentional capacity and with increased access to resources (Eisenhardt & Schoonhoven, 1990; Halebian & Finkelstein, 1993; Hambrick & D'Aveni, 1992). Through specialization, large new venture teams are associated with expanded attentional capacity (Eisenhardt & Schoonhoven, 1990; Kozlowski & Bell, 2003; Wuchty, Jones, & Uzzi, 2007), enabling new ventures to attend to more tasks simultaneously. Large new venture teams also expand access to resources, improving information processing and problem solving (Halebian & Finkelstein, 1993; Hambrick & D'Aveni, 1992; Kozlowski & Bell, 2003).

However, new ventures with large new venture teams may face loss of coordination (Kozlowski & Bell, 2003; Olson, 1965). Different founders may have different opinions and interests, complicating coordination in new ventures (Eisenhardt, 1989). Because of the advantages and disadvantages associated with large new venture teams, we do not expect a direct, unambiguous, positive relationship between new venture team size and new venture performance. Instead, we believe that the impact of
new venture team size on new venture performance is condition-dependent. Under some conditions, the advantages of resource availability outweigh the disadvantages of coordination loss. Under other conditions, the disadvantages may outweigh the advantages.

When performance falls below the level of aspiration, the advantages associated with large new venture teams enable new ventures to search for ways to restore organizational performance (see also Singh & Fleming, 2010; Sutton & Hargadon, 1996; Wuchty et al., 2007). Unsatisfactory size performance is not an easy problem to solve. To solve such a problem, for example, new ventures need to search for the causes of unsatisfactory size performance and search for solutions to expand organizational size. New ventures need to explore different causes and propose different solutions. Compared with new ventures with small new venture teams, new ventures with large new venture teams are able to attend to growth-related problems with a broader perspective, to attend to more information and cues related to organizational growth, to engage growth-related problems at a deeper level, and thus to identify more causes and propose more solutions to expand organizational size (Haleblian & Finkelstein, 1993, p. 846). Therefore, facing unsatisfactory size performance, new ventures with large new venture teams are able to quickly identify binding constraints and propose solutions to expand organizational size and achieve organizational growth. We therefore hypothesize:

Hypothesis 2.4. The size of the new venture team strengthens the relationship between performance feedback on size and organizational growth.
When attentional capacity and organizational resources are expanded by having a larger new venture team, new ventures become better able to deal with multiple organizational goals (Corner, Kinicki, & Keats, 1994; Hinsz et al., 1997). Even if new ventures allocate a portion of organizational attention to the pursuit of survival goal, the remaining attentional capacity may still be abundant enough to deal with growth-related issues. Although the pursuit of survival goal diverts organizational attention from the pursuit of size goal, new ventures with large new venture teams would be less severely impacted, because they may still have sufficient attentional capacity to attend to growth-related issues (Corner et al., 1994; Hinsz et al., 1997). Accordingly, the distracting effect of low survival performance on organizational growth decreases. We therefore hypothesize:

Hypothesis 2.5. The size of the new venture team weakens the relationship between performance feedback on survival and organizational growth.

What if a new venture faces both negative attainment discrepancy in growth and negative attainment discrepancy in survival? We argue that the expanded attentional capacity associated with large new venture teams becomes very valuable when new ventures need to attend to both size goal and survival goal. New ventures with large new venture teams are privileged to have increased access to resources and expanded attentional capacity, enabling them to effectively attend to multiple organizational goals without significant performance decline. They can either speed up the sequential processing of multiple organizational goals or rely on simultaneous processing to attend
to multiple organizational goals (Cyert & March, 1992; March & Simon, 1993; Simon, 1982).

New ventures with large new venture teams are able to quickly resolve the most pressing problem and then quickly move on to resolve the second most pressing problem (Simon, 1982). Hence, if they rely on sequential attention to attend to multiple organizational goals, they can increase their problem-solving speed and thus tackle organizational goals more effectively than new ventures with small new venture teams (Hinsz et al., 1997).

Large new venture teams allow for specialization in problem solving (Eisenhardt & Schoonhoven, 1990; Simon, 1997). For instance, new ventures with large new venture teams are able to assign growth problem and survival problem to different founders and attend to multiple organizational problems simultaneously (Eisenhardt & Schoonhoven, 1990). Through a divide and conquer strategy, new ventures with large new venture teams can transform sequential processing of different organizational goals to simultaneous processing of multiple goals (Spink, Cole, & Waller, 2008) without sacrificing performance. We therefore hypothesize:

Hypothesis 2.6. The size of the new venture team moderates the interaction between performance feedback on size and performance feedback on survival on organizational growth.

Figure 2.1 summarizes all the hypothesized relationships.
Method

Data and Sample

We drew the data for this study from the Kauffman Firm Survey (KFS), a panel study of 4,928 new ventures founded in the United States in 2004; KFS is a probability sample selected from around 250,000 new businesses. The KFS tracks these new ventures annually from 2004 to 2011, thus providing data about the operations and performance of new ventures in their early life stages (Robb & Robinson, 2014; Robb & Watson, 2012).

Using the KFS has several major advantages for researchers. It is a longitudinal panel data set, which is especially valuable for research on temporal phenomena, such as organizational growth (Garnsey, Stam, & Heffernan, 2006, p. 9). Because of the scarcity of such data sets, longitudinal research is rare among prior studies on firm growth (Dobbs & Hamilton, 2007). We are also able to control for time-invariant firm heterogeneity and

Figure 2.1. When survival trumps growth
time-specific effects by using the two-way fixed-effects model. Furthermore, all firms in the KFS were founded in the United States in same year, directly controlling for the confounding environmental (e.g., macroeconomic) effects as well as the effects of age and aging on organizational growth.

In generating our study sample, we excluded observations that did not contain sales revenue information and that had missing values for any studied variable. We also excluded firms with fewer than 2 years of observations, because the SAS Panel procedure requires that each firm have at least two observations. The final sample for this study contains 6,181 firm-year observations for 1,616 new ventures.

Measures

In our sample, a new venture can have at most six observations. There is a 1-year lag between the dependent variable and the independent variables. The dependent variable is drawn from the 2006 to 2011 survey data, while the independent variables are drawn mainly from the 2005 to 2010 survey data. Data from the 2004 survey are used to construct aspiration levels for year 2005.

Size and Growth

Size and growth are distinct but related concepts (Whetten, 1987). Size refers to the scale of an organization at a given point in time, while growth refers to the changes in size over time. Organizational size has many different conceptualizations (Barron, West, & Hannan, 1994). In this study, we follow prior research and measure the size of a new venture by its sales revenue (Eisenhardt & Schoonhoven, 1990; Greve, 2008a), which
reflects a venture’s capacity to acquire resources from its customers. Accordingly, growth is measured by changes in sales revenue over time.

**Survival**

A new venture’s chance of survival refers to its distance from bankruptcy (Iyer & Miller, 2008; Lim & McCann, 2014; Miller & Chen, 2004). We measure chance of survival using Dun & Bradstreet’s Financial Stress Score, which predicts the probability of a business failing over the subsequent 12 months. This study uses the percentile score, which ranges from 1 to 100 (1 = highest risk of failure, 100 = lowest risk of failure). The lower the Financial Stress Score, the closer a new venture is to bankruptcy; conversely, the higher the score, the higher a new venture’s survival chance.

**Size Aspiration and Survival Aspiration**

Aspiration is a key construct in the behavioral theory of the firm (Bromiley & Harris, 2014; Shinkle, 2012). According to the theory, aspiration level is a function of historical aspiration and social aspiration (Cyert & March, 1992; Greve, 2003b). Historical aspiration reflects a new venture’s past performance, and new ventures take their own past performance into account when they form their aspiration levels (Greve, 2003b). Social aspiration reflects the past performance of comparable new ventures, and new ventures draw on the performance of comparable new ventures to form their levels of aspiration (Greve, 2003b). In this study, we use the following formula to construct a new venture’s aspiration level:

\[ Aspiration_{i,t} = \alpha \times historical\_aspiration_{i,t} + \beta \times social\_aspiration_{i,t} \]
where $\alpha + \beta = 1$. Following prior studies, we try different values for $\alpha$ and $\beta$ by increments of 0.1 and choose weights that produce the best model fit (Bromiley & Harris, 2014; Greve, 2003a).\(^6\)

Although the influence of past performance on organizational aspiration can date back infinitely to the beginning of a new venture, immediate past performance tends to have a disproportionately larger impact on aspiration than remote past performance (Cyert & March, 1992; Greve, 2003b). In research on organizational aspiration, the time span for past performance generally ranges from 1 year to 3 years (Bromiley & Harris, 2014). Bromiley and Harris (2014, p. 353) point out that “most firms do not pay much attention to the past beyond the previous year.” Because new ventures have limited life histories and are rapidly evolving, a 3-year span would be too long to capture the impact of past performance on organizational aspiration. Therefore, in this study, we adopt a 1-year span in capturing the influence of past performance (Bromiley & Harris, 2014; Harris & Bromiley, 2007).

We are interested in the pursuit of multiple organizational goals in new ventures; consequently, we need to construct aspiration levels for different organizational goals, including those for size and survival. Size aspiration is a function of a new venture’s size in the previous period and the size of comparable new ventures in the previous period (Cyert & March, 1992; Greve, 2003b). Comparable new ventures are defined by a few

\(^6\) We chose the combination of $\alpha$ and $\beta$ that produces the highest $R$-squared. The size-dependent model with the focal attainment discrepancy as the sole explanatory variable is used in the analyses. The random-effects models and the fixed-effects models produce the same results.
major criteria. First, new ventures with similar age are more comparable than new ventures with different ages, as age is closely related to the stage of development (Aldrich & Ruef, 2006). In this data set, all new ventures were founded in 2004, so they all have comparable age. Second, new ventures in the same industry are more comparable than those in different industries (Washburn & Bromiley, 2012). In constructing social aspiration, we operationalize the size of comparable new ventures as the mean size of new ventures with the same age in the same industry (Washburn & Bromiley, 2012). In determining the weights for historical aspiration and social aspiration, we try different weights by increments of 0.1 and choose the weights that produce the best model fit. The best weights for historical aspiration and social aspiration are $\alpha = 0.1$ and $\beta = 0.9$, respectively.

Survival aspiration is a function of the new venture’s chance of survival in the previous period as well as the average chances of survival of comparable new ventures in the previous period (Cyert & March, 1992; Greve, 2003b). Comparable new ventures are defined as new ventures with the same age in the same industry. The best weights for historical aspiration and social aspiration are $\alpha = 0.1$ and $\beta = 0.9$, respectively.

---

7 We account for sampling weights when calculating the industry average.

8 We account for sampling weights when calculating the industry average.
Attainment discrepancy measures the difference between actual performance and aspiration level (Greve, 2003b; Lant, 1992; Lewin et al., 1944). Accordingly, attainment discrepancy in size is measured by the difference between actual size and size aspiration; similarly, attainment discrepancy in survival is measured by the difference between actual chance of survival and survival aspiration. In order to ease presentation, interpretation, and discussion, we use performance shortfall to refer to the opposite of attainment discrepancy. For example, size shortfall is size aspiration minus actual size; survival shortfall is survival aspiration minus actual chance of survival.

*The Size of the New Venture Team*

Team size is measured by the number of owner-operators in a new venture (Eisenhardt & Schoonhoven, 1990; Klotz et al., 2014). In order to be counted as a founder, the owner of a new venture must not only have an equity stake in the new venture but also actively participate in the operations of the new venture (Klotz et al., 2014). Because founders may join and leave a new venture, the size of the new venture team is a time-varying variable.

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9 In constructing attainment discrepancies, we follow the weighted-average model (Bromiley & Harris, 2014). We are aware of the existence of other models, such as the separate model and the switching model (Bromiley & Harris, 2014). We choose to follow the weighted-average model in order to keep our model as close to the original behavioral theory of firm growth as possible (Greve, 2008a). In addition, we are also aware of the spline specification (Greve, 2003b), in which performance above aspiration level and performance below aspiration level are entered as two separate variables. In order to study the interrelation between different goal variables and to keep the model as simple as possible, we choose not to follow the spline specification in this study.
Control Variables

*Organizational Slack*

Organizational slack refers to the resources that are available to a new venture but not fully exploited (Cyert & March, 1992; March, 1994). It reflects uncommitted resources, unexploited opportunities, and undiscovered economies (Cyert & March, 1992; March, 1994). In this study, we focus specifically on a prototypical type of organizational slack, financial slack. Financial resources are fungible, so they can be deployed to support various growth-related initiatives in new ventures (Mishina, Pollock, & Porac, 2004; Penrose, 1959). Financial slack is measured by the amount of the new venture’s cash holdings in the prior year (Myers & Majluf, 1984). Following Voss, Sirdeshmukh, and Voss (2008, p. 154), we adjust for total expenses in calculating cash holdings.

*Patents*

We also control for the number of patents that a new venture possesses. Patents reflect a new venture’s technological know-how, which improves productivity and enables the carrying out of new combinations (Ahuja & Katila, 2001; Coad, 2009; Mowery, Oxley, & Silverman, 1996). With technological know-how, as embodied in

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10 According to Myers and Majluf (1984), a firm’s financial slack consists of the level of cash holding, the value of marketable securities, and the amount of default-risk-free debt. New ventures generally hold very little marketable securities. Furthermore, because of severe information asymmetry and fundamental uncertainty, new ventures are unable to issue default-risk-free debt. Therefore, the financial slack of new firms is mainly made up of cash holding.

11 Because many new ventures have very limited expense, the ratio of cash to total expense may become unreasonably high. Following Robb and Watson (2012), this ratio is bounded between 0 and 10.
patents, new ventures can pursue technological opportunities and create products that may interest potential customers, possibly resulting in higher growth rates (Coad, 2009; Nelson & Winter, 1982).

Models and Econometric Methods

Following Greve (2008a), we adopt the size-dependent growth model in this study (see also Audia & Greve, 2006; Barron et al., 1994; Desai, 2008). This generalized model includes Gibrat’s law as a special case (Barron et al., 1994; Sutton, 1997). The size-dependent growth model can be specified as follows:

$$\frac{\text{Size}_{i,t}}{\text{Size}_{i,t-1}} = \text{Size}_{i,t-1}^\gamma e^{\beta x_{i,t-1} + \varepsilon_{i,t}}$$

In this model, $\text{Size}_{i,t}$ is the sales revenue of firm $i$ at time $t$; $\text{Size}_{i,t-1}$ is the sales revenue of firm $i$ at time $t-1$; $\text{Size}_{i,t-1}^\gamma$ is the size-dependent factor; $X_{i,t-1}$ is an array of covariates explaining organizational growth; $\beta$ are a set of parameters. Gibrat’s law implies that growth rates are independent of size (Sutton, 1997). In this model, Gibrat’s law holds when $\gamma = 0$. However, this model also allows growth rates to be related to organizational size.

This model can be transformed into a linear model by taking the natural logarithm of both sides.

$$\ln(\text{Size}_{i,t}) - \ln(\text{Size}_{i,t-1}) = \gamma \ln(\text{Size}_{i,t-1}) + \beta x_{i,t-1} + \varepsilon_{i,t}$$

After rearranging this model, we get:

$$\ln(\text{Size}_{i,t}) = (1 + \gamma) \ln(\text{Size}_{i,t-1}) + \beta x_{i,t-1} + \varepsilon_{i,t}$$
In this transformed model, the natural logarithm of organizational size at time $t$ is a function of the natural logarithm of organizational size at time $t - 1$ and a set of covariates. This model is a size-dependent model of organizational growth in the sense that organizational growth can be dependent on organizational size at time $t - 1$. It is critical to note that, when we interpret our estimates, we need to put them back into the original model.

Following Greve (2008a), we adopt the fixed-effects models to estimate the transformed model. As Greve (2008a) suggests, accounting for time-invariant firm heterogeneity in growth performance is critical for research on firm growth, because unobserved fixed factors affect the varying growth performance across firms. For example, founding conditions may affect growth rates (Barron et al., 1994); so do many time-invariant factors (Gilbert et al., 2006). Accounting for time-invariant firm heterogeneity allows us to focus on the impacts of time-varying factors on organizational growth.

Accounting for time-specific effect is also critical to this study for two major reasons. First, firms experienced changing macroeconomic conditions during the study period. Time-specific effects account for the macroeconomic conditions. Second, because all firms in this data set were founded in 2004, time is related to firm age. Therefore, time-specific effects also account for the effect of age and aging on organizational growth.

Therefore, we choose the two-way fixed-effects model, which accounts for both time-invariant firm heterogeneity and time-specific effects (Baltagi, 2005, p. 33). We
adopt the SAS Panel procedure with Fixtwo option to estimate the model. As a robustness check, we also run the random-effects model to estimate the model.

Results

Means, Standard Deviations, and Correlations

Table 2.1 reports the descriptive statistics of the panel data. As this table shows, a new venture on average has 1.432 founders, 0.170 patents, and cash holdings of 44.0 percent of its total annual expenditure across years and firms. The average (natural logarithms of) annual revenue and lagged annual revenue of a new venture across years and firms are 11.747 and 11.734, respectively.

Hypothesis Testing

In interpreting the results from the two-way fixed-effects model (see table 2.2), we need to transform the model into the original size-dependent growth model. Following Jaccard and Turrisi (2003), we use Model 1 to interpret the main effects, Model 2 to interpret the two-way interaction effects, and Model 3 to interpret the three-way interaction effect.

---

12 As Table 2.2 shows, model 1 explains 90.50 percent of the variance of the dependent variable. After including the interaction effects, model 3 explains 90.60 percent of the variance of the dependent variable. The change in R-square seems to be modest. However, we need to note two things. First, unlike the conventional R-Square, the R-square in the SAS panel procedure is calculated using a generalized formula proposed by Buse (1973). Second, because model 1 has already explained a large portion of the variance in organizational size, the additional interaction effects explain a portion of the variance that is originally explained by the fixed-effects. As we can see from Table 2.3, the change in R-square across random-effects models is much larger than that across fixed-effects models.
Table 2.1. Means, standard deviations, and correlations

<table>
<thead>
<tr>
<th>Variable$^a$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Revenue$_t$$^b$</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Revenue$_{t-1}$$^c$</td>
<td>0.894***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Size Shortfall$_{t-1}$$^d$</td>
<td>-0.110***</td>
<td>-0.196***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Survival Shortfall$_{t-1}$$^e$</td>
<td>-0.178***</td>
<td>-0.171***</td>
<td>-0.004</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Team Size$_{t-1}$</td>
<td>0.306***</td>
<td>0.301***</td>
<td>-0.049***</td>
<td>-0.107***</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Cash Holding$_{t-1}$</td>
<td>-0.191***</td>
<td>-0.208***</td>
<td>-0.022*</td>
<td>0.055***</td>
<td>-0.055***</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>7. Patent$_{t-1}$</td>
<td>0.075***</td>
<td>0.071***</td>
<td>-0.005</td>
<td>0.002</td>
<td>0.195***</td>
<td>-0.003</td>
<td>1.000</td>
</tr>
</tbody>
</table>

| Mean          | 11.747 | 11.734 | -0.534 | -7.435 | 1.432 | 0.440 | 0.170 |
| Std Dev       | 2.185  | 2.108  | 15.138 | 22.713 | 0.941 | 1.426 | 1.592 |

Notes:
- $a. n = 6181$;
- $b. $Natural logarithm$;$
- $c. $Natural logarithm$;$
- $d. $It is the opposite of attainment discrepancy in size. It is measured by size aspiration minus actual size performance$;
- $\text{Size Shortfall}_{t-1} = \text{Size Aspiration}_{t-1} - \text{Size Performance}_{t-1}$;
- $e. $It is the opposite of attainment discrepancy in survival. It is measured by survival aspiration minus actual survival performance$;
- $\text{Survival Shortfall}_{t-1} = \text{Survival Aspiration}_{t-1} - \text{Survival Performance}_{t-1}$;
- $^* p < 0.10; ~ ^{**} p < 0.05; ~ ^{***} p < 0.01$
Table 2.2. Results from two-way fixed-effects models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>9.6552***</td>
<td>9.5145***</td>
<td>9.4953***</td>
</tr>
<tr>
<td></td>
<td>(0.3945)</td>
<td>(0.3941)</td>
<td>(0.3938)</td>
</tr>
<tr>
<td>Firm Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cash Holding$_{t-1}$</td>
<td>-0.0011</td>
<td>-0.0017</td>
<td>-0.0014</td>
</tr>
<tr>
<td></td>
<td>(0.0107)</td>
<td>(0.0106)</td>
<td>(0.0106)</td>
</tr>
<tr>
<td>Patent$_{t-1}$</td>
<td>0.0082</td>
<td>0.0060</td>
<td>0.0060</td>
</tr>
<tr>
<td></td>
<td>(0.0106)</td>
<td>(0.0106)</td>
<td>(0.0106)</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue$_{t-1}$</td>
<td>0.1357***</td>
<td>0.1464***</td>
<td>0.1479***</td>
</tr>
<tr>
<td></td>
<td>(0.0156)</td>
<td>(0.0157)</td>
<td>(0.0157)</td>
</tr>
<tr>
<td>Size Shortfall$_{t-1}^b$</td>
<td>0.0039***</td>
<td>0.0042**</td>
<td>0.0020</td>
</tr>
<tr>
<td></td>
<td>(0.0008)</td>
<td>(0.0018)</td>
<td>(0.0019)</td>
</tr>
<tr>
<td>Survival Shortfall$_{t-1}^c$</td>
<td>-0.0016**</td>
<td>-0.0043***</td>
<td>-0.0049***</td>
</tr>
<tr>
<td></td>
<td>(0.0007)</td>
<td>(0.0013)</td>
<td>(0.0013)</td>
</tr>
<tr>
<td>Team Size$_{t-1}$</td>
<td>0.0443</td>
<td>0.0723**</td>
<td>0.0768**</td>
</tr>
<tr>
<td></td>
<td>(0.0275)</td>
<td>(0.0305)</td>
<td>(0.0305)</td>
</tr>
<tr>
<td><strong>Interaction Effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size Shortfall$_{t-1}$ ×</td>
<td>-0.0002***</td>
<td>-0.0005***</td>
<td></td>
</tr>
<tr>
<td>Survival Shortfall$_{t-1}$</td>
<td>(0.0000)</td>
<td>(0.0001)</td>
<td></td>
</tr>
<tr>
<td>Team Size$_{t-1}$ ×</td>
<td>0.0006</td>
<td>0.0010</td>
<td></td>
</tr>
<tr>
<td>Size Shortfall$_{t-1}$</td>
<td>(0.0010)</td>
<td>(0.0010)</td>
<td></td>
</tr>
<tr>
<td>Team Size$_{t-1}$ ×</td>
<td>0.0018**</td>
<td>0.0021***</td>
<td></td>
</tr>
<tr>
<td>Survival Shortfall$_{t-1}$</td>
<td>(0.0007)</td>
<td>(0.0007)</td>
<td></td>
</tr>
<tr>
<td>Team Size$_{t-1}$ ×</td>
<td></td>
<td>0.0002***</td>
<td></td>
</tr>
<tr>
<td>Size Shortfall$_{t-1}$</td>
<td></td>
<td>(0.0001)</td>
<td></td>
</tr>
<tr>
<td>Survival Shortfall$_{t-1}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buse R-Square$^d$</td>
<td>0.9050</td>
<td>0.9058</td>
<td>0.9060</td>
</tr>
</tbody>
</table>

Notes: a. 6181 firm-year observations for 1616 firms; b. Size Shortfall$_{t-1}$ = Size Aspiration$_{t-1} -$ Size Performance$_{t-1}$; c. Survival Shortfall$_{t-1}$ = Survival Aspiration$_{t-1} -$ Survival Performance$_{t-1}$; d. Unlike the conventional R-Square, the R-Square in the SAS Panel procedure follows a generalized formula proposed by Buse (1973);

* $p < 0.10$ (two-tailed test); ** $p < 0.05$ (two-tailed test); *** $p < 0.01$ (two-tailed test).
Hypothesis 2.1 predicts that size shortfall is positively associated with organizational growth. We use size shortfall (measured by size aspiration minus actual size) to refer to the opposite of negative attainment discrepancy in size. By so doing, we can simplify our presentation and interpretation of the results. As Model 1 shows, Hypothesis 2.1 is supported ($p < 0.01$). This result implies that performance feedback on size is a mechanism of organizational growth. As size performance falls below size aspiration, new ventures direct organizational attention, resources, and energy to growth-related issues, leading to better growth performance in the next time period.\(^\text{13}\)

Hypothesis 2.2 predicts that survival shortfall is negatively associated with organizational growth. To simplify presentation and interpretation, we use survival shortfall to refer to the opposite of attainment discrepancy in survival; survival shortfall is measured by survival aspiration minus actual survival performance. As Model 1 shows, Hypothesis 2.2 is supported ($p < 0.05$). This result implies that survival shortfall focuses organizational attention on organizational survival and directs new ventures to look for ways to improve survival performance. Because of attentional limitations, organizational growth may decline, as organizational attention is diverted from organizational growth to organizational survival.\(^\text{14}\)

Hypothesis 2.3 predicts that survival shortfall negatively moderates the relationship between size shortfall and organizational growth. As Model 2 shows, the

\(^{13}\) One way to interpret this result is as follows: one standard deviation increase in size shortfall results in 5.9 percent increase in size (Wooldridge, 2013, p. 44).

\(^{14}\) One way to interpret this result is as follows: one standard deviation increase in survival shortfall results in 3.6 percent decrease in size (Wooldridge, 2013, p. 44).
interaction between size shortfall and survival shortfall is negative and significant ($p < 0.01$), supporting Hypothesis 2.3. This result implies that attention to survival interferes with attention to size. Given bounded rationality and attentional limitations, new ventures may have difficulty in dealing with shortfalls in both size and survival. Consequently, survival shortfall reduces the impact of size shortfall on growth performance.

Hypothesis 2.4 predicts that new venture team size positively moderates the relationship between size shortfall and organizational growth. As Model 2 shows, the interaction between new venture team size and size shortfall is insignificant, and thus this result does not support Hypothesis 2.4.

Hypothesis 2.5 predicts that new venture team size positively moderates the relationship between survival shortfall and organizational growth. As Model 2 shows, the interaction between new venture team size and survival shortfall is positive and significant ($p < 0.05$), supporting Hypothesis 2.5. The result implies that, as new venture team size increases, the negative impact of survival shortfall on organizational growth weakens.

Hypothesis 2.6 predicts that new venture team size positively moderates the negative interaction between size shortfall and survival shortfall. As Model 3 shows, the three-way interaction among new venture team size, size shortfall, and survival shortfall is positive and significant ($p < 0.01$), supporting Hypothesis 2.6. This result implies that new ventures with large new venture teams are better able to attend to multiple organizational goals than new ventures with small teams.
As a robustness check, we rerun the models using the two-way random-effects models, the results of which support all hypotheses, including Hypothesis 2.4 (see table 2.3). As table 2.3 shows, Model 4 explains 16.40 percent of the variance of the dependent variable, and Model 6 explains 17.96 percent of the variance of the dependent variable. However, the random-effects may not be appropriate for this study, because the Hausman tests \((p < 0.01)\) are all significant for Model 4, Model 5, and Model 6 in table 2.3. Nevertheless, the random-effects models suggest that the results from the fixed-effects model are robust.

**Discussion**

**Toward a Behavioral Theory of New Venture Growth**

New ventures learn from performance feedback. As the performance feedback theory suggests, the failure to achieve satisfactory performance directs organizational attention to improve organizational performance (Greve, 2003b). When size performance falls below size aspiration, size goal becomes activated and salient (Fishbach & Dhar, 2008; Greve, 2003b), causing new ventures to focus on growth-related issues. As new ventures become attentive to organizational growth, they are more likely to notice and respond to growth-related problems and opportunities, resulting in higher growth rates. Therefore, performance feedback on organizational size can be a mechanism of organizational growth (Greve, 2008a).
Table 2.3. Results from two-way random-effects models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.7194***</td>
<td>6.5041***</td>
<td>6.4819***</td>
</tr>
<tr>
<td></td>
<td>(0.1540)</td>
<td>(0.1545)</td>
<td>(0.1542)</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Holding _t_1</td>
<td>-0.0017</td>
<td>-0.0021</td>
<td>-0.0018</td>
</tr>
<tr>
<td></td>
<td>(0.0099)</td>
<td>(0.0098)</td>
<td>(0.0098)</td>
</tr>
<tr>
<td>Patent _t_1</td>
<td>0.0057</td>
<td>0.0029</td>
<td>0.0029</td>
</tr>
<tr>
<td></td>
<td>(0.0097)</td>
<td>(0.0097)</td>
<td>(0.0097)</td>
</tr>
<tr>
<td>Independent Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue _t_1</td>
<td>0.4078***</td>
<td>0.4217***</td>
<td>0.4233***</td>
</tr>
<tr>
<td></td>
<td>(0.0125)</td>
<td>(0.0125)</td>
<td>(0.0125)</td>
</tr>
<tr>
<td>Size Shortfall _t_1 _b</td>
<td>0.0065***</td>
<td>0.0045***</td>
<td>0.0017</td>
</tr>
<tr>
<td></td>
<td>(0.0008)</td>
<td>(0.0017)</td>
<td>(0.0018)</td>
</tr>
<tr>
<td>Survival Shortfall _t_1 _c</td>
<td>-0.0024***</td>
<td>-0.0048***</td>
<td>-0.0057***</td>
</tr>
<tr>
<td></td>
<td>(0.0007)</td>
<td>(0.0012)</td>
<td>(0.0012)</td>
</tr>
<tr>
<td>Team Size _t_1</td>
<td>0.1351***</td>
<td>0.1763***</td>
<td>0.1790***</td>
</tr>
<tr>
<td></td>
<td>(0.0234)</td>
<td>(0.0263)</td>
<td>(0.0263)</td>
</tr>
<tr>
<td>Interaction Effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size Shortfall _t_1 _c _ ×</td>
<td>-0.0003***</td>
<td>-0.0007***</td>
<td></td>
</tr>
<tr>
<td>Survival Shortfall _t_1 _c</td>
<td>(0.0000)</td>
<td>(0.0001)</td>
<td></td>
</tr>
<tr>
<td>Team Size _t_1 _c _ ×</td>
<td>0.0025**</td>
<td>0.0030***</td>
<td></td>
</tr>
<tr>
<td>Survival Shortfall _t_1 _c</td>
<td>(0.0010)</td>
<td>(0.0010)</td>
<td></td>
</tr>
<tr>
<td>Team Size _t_1 _c _ ×</td>
<td>0.0015**</td>
<td>0.0022***</td>
<td></td>
</tr>
<tr>
<td>Survival Shortfall _t_1 _c</td>
<td>(0.0007)</td>
<td>(0.0007)</td>
<td></td>
</tr>
<tr>
<td>Buse R-Square _d</td>
<td>0.1640</td>
<td>0.1765</td>
<td>0.1796</td>
</tr>
</tbody>
</table>

Notes:
- a. 6181 firm-year observations for 1616 firms;
- b. Size Shortfall \_t\_1 = Size Aspiration \_t\_1 − Size Performance \_t\_1;
- c. Survival Shortfall \_t\_1 = Survival Aspiration \_t\_1 − Survival Performance \_t\_1;
- d. Unlike the conventional R-Square, the R-Square in the SAS Panel procedure follows a generalized formula proposed by Buse (1973);
  * p < 0.10 (two-tailed test);  ** p < 0.05 (two-tailed test);  *** p < 0.01 (two-tailed test).
Performance feedback has been shown to affect a wide variety of organizational decisions and actions (Greve, 2003b; Shinkle, 2012); however, its role in organizational growth has been underexplored (Greve, 2008a). We believe that documenting the role of performance feedback in organizational growth is an important step toward building a behavioral theory of new venture growth.

In building a behavioral theory of new venture growth, we need to recognize how the struggle for survival in new ventures affects new venture growth (Aldrich & Auster, 1986; Stinchcombe, 1965). When survival performance falls below survival aspiration, new ventures become attentive to survival, diverting attention away from the pursuit of organizational size. Because unsatisfactory survival performance may be considered to be an urgent and pressing problem, it may become the focus of organizational attention. When both survival performance and growth performance are unsatisfactory, both goals are activated and competing for organizational attention. Because survival tends to be more urgent, survival goal may take priority over growth goal when both goals are activated (Aldrich & Auster, 1986; Simon, 1997).

Attentional capacity, which is generally limited, expands as the size of the new venture team increases, thus aiding new ventures in their pursuit of multiple organizational goals. In this study, we identify two mechanisms through which large new venture teams may be helpful in the pursuit of multiple organizational goals (Simon, 1982). First, new venture team size is associated with the speed of problem solving. Large new venture teams are generally associated with expanded attentional capacity and increased access to resources, enabling new ventures to process information and solve
problems effectively. Second, large new venture teams enable new ventures to transform the sequential processing of multiple organizational goals into the simultaneous processing of multiple organizational goals. Large new venture teams allow for specialization, which facilitates simultaneous processing of multiple organizational goals. Therefore, as the size of the new venture team increases, new ventures become better able to deal with multiple organizational goals.

Entrepreneurial Learning from Performance Feedback

According to the behavioral theory of the firm, decision alternatives are generally not given; they need to be searched. The consequences of a decision alternative are generally not known; they need to be explored (Cyert & March, 1992; March, 1994; Simon, 1982). Like any organization, a new venture is a boundedly rational entity that learns from performance feedback when it is searching for decision alternatives to realize its organizational goals (Greve, 2003b).

As new ventures explore decision alternatives in their early years of existence, organizational search is of critical importance. Unlike established business units with established courses of action, new business ventures are in the process of searching for feasible and desirable courses of action (Blank, 2013a; Sommer, Loch, & Dong, 2009). They generally lack well-established strategies, structures, processes, and external ties (Stinchcombe, 1965). Consequently, they rely on performance feedback to separate what is working from what is not working (Blank, 2013a). Therefore, organizational learning from performance feedback seems to be of critical importance to new ventures.
Many prior studies have examined entrepreneurial learning (see Wang & Chugh, 2014 for a review) and, in particular, entrepreneurial learning from failure (e.g., Cope, 2011; McGrath, 1999; Shepherd, 2003; Ucbasaran, Shepherd, Lockett, & Lyon, 2013). Failure is an extreme type of performance feedback that allows entrepreneurs to learn hard-core lessons about entrepreneurship. However, business failure is also very costly and only allows for postmortem learning (Ucbasaran et al., 2013). Business failure does not allow failed new ventures to learn from performance feedback and improve organizational performance. Therefore, business failure may contribute knowledge to the society in general but not to the failed new ventures.

We draw on the behavioral theory of the firm to study how new ventures learn from performance feedback. Performance feedback learning enables new ventures to learn in real time and adjust action accordingly (Eisenhardt, 1989; Greve, 2003b). As boundedly rational entities, they generally cannot predict the consequences of alternative courses of action before taking action. In the process of search, they may also make mistakes or discover new insights (Blank, 2013a). They can learn from performance feedback and gradually discover what may work and what may not work. Positive feedback calls for commitment to the current course of action, while negative feedback suggests the need for change. By learning from and responding to performance feedback, new ventures may gradually discover feasible and desirable courses of action.

The Pursuit of Multiple Organizational Goals

Like individuals (Fishbach & Dhar, 2008; Louro, Pieters, & Zeelenberg, 2007) and large organizations (Cyert & March, 1992; March, 1994), new ventures pursue
multiple goals (Cyert & March, 1992; Kaplan & Norton, 1996). However, performance feedback theory generally focuses on the pursuit of a single organizational goal (Greve, 2003b; Shinkle, 2012), leaving the pursuit of multiple organizational goals underexplored (Greve, 2008a).

Because of attentional limitations, the pursuit of multiple organizational goals is challenging (Ethiraj & Levinthal, 2009). The pursuit of one goal will divert attention and resources from the pursuit of another goal (Louro et al., 2007), and thus the activation of multiple organizational goals results in divided attention (Pashler, 1999). However, in this study, we also find that, although organizational attention is generally limited, attentional limits are heterogeneous across new ventures. This limit depends on the size of the new venture team: as the size of the new venture team increases, attentional capacity expands, enabling new ventures to deal with multiple organizational goals.

Sequential Attention versus Simultaneous Attention

This study also contributes to the attention-based view. Prior studies on organizational attention tend to focus on how organizations allocate limited attention to different activities (Cho & Hambrick, 2006; Li, Maggitti, Smith, Tesluk, & Katila, 2013; Maula, Keil, & Zahra, 2013; Ocasio, 1997, 2011; Tuggle, Sirmon, Reutzel, & Bierman, 2010). However, we believe that a complete understanding of organizational attention also requires a better understanding of what determines the limits in organizational attention and how organizations cope with attentional limitations.

As a first step, our results show that attentional capacity increases with the size of the new venture team. A large new venture team allows founders to specialize on
different tasks and thus mitigate the distracting effects of divided attention caused by the pursuit of multiple organizational goals (Pashler, 1994; Pashler, 1999). Because of attentional limitations, prior studies tend to suggest that organizations rely on sequential attention to deal with multiple organizational goals (Cyert & March, 1992; Greve, 2008a). However, our findings suggest that the expanded attentional capacity associated with large new venture teams may allow new ventures to deal with multiple organizational goals simultaneously rather than sequentially.

Limitations and Future Research Directions

We acknowledge that this study has some limitations. First, like most studies drawing on the behavioral theory of the firm, this study does not have data about the actual aspiration levels of new ventures over the study period (Bromiley & Harris, 2014; Shinkle, 2012). Following prior studies, we infer that aspiration levels are formed by past performance and social comparison. Like other researchers in the behavioral tradition, we believe that substantial insights could be obtained by explicitly measuring aspiration levels in future research.

Second, in this study we focus specifically on two organizational goals. But organizations often pursue multiple goals (Cyert & March, 1992). Future studies may extend this study by investigating other organizational goals and the interrelationships among them.

Third, we focus on the role of attention in the pursuit of multiple organizational goals. Subsequent studies can delve into other mechanisms through which new ventures deal with multiple organizational goals.
Conclusion

New ventures learn from performance feedback as they explore alternative courses of action to fight against the liability of newness and to pursue organizational growth. Drawing on the behavioral theory of the firm, we have shown that performance feedback can be a mechanism of organizational growth. Performance feedback on organizational size drives new ventures to search for ways to expand organizational size and achieve organizational growth. However, performance feedback on multiple organizational goals may complicate organizational action, as different goals compete for limited organizational attention. In this study, we find that the pursuit of size goal may be affected by the pursuit of survival goal. When chance of survival is unsatisfactory, new ventures divert attention from the pursuit of size goal to the pursuit of survival goal, resulting in a decline in organizational growth. We also find that limits on attentional capacity are not homogeneous across new ventures; instead, as the size of the new venture team increases, attentional capacity increases. As attention capacity expands with the size of the new venture team, new ventures with large new venture teams become better able to deal with multiple organizational goals. This study is our initial effort in drawing on the behavioral theory of the firm to study entrepreneurial learning from performance feedback and to develop a behavioral theory of new venture growth. We believe that such studies not only contribute to our understanding of the entrepreneurial processes but also contribute to further developments of the behavioral theory of the firm. We believe that this area of research is promising and that true insights are still awaiting subsequent efforts in this area.
CHAPTER 3
R&D SEARCH UNDER AN ENVIRONMENTAL JOLT:
EVIDENCE FROM HIGH-TECH NEW VENTURES

Organizational search is a process through which organizations acquire information, construct alternatives, evaluate alternatives, and solve problems (Cyert & March, 1992; Knudsen & Levinthal, 2007; March & Simon, 1993). Research and development (R&D) search is a prototypical type of organizational search (Chen & Miller, 2007; Dosi, 1988; Greve, 2003a, 2003b); it involves the construction and evaluation of technology alternatives that enable organizations to create, deliver, and capture value in innovative ways (Chen & Miller, 2007; Eberhart, Maxwell, & Siddique, 2004; Simon, 1996; Song & Chen, in press). Given its importance, R&D search has been a major research topic in the literature (Chen, 2008; Chen & Miller, 2007; Gentry & Shen, 2013; Greve, 2003a; Lim & McCann, 2014). However, prior studies focus primarily on R&D search under normal situations, leaving R&D search under environmental jolts underexplored, especially from a behavioral perspective.\(^1\) This gap is surprising, because environmental jolts call for organizational adaptation, and organizational search is a major mechanism of organizational adaptation (Levinthal & March, 1981; Meyer, 1982).

\(^1\) The impacts of environmental jolts on other areas of strategic management have been extensively researched. Prior studies, for instance, have examined the impacts of environmental jolts on hospital operations and performance (Meyer, 1982), inter-organizational relationships (Park & Mezias, 2005; Venkataraman & Van de Ven, 1998), corporate acquisitions (Wan & Yiu, 2009), the emergence of entrepreneurial opportunities (Sine & David, 2003), and new venture survival (Bradley, Aldrich, Shepherd, & Wiklund, 2011), among others.
Environmental jolts are unexpected and transient environmental perturbations. They differ from tranquil situations, foreseeable trends, and irreversible shifts in two major ways (Meyer, 1982; Meyer, Gaba, & Colwell, 2005). First, unlike irreversible environmental shifts, environmental jolts are transient and will eventually subside (Meyer, 1982; Meyer et al., 2005; Wan & Yiu, 2009); therefore, their influences may also be transient. Second, unlike foreseeable environmental trends, environmental jolts are unexpected and disruptive (Meyer, 1982; Wan & Yiu, 2009). Environmental jolts cause sudden, unsettling environmental changes, which call for organizational adaptation but may also complicate the process of organizational adaptation (Levinthal & March, 1981; Meyer, 1982).²

As an environmental jolt, the 2008 financial crisis suddenly and temporarily reduced the level of environmental munificence and increased the level of environmental uncertainty (Kahle & Stulz, 2013; Wan & Yiu, 2009). It jolted organizational environments and surprised organizations. The 2008 financial crisis resulted in the 2009 global recession (Kose, Loungani, & Terrones, 2009, 2012) and had a huge impact on firm investment in 2009 (Bacchetta & Wincoop, 2013; Campello, Graham, & Harvey, 2010; Kahle & Stulz, 2013; Kose et al., 2012). Kahle and Stulz (2013) and Bacchetta and Wincoop (2013) suggest that firms experienced a severe jolt in 2009 and that the impact of the jolt subsided after 2009. Campello et al. (2010) find that, compared with

² The 2008 global financial crisis can be considered to be an environmental jolt to firms in the real sector; however, it may be regarded as an irreversible shift for financial firms (Lo, 2012).

In this study, we capitalize on the natural experiment of the 2008 financial crisis to examine R&D search under environmental jolts. We examine how environmental jolts affect R&D search behavior by influencing the impacts of situational factors and institutional factors on R&D search intensity. Specifically, we are interested in the following three questions in this study: (1) Do new ventures become more responsive to performance feedback under environmental jolts? (2) Do new ventures become more sensitive to distance from bankruptcy under environmental jolts? (3) Do environmental jolts affect institutionalized search?³

High-tech new ventures provide a desirable context for investigating R&D search under environmental jolts. Because new ventures are generally young and small, they are especially vulnerable to environmental jolts (Stinchcombe, 1965). When environmental jolts reduce environmental munificence and increase environmental uncertainty, new ventures are immediately, directly, and deeply impacted. Furthermore, new ventures are generally run by their owners and founders (Aldrich & Ruef, 2006). Consequently, resource allocation and decision making in new ventures are driven less by agency problems and political considerations than those in established firms (Bower, 1970; Fang et al., in press; Miller & Chen, 2004; Wasserman, 2006), providing a favorable context

³ Prior studies, for example, have pointed out that organizational learning from performance feedback is influenced by economic environments (Deephouse & Wiseman, 2000), environmental opportunities (Wiklund & Shepherd, 2003), and institutional environments (Wezel & Saka-Helmhout, 2006). However, the primary focus of those studies is not R&D search behavior under environmental jolts.
for examining the influences of situational factors and institutional factors on R&D search behavior.

This research attempts to link the R&D search literature to the environmental jolt literature in strategic management. With respect to R&D search behavior, prior studies have drawn on the behavioral theory of the firm to examine the roles of situational and institutional factors in firms’ R&D search behavior (Chen, 2008; Chen & Miller, 2007; Greve, 2003a, 2003b; Lim & McCann, 2014). We extend this literature to examine new ventures’ R&D search behavior under environmental jolts. Although the influences of environmental jolts on some areas of strategic management have been recognized by prior studies (Bradley et al., 2011; Meyer, 1982; Meyer, Brooks, & Goes, 1990; Park & Mezias, 2005; Wan & Yiu, 2009), to our best knowledge, no prior studies have examined R&D search under environmental jolts from a behavioral perspective.

By combining these two seemingly unconnected streams of research in strategic management, we make several contributions to the literature. First, we examine the impact of social aspiration (versus historical aspiration) on R&D search behavior under an environmental jolt. We find that environmental jolts make high-tech new ventures more responsive to social aspiration. Second, we consider the influence of the distance from bankruptcy on new ventures’ R&D search behavior as well as the impact of an environmental jolt on this relationship. We find that, under normal circumstances, the distance from bankruptcy has an inverted U-shaped relationship with R&D search intensity; under environmental jolts, this inverted U-shaped relationship has a higher peak and a stronger decline. Third, we explore the institutionalization of R&D search in new
ventures and the impact of an environmental jolt on institutionalized search. We find that environmental jolts strengthen, rather than weaken, the impact of an institutional factor on R&D search behavior. Our findings have implications not only for organizational search under environmental jolts but also for organizational learning from performance feedback.

**Hypotheses**

**Environmental Jolts**

Organizations function within environments, with which they exchange resources and information (Scott, 1998, p. 132). Environmental jolts suddenly and temporarily change the availability of resources and the level of uncertainty in organizational environments (Meyer, 1982; Meyer et al., 1990; Meyer et al., 2005). Meyer (1982, p. 515) defines environmental jolts as “transient perturbations whose occurrences are difficult to foresee and whose impacts on organizations are disruptive and potentially inimical.” Because of environmental jolts, the availability of resources changes, the demand for products and services shifts, and the level of uncertainty increases (Meyer, 1982; Meyer et al., 1990; Meyer et al., 2005).

The 2008 global financial crisis is an example of a severe environmental jolt and a good empirical context for studying the impact of environmental jolts on search behavior (cf. Kahle & Stulz, 2013; Wan & Yiu, 2009). The 2008 financial crisis first affected the financial sector. Through a negative financial shock and a negative demand shock, it then started to impact the real sector of the economy, causing an unexpected reduction in resource availability and a sudden increase in environmental uncertainty (Kahle & Stulz, 2013; Wan & Yiu, 2009).
The environmental jolt therefore greatly influenced corporate investment. Duchin, Ozbas, and Sensoy (2010) find that firms reduced their investments during the aftermath of the 2008 global financial crisis. In a survey of executives conducted in 2008, Campello et al. (2010) report that most firms planned to cut their R&D spending in 2009. Compared with established companies, new ventures were more vulnerable to the 2008 global financial crisis, and we expect new ventures to be more severely impacted by the environmental jolt.

Environmental jolts, however, do not figure prominently in prior studies on R&D search in the strategic management literature. As a core idea in the behavioral theory of the firm, imperfect environmental matching suggests the importance of organizational adaptation (Cyert & March, 1992, p. 215). Sudden and transient environmental perturbations call for organizational adaptation and can also complicate adaptation processes (Levinthal & March, 1981). However, very few studies have investigated how environmental jolts affect organizational search (see Sine & David, 2003 for an exception). We bridge this gap in strategic management by studying how environmental jolts affect situational search and institutionalized search.

Organizational Search

In explaining R&D search behavior, the behavioral theory of the firm begets two lineages (Chen & Miller, 2007). The first lineage, sometimes called situational search (Chen & Miller, 2007), emphasizes decisions and choices from a behavioral perspective (Chen & Miller, 2007; Cohen, 2007). It focuses on how organizations adapt to performance feedback and organizational slack (March, 1994). According to this lineage,
performance feedback drives organizational search. When performance falls below aspiration, organizations initiate “problemistic search” to reduce the gap between performance and aspiration. Organizational slack also drives organizational search. Organizational slack allows new ventures to relax control, encourage experimentation, and take risks (Cyert & March, 1992; March, 1994; March & Shapira, 1992). When organizations are not very close to bankruptcy, for example, they may have slack resources, which may allow them to carry out organizational search (Cyert & March, 1992; March, 1994; March & Shapira, 1992).

The second lineage, sometimes called institutionalized search (March, 1994, p. 33), emphasizes the role of institutional factors in R&D search (Chen & Miller, 2007; Helfat, 1994b; Nelson & Winter, 1982). It argues that organizational search can be institutionalized and that institutionalized search behavior is not very sensitive to situational factors (March, 1994; March & Simon, 1993). Institutionalized search is designed to look for problems and solutions (see also Nelson & Winter, 1982). Unlike situational search, institutionalized search “tends to be orderly, standardized, and somewhat independent of success or failure” (March, 1994, p. 30). Accordingly, this lineage generally recognizes the path-dependent, incrementally adaptive nature of R&D search behavior (Helfat, 1994b). It also recognizes that R&D search behavior is constrained by resource-allocation patterns and organizational structure (Greve, 2003b, p. 54).
Recent studies point out that both situational and institutional factors should be taken into account in explaining R&D search behavior (Chen & Miller, 2007). Both lineages share a common commitment to bounded rationality (March & Simon, 1993; Simon, 1997) and are consistent with the original emphasis of the behavioral theory of the firm on performance feedback, slack, and routines (Cyert & March, 1992; March, 1994; March & Simon, 1993; Simon, 1997). Combining insights from both lineages, we examine how environmental jolts moderate the impacts of situational and institutional factors on new ventures’ R&D search intensity (Bromiley, 2005; Chen & Miller, 2007; Cohen, 2007; March, 1994). The conceptual model of this study is displayed in figure 3.1.

**Performance Feedback**

Performance feedback, or attainment discrepancy, refers to the difference between a firm’s actual performance and its aspiration level (Greve, 2003b). Aspiration level...
reflects the minimally satisfactory level of performance (Greve, 2003b). “An aspiration level represents the smallest outcome that would be deemed satisfactory by the decision maker” (Schneider, 1992, p. 1053). Aspiration level is important to boundedly rational entities for assessing organizational performance. New ventures may compare actual performance with aspiration and learn from performance feedback to determine what they should do (Cyert & March, 1992; March, 1994). When actual performance level is lower than aspiration level, for example, new ventures may carry out organizational search to look for ways to improve organizational performance (Bromiley & Harris, 2014; Cyert & March, 1992; Gavetti et al., 2012; Greve, 2003b; Shinkle, 2012).

What determines aspiration level? Aspiration level is influenced by both historical performance and social comparison (Cyert & March, 1992; Greve, 2003b; Shinkle, 2012). Historical aspiration recognizes historical performance as a source of organizational aspiration, while social aspiration recognizes peer performance as another source of organizational aspiration (Greve, 2003b). Historical aspiration accounts for firm heterogeneity, while social aspiration can account for environmental changes in the evaluation of organizational performance (Greve, 2003b).

Performance is considered to be not good enough when it is lower than aspiration level (Cyert & March, 1992; Greve, 2003b; March, 1994; Simon, 1955); in this situation, attainment discrepancy (i.e., performance minus aspiration) is in the negative domain. Negative attainment discrepancy reveals pressing issues in new ventures, spurring them to take action to resolve problems, make changes, and restore performance (Cyert & March, 1992; Gavetti et al., 2012; Greve, 2003b). When performance is lower than
aspiration level, organizations are willing to engage in risky activities to improve performance (Kahneman & Tversky, 1979; March & Shapira, 1987). For example, new ventures may increase R&D search intensity to look for new product solutions with the aim of improving new venture performance (Greve, 2003a). R&D search is risky because new ventures can never be certain about whether their investments in this area will pay off (Lim & McCann, 2014; Nelson & Winter, 1982).

Performance is considered to be good enough when it is higher than aspiration level (Cyert & March, 1992; Greve, 2003b; March, 1994; Simon, 1955); in this situation, attainment discrepancy is in the positive domain. Although many prior studies have found that positive attainment discrepancy reduces search intensity in established firms (Greve, 2003b; Shinkle, 2012), some research has found that positive attainment discrepancy may actually increase the intensity of organizational search (Baum & Dahlin, 2007). Baum and Dahlin (2007) point out that high performance relative to aspiration enables organizations to accumulate slack resources and gain confidence, possibly resulting in a high level of organizational search (see also March, 2010, p. 89-91).

Following Baum and Dahlin (2007), we suggest that new ventures performing above aspiration will gain confidence in their capabilities and in their prospects, resulting in a high level of R&D search intensity. Unlike established firms, new ventures are still in the early stages of development, and performance feedback provides valuable signals to help them construct and evaluate technology alternatives. Favorable performance may help new ventures confirm that they have recognized a promising opportunity and are capable of exploiting that opportunity (Blank, 2013b, 2013a; Blank & Dorf, 2012; March,
2010). Positive attainment discrepancy allows new ventures to confirm that they can create, deliver, and capture value; they become more certain that “there are customers who will pay attractive prices for the firm’s products” (Christensen & Raynor, 2003, p. 251). They may also be confident that they are making progress in discovering and developing product solutions that fit the market (Blank, 2013a; March, 2010). Consequently, new ventures may increase R&D search intensity in order to perfect their product solutions and capitalize on their promising future.

Hypothesis 3.1. (a) Under normal circumstances, the more a new venture is below its aspiration level, the higher its R&D search intensity is; (b) Under normal circumstances, the more a new venture is above its aspiration level, the higher its R&D search intensity is.

Hypotheses 1a and 1b suggest that attainment discrepancy has a V-shaped relationship with R&D search intensity. That is, when performance is relatively low or relatively high compared with aspiration level, R&D search intensity is high. When performance is in the vicinity of aspiration level, however, R&D search intensity is low (cf. Baum & Dahlin, 2007). These hypotheses do not distinguish social aspiration from historical aspiration. Under environmental jolts, however, we expect that the impact of social aspiration will differ from that of historical aspiration.

Environmental jolts unexpectedly and substantially change organizational environments (Cyert & March, 1992; Greve, 2003b; March, 2010; Wezel & Saka-Helmhout, 2006). Because of the sudden change, environmental jolts reduce the relevance of historical aspiration (Dekker, Groot, & Schoute, 2012; Greve, 2003b).
Because of environmental jolts, new ventures may learn very little from attainment discrepancy for historical aspiration (i.e., actual performance minus historical aspiration). Accordingly, we would expect that the impact of attainment discrepancy for historical aspiration on R&D search intensity becomes negligible under environmental jolts.

Social aspiration, however, becomes increasingly valuable for new ventures to make sense of their performance under such circumstances (Dekker et al., 2012; Greve, 2003b). Because similar new ventures may experience similar environmental conditions, their contemporary performance will account for changes in environments (Dekker et al., 2012; Greve, 2003b). As a result, social aspiration helps reduce the ambiguity in making sense of a new venture’s performance under environmental jolts (Dekker et al., 2012). Environmental jolts therefore increase the value of social comparison, and new ventures become more attentive to attainment discrepancy for social aspiration (i.e., actual performance minus social aspiration). Accordingly, we hypothesize:

Hypothesis 3.2. New ventures are more responsive to attainment discrepancy for social aspiration under environmental jolts than under normal circumstances.

Distance from Bankruptcy

New ventures give careful consideration not only to performance feedback but also to mortality risks. In the early years of existence, new ventures face a very high

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4 The behavioral theory of the firm has offered different interpretations for social aspiration. It may refer either to the past performance of peer organizations or the contemporary performance of peer organizations (Cyert & March, 1992; Greve, 2003b). In most studies, both interpretations work just fine. In this study, however, we need to follow the latter interpretation, because environmental jolts reduce the relevance of past performance.
probability of mortality. As a result, they are constantly struggling for survival, attending to their mortality risks, and adjusting organizational actions accordingly (Aldrich & Auster, 1986; Stinchcombe, 1965).

The distance from bankruptcy reflects a new venture’s risk of business failure. A new venture may fail when its total assets are not enough to satisfy its debt claims (Aldrich & Ruef, 2006; Altman & Hotchkiss, 2006; March & Shapira, 1992). As total assets increase beyond debt claims, the distance from bankruptcy increases. Hence, the distance from bankruptcy reflects a new venture’s ability to keep its resource exchange in favorable balance and to remain as a going concern (Aldrich & Ruef, 2006). The greater the distance from bankruptcy is, the less likely the new venture will go bankrupt in the near future.

The distance from bankruptcy will significantly affect a new venture’s R&D search behavior. For new ventures, the struggle for survival is immediate and urgent, while the return to R&D search is distant and uncertain (March, 1991; March & Shapira, 1992). R&D search represents an investment that may pay off in the future, but new ventures that are not likely to survive may not invest in their future (March & Shapira, 1987, 1992). As new ventures get close to bankruptcy, they become concerned with their abilities to satisfy debt claims (March & Shapira, 1992); they focus their attention on keeping their ventures alive by cutting costs, decreasing investments, and tightening control (Hu, Blettner, & Bettis, 2011; March & Shapira, 1987, 1992; Staw et al., 1981). Consequently, as new ventures approach bankruptcy, R&D search intensity declines. But as new ventures move away from bankruptcy, total assets increase beyond debt claims,
allowing them to have slack resources. Slack resources enable new ventures to relax control, take risks, and carry out R&D search (Cyert & March, 1992; March, 1994).

However, there may not be a linear relationship between the distance from bankruptcy and risk taking. Sundaram and Yermack (2007, p. 1555) point out that the distance from bankruptcy is an indicator of risk and risk taking (see also Dezső & Ross, 2012; Gerakos, 2007). In fact, firms that are very far from bankruptcy may also be risk averse. It may be the aversion to risk that pushes some new ventures to take a more conservative approach, with limited risk taking, that keeps them far from bankruptcy (Francis, Hasan, & Sharma, 2011, p. 562-563). Such firms may refrain from engaging in risky activities such as R&D search (Kothari, Laguerre, & Leone, 2002; Lim & McCann, 2014). Therefore, new ventures with a very large distance from bankruptcy may also have low R&D search intensity.

Compare with new ventures that are either very close to or very distant from bankruptcy, new ventures with a moderate distance from bankruptcy may have a relatively high level of R&D search intensity. On the one hand, they are not so close to bankruptcy that they need to focus merely on survival; instead, they are not so concerned with survival and may have slack resources for R&D search. On the other hand, they may not be too risk averse; instead, they may be willing to take the risks inherent in R&D search. We therefore expect that there is an inverted U-shaped relationship between the distance from bankruptcy and R&D search intensity.

Hypothesis 3.3. Under normal circumstances, the distance from bankruptcy has an inverted U-shaped relationship with R&D search intensity.
Environmental jolts may cause new ventures to become more attentive to their distance from bankruptcy. The 2008 financial crisis made it more difficult for firms to access financial capital; it also reduced market demands and increased environmental uncertainty (Kahle & Stulz, 2013). The 2008 financial crisis made business failure a real concern, and we expect the distance from bankruptcy to have a stronger impact on R&D search intensity under environmental jolts.

We expect that the inverted U-shaped relationship between the distance from bankruptcy and R&D search intensity will have a higher peak and stronger right- and left-side declines under environmental jolts. When new ventures are very close to bankruptcy, they will be even less likely to take the risks inherent in R&D search during environmental jolts (Lim & McCann, 2014). Likewise, new ventures that are far from bankruptcy, because of their aversion to risk, will be even more risk averse during an environmental jolt. New ventures that are at a moderate distance from bankruptcy not only have enough resources to satisfy their debt claims but also have slack resources that may help them deal with the environmental jolt. The increased distance from bankruptcy gives new ventures a buffer against environmental jolts, which is of critical importance to R&D search in such circumstances.

There is another way to look at the interaction between the distance from bankruptcy and environmental jolts. Environmental jolts can be expected to have a direct, negative impact on R&D search intensity, and this negative relationship can be mitigated by the distance from bankruptcy. Because of the reasons discussed above, we expect that
this negative relationship is smallest at a moderate distance from bankruptcy. Therefore, we hypothesize:

Hypothesis 3.4. The inverted U-shaped relationship between distance from bankruptcy and R&D search intensity has a higher peak and stronger declines under environmental jolts than it does under normal circumstances.

Institutionalized Search

R&D search intensity can be driven not only by situational factors such as performance feedback and the distance from bankruptcy, but also by internal institutional factors (Chen & Miller, 2007; Greve, 2003b; March, 1994). Although the literature is clear about what situational factors are, it is less clear about what could be considered to be institutional factors that influence R&D search behavior. Greve (2008b, p. 187) suggests that institutionalized search is an intra-organizational process rather than an inter-organizational process. Therefore, institutionalized search should reflect the influence of internal institutional factors rather than that of external institutional pressure. In addition, R&D search is ultimately carried out by people (Jain, Triandis, & Weick, 2010), especially “highly trained scientists, engineers and other specialists” (Himmelberg & Petersen, 1994, p. 41); hence, “[i]ncreasing institutionalized search normally requires hiring additional workers” (Greve, 2003b, p. 54). Therefore, the share of R&D employment in total employment can be an important indicator of institutionalized search (Teirlinck, Dumont, & Spithoven, 2010).

Although some new ventures may perform informal R&D on an informal basis, institutionalized R&D search is generally performed by R&D employees on a regular
basis (Brouwer & Kleinknecht, 1999; Dosi, 1988; Kleinknecht, 1987). New ventures that have institutionalized R&D search tend to have dedicated R&D employees to carry out R&D search (Chen & Miller, 2007; Greve, 2003b; Greve, 2008b; March, 1994). We therefore argue that the extent to which R&D search is institutionalized in a new venture is reflected by the proportion of total employees that are devoted to R&D efforts. The larger the proportion of R&D employees to total employees is, the more institutionalized the process is (Greve, 2003b; Greve, 2008b) and the greater the R&D search intensity will be. We thus hypothesize:

Hypothesis 3.5. Under normal circumstances, as the ratio of R&D employees to total employees increases, R&D search intensity increases.

Under environmental jolts, new ventures without institutionalized R&D search may succumb to pressure and temporarily reduce their R&D search intensity (cf. Gentry & Shen, 2013). In these new ventures, people perform R&D search on a nonregular basis; R&D employees can therefore be reassigned to perform other duties or may even be laid off or terminated during environmental jolts.

Institutionalized search, however, is institutional in the sense that it is carried out in a regular, formal, and orderly manner (Greve, 2003b; March, 1994; March & Simon, 1993). Institutionalized search gives rise to adjustment costs, and new ventures with highly institutionalized R&D search may find it not worthwhile to adjust their levels of R&D search under transient environmental jolts (Helfat, 1994b; Himmelberg & Petersen, 1994). They may not want to lose their R&D employees, because these employees generally possess valuable firm-specific knowledge (Helfat, 1994a).
Therefore, the gap between new ventures with a high level of institutionalized search and those with a low level of institutionalized search widens under environmental jolts. Accordingly, we expect that institutional factors will have a larger impact on R&D search intensity under environmental jolts than under normal circumstances. We therefore hypothesize:

**Hypothesis 3.6.** The impact of an institutional factor, the share of R&D employment in total employment, on R&D search intensity is larger under environmental jolts than under normal circumstances.

**Method**

**Sample and Data**

We drew our research sample from the restricted-access data of the Kauffman Firm Survey (KFS). KFS is a panel study of 4,928 new ventures founded in the United States in 2004; KFS tracked the operations of the new ventures annually from 2004 to 2011. Because we are interested in R&D search behavior, we limited our study sample to new ventures designated by the KFS as firms in the high-tech industries (Chapple, Markusen, Schrock, Yamamoto, & Yu, 2004).

The KFS did not collect information about R&D expenditure until 2007; therefore our dependent variable draws on data from only the 2007–2011 surveys. But because there is a 1-year lag between the independent variables and the dependent variable, the independent variables draw on data from the 2006–2010 surveys. Each new venture in our sample can thus have, at most, 5 years of observations. Following prior studies, we excluded firms that have a R&D-to-sales ratio higher than 1 (Chen & Miller, 2007; Lim
& McCann, 2014) because these firms may exhibit a different pattern of R&D search behavior (Chen & Miller, 2007; Lim & McCann, 2014). We also eliminated new ventures with less than 2 years of observations because the panel model method we used requires at least two observations per firm in order to perform the analysis. We further eliminated new ventures with missing data on the studied variables. Our final sample comprised 907 firm-year observations for 235 high-tech new ventures.

Measures

*R&D Search Intensity*

R&D search intensity is calculated as the percentage of total sales revenue allocated to R&D expenditure (Chen, 2008; Chen & Miller, 2007; Greve, 2003b; Lim & McCann, 2014), multiplied by 100. R&D expenditure includes the costs of materials, equipment, facilities, personnel, and contract services that are related to R&D activities (Oliver, 2003).

*Environmental Jolt*

We use a dummy variable to indicate the environmental jolt caused by the 2008 financial crisis. The dummy variable equals 1 for observations with the dependent variable from calendar year 2009 and independent variables from calendar year 2008. The 2008 financial crisis resulted in the 2009 global recession (Kose et al., 2009, 2012)

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5 According to the Business Cycle Dating Committee of the National Bureau of Economic Research (NBER), the great recession began in December 2007 and ended in June 2009 (http://www.nber.org/cycles.html). However, the financial crisis first impacted the financial sector and then the real sector (Lo, 2012). It had the greatest impact on firms in the real sector during the calendar year 2009 (Bacchetta & Wincoop, 2013; Kahle & Stulz, 2013)
and had a huge impact on firm investment in 2009 (Bacchetta & Wincoop, 2013; Campello et al., 2010; Kahle & Stulz, 2013; Kose et al., 2012). Campello et al. (2010) find that, compared with technology expenditures in 2008, technology expenditures decreased in 2009. After year 2009, the impact of the environmental jolt subsided. Kahle and Stulz (2013) and Bacchetta and Wincoop (2013), for example, suggest that firms experienced a severe jolt in calendar year 2009 and that the impact of the jolt subsided after 2009. Accordingly, we expect the environmental jolt to have significant impact on new ventures’ R&D search behavior in calendar year 2009.

**Performance Feedback**

Performance feedback, or attainment discrepancy, is calculated as the difference between actual performance and aspiration level (Lant, 1992; Lewin et al., 1944). Bromiley and Harris (2014) compare many different performance measures and conclude that net income is an appropriate performance indicator in performance feedback research. We therefore use net income (in millions of dollars) as our performance measure in this study.

Aspiration level for net income refers to the level of net income that would be considered satisfactory by a new venture (Greve, 2003b; Shinkle, 2012). Bromiley and Harris (2014) compare different models of organizational aspiration and conclude that the separate model, which creates difference measures for historical and social aspirations, is an appropriate model. We therefore include two types of attainment discrepancy in our model: attainment discrepancy for historical aspiration, measured by a new venture’s performance minus its past performance, and attainment discrepancy for social aspiration,
measured by a new venture’s performance minus the contemporary average performance of comparable new ventures (Cyert & March, 1992; Greve, 2003b; Lewin et al., 1944). Historical aspiration is determined by the past performance of a new venture, referring to its performance in the previous year (Bromiley & Harris, 2014; Harris & Bromiley, 2007). Social aspiration is determined by the contemporary performance of comparable new ventures (Greve, 2003b), which are new ventures with the same age in the same industry, as defined by the 3-digit NAICS code (Bromiley & Harris, 2014). Prior studies have also shown that R&D search behavior may react to performance above aspiration level differently from performance below aspiration level and suggest the use of a spline specification (Chen & Miller, 2007; Greve, 2003a; Lim & McCann, 2014). Accordingly, our model includes four measures for performance feedback: negative attainment discrepancy for historical aspiration, positive attainment discrepancy for historical aspiration, negative attainment discrepancy for social aspiration, and positive attainment discrepancy for social aspiration, measured as follows:⁶

Negative attainment discrepancy for social aspiration_{t−1}

\[
= \begin{cases} 
    \text{Net income}_{t-1} - \text{Net income}_{t-2} & \text{if } \text{Net income}_{t-1} < \text{Net income}_{t-2} \\
    0 & \text{if } \text{Net income}_{t-1} \geq \text{Net income}_{t-2}
\end{cases}
\]

⁶ Although the influences of the past can trace back infinitely to the beginning of an organization, prior studies have shown that recent performance tends to have a stronger impact (Bromiley & Harris, 2014). Bromiley and Harris (2014, p. 353), especially, has pointed out that past performance can be operationalized by the most recent year’s performance, because “most firms do not pay much attention to the past beyond the previous year, and old plans, initiatives, and documents disappear quickly.”
Distance from Bankruptcy

A new venture’s distance from bankruptcy is measured by Dun & Bradstreet’s (D&B) financial stress score. The financial stress score predicts the risk of bankruptcy within the following 12 months. The lower the score is, the higher the risk of bankruptcy is. The D&B financial stress scores we use is a percentile score ranging from 1 (highest risk of bankruptcy) to 100 (lowest risk of bankruptcy). To allow for a curvilinear relationship between distance from bankruptcy and R&D intensity, we include a quadratic term for the distance from bankruptcy.

Institutionalized Search

Institutionalized search refers to the degree to which R&D search has been institutionalized by dedicating a significant portion of employees to perform R&D
activities in new ventures (Greve, 2003b; March, 1994). It is measure by the ratio of R&D employees to total employees, multiplied by 100.

*Control Variables*

We include several control variables: *Industry R&D intensity*, an external institutional factor that affects new ventures’ R&D search intensity (Chen & Miller, 2007), is measured as the average R&D search intensity of new ventures in an industry. *Financial slack*, an internal factor that allows new ventures to relax control, encourage experimentation, and increase R&D search intensity (Cyert & March, 1992; March, 1994), is measured by total cash holdings (Myers & Majluf, 1984), which is then divided by total expenses to account for the effect of organizational size (Voss et al., 2008). To limit the impact on our results of the unreasonably high cash holdings–expense ratios of some new ventures, we follow Robb and Watson (2012) and bound the ratio between 0 and 10. We then multiply the result by 100. We also include a quadratic term to allow for a possible curvilinear relationship (Nohria & Gulati, 1996). *Number of patents* and *Number of copyrights* are included as measures of a new venture’s technological

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7. Prior studies have recognized three major types of organizational slack: absorbed slack, unabsorbed slack, and potential slack (Bourgeois, 1981; Bourgeois & Singh, 1983; Greve, 2003a). The construction of these three measures requires detailed accounting data. Due to data limitations, we are unable to construct these measures and choose to include financial slack as a control variable.

8. According to Myers and Majluf (1984), a firm’s financial slack consists of the level of cash holding, the value of marketable securities, and the amount of default-risk-free debt. New ventures generally hold very little marketable securities. Furthermore, because of severe information asymmetry and fundamental uncertainty, new ventures are unable to issue default-risk-free debt. Therefore, the financial slack of new firms is mainly made up of cash holding.
resources and capabilities. *Firm size* is calculated as the natural logarithm of a new venture’s sales revenue. *New venture team size* is calculated as the number of owner-operators.

**Econometric Methods**

We adopt random-effects models to analyze the data. Empirically, the Hausman test is insignificant ($p > 0.05$), suggesting the appropriateness of the random-effects model. In addition, the random-effects model has a major advantage: it is “an example of marginal analysis or population-averaged analysis” (Cameron & Trivedi, 2005, p. 717) and thus allows us to draw inferences not for a particular firm but for the entire population of high-tech new ventures (Cameron & Trivedi, 2005, p. 717).

To test the impact of an environmental jolt on R&D search behavior, we interact the independent variables with a dummy variable indicating the environmental jolt caused by the 2008 financial crisis (Wooldridge, 2013). Similar methods have been used in prior studies (e.g., Bonfiglioli, 2008; Fleisher, Li, & Zhao, 2010; Tsoukas, 2011).

**Results**

**Simple Statistics and Correlation**

Table 3.1 displays the means and standard deviations of each variable. As table 3.1 shown, the R&D search intensity across firms and years is 3.53 percent; that is, high-tech new ventures on average spend 3.53 percent of sales revenue on R&D. It is lower than the average R&D intensity of publicly listed firms reported in prior studies (Chen & Miller, 2007; Lim & McCann, 2014).
### Table 3.1: Descriptive statistics for the panel data

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D search intensity, t</td>
<td>1.00</td>
<td>0.02</td>
<td>1.00</td>
<td>-0.01</td>
<td>0.06</td>
<td>1.00</td>
<td>0.01</td>
<td>0.63</td>
<td>-0.07</td>
<td>1.00</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Positive attainment discrepancy for historical aspiration, t</td>
<td>0.02</td>
<td>-0.03</td>
<td>-0.04</td>
<td>-0.01</td>
<td>0.01</td>
<td>1.00</td>
<td>0.26</td>
<td>-0.01</td>
<td>0.04</td>
<td>-0.03</td>
<td>-0.04</td>
<td>-0.01</td>
</tr>
<tr>
<td>Negative attainment discrepancy for historical aspiration, t</td>
<td>0.01</td>
<td>0.03</td>
<td>0.04</td>
<td>0.05</td>
<td>0.10</td>
<td>0.05</td>
<td>0.17</td>
<td>0.01</td>
<td>-0.03</td>
<td>0.15</td>
<td>0.10</td>
<td>0.01</td>
</tr>
<tr>
<td>Distance from bankruptcy, t</td>
<td>0.07</td>
<td>0.21</td>
<td>-0.16</td>
<td>0.21</td>
<td>-0.07</td>
<td>0.17</td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
<td>0.15</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>R&amp;D employment, t</td>
<td>0.07</td>
<td>0.21</td>
<td>-0.16</td>
<td>0.21</td>
<td>-0.07</td>
<td>0.17</td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
<td>0.15</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Industry R&amp;D intensity, t</td>
<td>0.26</td>
<td>-0.01</td>
<td>0.04</td>
<td>-0.03</td>
<td>-0.04</td>
<td>-0.01</td>
<td>1.00</td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cash holdings, t</td>
<td>0.26</td>
<td>0.21</td>
<td>-0.21</td>
<td>0.27</td>
<td>-0.07</td>
<td>0.20</td>
<td>0.09</td>
<td>0.04</td>
<td>-0.10</td>
<td>0.01</td>
<td>0.29</td>
<td>1.00</td>
</tr>
<tr>
<td>Firm size, t</td>
<td>3.53</td>
<td>0.05</td>
<td>-0.04</td>
<td>0.11</td>
<td>-0.05</td>
<td>43.62</td>
<td>11.94</td>
<td>11.94</td>
<td>4.34</td>
<td>11.94</td>
<td>38.34</td>
<td>4.34</td>
</tr>
</tbody>
</table>

**Notes:** n = 907. Correlations with absolute value greater than 0.06 are significant at the 0.05 level (one-tailed test).
Table 3.1 also shows that high-tech new ventures on average have 11.94 percent of their employees performing R&D activities. The average financial stress score is 43.62 in high-tech new ventures across firms and years, indicating that a typical high-tech new venture belongs to the financial stress class 3 (moderate risk of financial stress), as defined by D&B.

As table 3.1 also shows, high-tech new ventures on average have cash holdings of 42.18 percent of total expenses; that is, a typical high-tech new venture has sufficient cash on hand to meet operating expenses for 154 days (i.e., 42.18% * 365 = 154) even if it does not generate new income.

Table 3.1 also shows that the average logged sales revenues across firms and years is 11.09 and that the average size of the new venture team across firms and years is 1.68, further confirming that these high-tech new ventures are still in the early stages of development.

Hypothesis Testing

We use the random-effects models to test out hypotheses. Table 3.2 shows the results of the random-effects models. In table 3.2, Model 1 includes only control variables. Model 2 includes all studied variables. We use Model 2 to test all hypotheses.

The Hausman tests for neither Model 1 nor Model 2 is significant ($p > 0.05$), confirming the appropriateness of the random-effects models. Because all hypotheses are directional, we use one-tailed tests.
Table 3.2. Random-effects regressions for R&D search intensity

<table>
<thead>
<tr>
<th></th>
<th>R&amp;D search intensity$_t$</th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Estimate</td>
<td>(Standard Error)</td>
<td>Estimate</td>
<td>(Standard Error)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.3515**</td>
<td>-5.9714***</td>
<td>(1.5132)</td>
<td>(1.8474)</td>
<td></td>
</tr>
<tr>
<td>Industry R&amp;D intensity$_{t-1}$</td>
<td>1.0738***</td>
<td>1.0398***</td>
<td>(0.1931)</td>
<td>(0.1999)</td>
<td></td>
</tr>
<tr>
<td>Cash holdings$_{t-1}$</td>
<td>-0.0021</td>
<td>0.0004</td>
<td>(0.0083)</td>
<td>(0.0082)</td>
<td></td>
</tr>
<tr>
<td>Cash holdings squared$_{t-1}$</td>
<td>0.0000</td>
<td>0.0000</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td></td>
</tr>
<tr>
<td>Patents$_{t-1}$</td>
<td>0.4362</td>
<td>0.4012</td>
<td>(0.3642)</td>
<td>(0.3615)</td>
<td></td>
</tr>
<tr>
<td>Copyrights$_{t-1}$</td>
<td>-0.0049</td>
<td>-0.0132</td>
<td>(0.0231)</td>
<td>(0.0229)</td>
<td></td>
</tr>
<tr>
<td>Firm size$_{t-1}$</td>
<td>0.0155</td>
<td>0.0783</td>
<td>(0.1039)</td>
<td>(0.1041)</td>
<td></td>
</tr>
<tr>
<td>New venture team size$_{t-1}$</td>
<td>1.5387***</td>
<td>1.6679***</td>
<td>(0.3091)</td>
<td>(0.3309)</td>
<td></td>
</tr>
<tr>
<td>Positive attainment discrepancy for historical aspiration$_{t-1}$</td>
<td>-1.3172</td>
<td>(2.6659)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative attainment discrepancy for historical aspiration$_{t-1}$</td>
<td>2.0588</td>
<td>(2.8171)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive attainment discrepancy for social aspiration$_{t-1}$</td>
<td>-1.1743</td>
<td>(2.0363)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative attainment discrepancy for social aspiration$_{t-1}$</td>
<td>-0.1912</td>
<td>(2.7701)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from bankruptcy$_{t-1}$</td>
<td>0.1000**</td>
<td>(0.0595)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from bankruptcy squared$_{t-1}$</td>
<td>-0.0014**</td>
<td>(0.0007)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of R&amp;D employment$_{t-1}$</td>
<td>0.0786***</td>
<td>(0.0219)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental jolt</td>
<td>-5.1982**</td>
<td>(2.2466)</td>
<td></td>
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</tr>
</tbody>
</table>

table continued
Table 3.2. Continued.

<table>
<thead>
<tr>
<th></th>
<th>R&amp;D search intensity, ( t )</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td></td>
<td>Estimate (Standard Error)</td>
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<tr>
<td>Environmental jolt ×</td>
<td>-11.9172</td>
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<tr>
<td>Positive attainment discrepancy for</td>
<td>(9.9992)</td>
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<tr>
<td>historical aspiration, ( t-1 )</td>
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<tr>
<td>Environmental jolt ×</td>
<td>3.4735</td>
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<tr>
<td>Negative attainment discrepancy for</td>
<td>(4.0173)</td>
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<tr>
<td>historical aspiration, ( t-1 )</td>
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<tr>
<td>Environmental jolt ×</td>
<td>4.5899**</td>
</tr>
<tr>
<td>Positive attainment discrepancy for</td>
<td>(2.5522)</td>
</tr>
<tr>
<td>social aspiration, ( t-1 )</td>
<td></td>
</tr>
<tr>
<td>Environmental jolt ×</td>
<td>-18.3032***</td>
</tr>
<tr>
<td>Negative attainment discrepancy for</td>
<td>(6.9177)</td>
</tr>
<tr>
<td>social aspiration, ( t-1 )</td>
<td></td>
</tr>
<tr>
<td>Environmental jolt ×</td>
<td>0.2690***</td>
</tr>
<tr>
<td>Distance from bankruptcy, ( t-1 )</td>
<td>(0.1129)</td>
</tr>
<tr>
<td>Environmental jolt ×</td>
<td>-0.0032***</td>
</tr>
<tr>
<td>Distance from bankruptcy squared, ( t-1 )</td>
<td>(0.0013)</td>
</tr>
<tr>
<td>Environmental jolt ×</td>
<td>0.0689*</td>
</tr>
<tr>
<td>Share of R&amp;D employment, ( t-1 )</td>
<td>(0.0461)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Observations</th>
<th>907</th>
<th>907</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance Component for Cross Sections</td>
<td>43.3166</td>
<td>43.5203</td>
</tr>
<tr>
<td>Variance Component for Error</td>
<td>71.1480</td>
<td>69.9097</td>
</tr>
<tr>
<td>R-Square</td>
<td>0.0644</td>
<td>0.1104</td>
</tr>
</tbody>
</table>

Notes:
* \( p < 0.10 \) (one-tailed test)
** \( p < 0.05 \) (one-tailed test)
*** \( p < 0.01 \) (one-tailed test)
Hypotheses 3.1a and 3.1b suggest that attainment discrepancy has a V-shaped relationship with R&D search intensity under normal circumstances. The results show that none of the four measures of performance feedback has a significant relationship with R&D search intensity under normal circumstances ($p > 0.10$). The results suggest that high-tech new ventures’ R&D search intensity is not sensitive to performance feedback under normal circumstances.

Hypothesis 3.2 suggests that the impact of attainment discrepancy for social aspiration on R&D search intensity is larger under environmental jolts than under normal circumstances. The results show that environmental jolt moderates the relationship between negative attainment discrepancy for social aspiration and R&D search intensity ($\beta = -18.3032, p < 0.01$), indicating that, as performance falls below social aspiration by 1 million dollars, R&D search intensity increases by 18.3032 percentage points under the environmental jolt. Environmental jolt also moderates the relationship between positive attainment discrepancy for social aspiration and R&D search intensity ($\beta = 4.5899, p < 0.05$), indicating that, as performance exceeds social aspiration by 1 million dollars, R&D search intensity increases by 4.5899 percentage points under environmental jolt.

Combining the results for Hypotheses 3.1a, 3.1b, and 3.2, we find that, under normal circumstances, the relationships between attainment discrepancy for social aspiration and R&D search intensity are insignificant. Under environmental jolts, however, the relationships become significant. In other words, the V-shaped relationship between attainment discrepancy and R&D search only exists under environmental jolts. Therefore, high-tech new ventures are more responsive to attainment discrepancy for
social aspiration under environmental jolts than under normal circumstances. The results also suggest that, under environmental jolts, new ventures are more responsive to social aspiration than historical aspiration. Overall, the empirical evidence is consistent with the prediction of Hypothesis 3.2.

Hypothesis 3.3 posits that, under normal circumstances, the distance from bankruptcy has an inverted U-shaped relationship with R&D search intensity. The results show that the linear term is positive and significant ($\beta = 0.1000, p < 0.05$) and that the quadratic term is negative and significant ($\beta = -0.0014, p < 0.05$), supporting this Hypothesis 3.3. The turning point for the inverted U-shaped relationship is 36. When the distance from bankruptcy is lower than 36, an increase in the distance from bankruptcy corresponds to an increase in R&D search intensity. When the distance from bankruptcy is higher than 36, an increase in the distance from bankruptcy corresponds to a decrease in R&D search intensity.

Hypothesis 3.4 predicts that the inverted U-shaped relationship between the distance from bankruptcy and R&D search intensity has a higher peak and a stronger decline under environmental jolts than under normal circumstances. Consistent with this prediction, the results show that the linear interaction term is positive and significant ($\beta = 0.2690, p < 0.01$) and that the quadratic interaction term is negative and significant ($\beta = -0.0032, p < 0.01$). Combining the results for Hypotheses 3.3 and 3.4, we find that the turning point for the inverted U-shaped relationship is 40; the U-shaped relationship also has a higher peak and a stronger decline under environmental jolts. The results are displayed in figure 3.2.
Hypothesis 3.5 predicts that, under normal circumstances, as the ratio of R&D employees to total employees increases, R&D search intensity increases. The result shows that, under normal circumstances, this relationship is positive and significant ($\beta = 0.0786$, $p < 0.01$); a one-percentage-point increase in the proportion of total employees that are devoted to R&D efforts corresponds to a 0.0786-percentage-point increase in R&D search intensity.

Hypothesis 3.6 predicts that the proportion of total employees devoted to R&D efforts has a larger impact on R&D search intensity under environmental jolts than under normal circumstances. The results show that this interaction is positive and marginally
significant ($\beta = 0.0689, p < 0.10$), providing some support for Hypothesis 3.6. Under environmental jolts, a one-percentage-point increase in the proportion of total employees devoted to R&D efforts corresponds to a 0.1475-percentage-point increase in R&D search intensity.

**Discussion**

Organizational Search under Environmental Jolts

Prior research has examined organizational search under normal circumstances (Chen, 2008; Chen & Miller, 2007; Greve, 2003a, 2003b; Lim & McCann, 2014; Shinkle, 2012). Although the literature has long recognized that environmental changes can complicate organizational search (e.g., Levinthal & March, 1981), few studies have pursued further examination of this insight, and no prior studies have examined R&D search under environmental jolts. In this study, we address this gap and endeavor to link the R&D search literature to the environmental jolt literature.

Environmental jolts change the relationships between R&D search drivers and R&D search intensity. First, environmental jolts fundamentally change organizational environments, rendering historical aspiration useless in guiding new ventures’ interpretations of past performance. Environmental jolts, however, make high-tech new ventures more responsive to social aspiration. This finding is consistent with Greve’s observation that “rapid changes in the environment make the history of the focal organization less diagnostic for judging its performance than the contemporary performance of comparable organizations” (2003, p. 47).
Second, new ventures’ R&D search behavior becomes more sensitive to the distance from bankruptcy under environmental jolts. The behavioral theory of the firm recognizes that new ventures, like other organizations, are boundedly rational (March & Simon, 1993; Simon, 1997). They can be influenced by “animal spirits,” and fear may trump hope under environmental jolts (Akerlof & Shiller, 2009; Lopes, 1987). As new ventures become increasingly fearful of bankruptcy under environmental jolts, they pay more attention to their distance from bankruptcy (March & Shapira, 1987, 1992). Therefore, the impact of the distance from bankruptcy on new ventures’ R&D search intensity is larger under environmental jolts than under normal circumstances.

Third, environmental jolts strengthen, rather than weaken, the impact of institutional factors on R&D search behavior. Internal institutional factors reflect persistent organizational differences among new ventures, and these differences may be amplified by environmental jolts (Meyer, 1982); extreme situations will reveal persistent differences among organizations (Kates, Colten, Laska, & Leatherman, 2006; Meyer, 1982).

In sum, our results show that environmental jolts make new ventures more sensitive to social aspiration and to the distance from bankruptcy. We also find that environmental jolts may strengthen, rather than weaken, the impact of institutional factors on R&D search behavior.

**Toward a Theory of New Venture Search**

What drives new ventures to carry out organizational search? Drawing on prior studies on organizational search in established firms, we argue that new ventures’ R&D
search is driven by both situational and institutional factors (Chen & Miller, 2007; Greve, 2003b; March, 1994). Chen and Miller (2007) suggest that institutional factors tend to dominate situational factors as drivers of R&D search in publicly listed firms. Our study, however, seems to suggest that situational factors may be of critical importance to new ventures that are still in the early stages of institutionalization and development.

Following prior studies, we include an internal institutional factor (i.e., the proportion of total employees devoted to R&D efforts) and an external institutional factor (i.e., the industry-average R&D search intensity) in our model (Chen & Miller, 2007; Greve, 2003b). We find that they both influence R&D search intensity in new ventures. But we do not find that these institutional factors dominate situational factors as drivers of R&D search in new ventures.

Situational factors play important roles in new ventures’ R&D search for a couple of major reasons. First, new ventures in our sample are still in the early stages of institutionalization and development (Aldrich & Ruef, 2006), and thus institutional elements have simply not yet evolved as far as they have in established firms. Second, we focus on new ventures under environmental jolts, which may increase the importance of situational factors. Environmental jolts have immediate and direct impacts on new ventures, necessitating attention to situational factors to respond accordingly.

Although prior studies have documented factors that may influence R&D search behaviors, we believe that the importance of these factors may vary according to organizations and environments. We hope this study serves as a reminder of the importance and promise of explicitly studying such differences.
Limitations and Future Research Directions

In this study, we focused specifically on new ventures’ R&D search. However, we believe that a complete model of organizational search is still awaiting subsequent efforts to simultaneously model different types of organizational search. Second, we examine search behavior under only one environmental jolt; future research should further explore organizational search under other types of environmental jolts. Third, we argue that new venture search may be driven by factors that are different from those that drive organizational search in established firms. However, we do not include established firms in our study sample and thus were unable to make any direct comparisons. Future research should explicitly compare organizational search in new ventures with organizational search in established firms.

Conclusion

What drives new ventures to increase or decrease R&D search intensity under environmental jolts? Drawing on the behavioral theory of the firm, we show that R&D search is driven by situational factors and institutional factors. We find that environmental jolts make new ventures’ R&D search behavior more sensitive to social aspiration and the distance from bankruptcy. We also find that the impact of an internal institutional factor, the proportion of total employees devoted to R&D efforts, increases under environmental jolts. This study extends previous research on R&D search behavior by examining high-tech new ventures’ R&D search under environmental jolts. Prior studies have focused mainly on organizational search under normal situations, but we believe that studying R&D search under environmental jolts can lead to a deeper
understanding of R&D search under different environmental conditions. Furthermore, prior studies on organizational search focus primarily on established firms, but we believe that it is extremely beneficial to study organizational search in new ventures because organizational search is a core organizational process in such firms. The behavioral theory of the firm can undoubtedly provide insights into the search processes in new ventures. More importantly, research on organizational search in new ventures has the potential to significantly advance our understanding of organizational search and organizational adaptation. We believe that there are a lot of exciting opportunities for future research to make significant contributions to our understanding of organizational search in new ventures.
CHAPTER 4

THE BENEFITS OF UNBALANCED SEARCH IN NEW VENTURES

Organizational search is a process for constructing, evaluating, and improving alternatives (Cyert & March, 1963; Knudsen & Levinthal, 2007; March & Simon, 1993). Organizational search has a critically important role in new ventures, because new ventures generally lack well-established courses of action and need to search for alternatives that may work (Curley & Formica, 2013; Stinchcombe, 1965). New ventures carry out organizational search in the technology domain and in the market domain (Blank, 2013b, 2013a; Blank & Dorf, 2012). Technological search helps new ventures design product solutions that satisfy customer needs (Katila & Ahuja, 2002; Zhang & Li, 2010), while market search helps new ventures understand what customers need and how to attract and retain customers (Day, 1994; Gruber, MacMillan, & Thompson, 2008; Spanjol, Qualls, & Rosa, 2011; Vissa et al., 2010). Technological search and market search complement each other, but they may also compete for the limited resources that new ventures have (Bower, 1970; March, 1991). So, how should new ventures allocate resources to these two types of organizational search?

Prior research suggests that there are two major approaches that new ventures can take to allocating resources to organizational search. The first, sometimes referred to as the ambidextrous approach, suggests that technological search and market search are of similar importance and resources should be allocated to both (Zuzul & Edmondson, 2014). Ambidexterity allows new ventures to enjoy the benefits of synergy and
complementarity, but it may also result in competition for limited organizational resources and attention (Gupta, Smith, & Shalley, 2006; He & Wong, 2004; March, 1991; O'Reilly & Tushman, 2013; Raisch & Birkinshaw, 2008; Raisch, Birkinshaw, Probst, & Tushman, 2009). The second approach, referred to as the focus approach, suggests that new ventures are resource constrained and thus should focus on either technological search or market search (Ambos & Birkinshaw, 2010). Focus allows new ventures to emphasize and concentrate resources on the area of focus, contributing to improved coordination and superior performance (Comment & Jarrell, 1995; Drucker, 1985; Haunschild & Sullivan, 2002; Huckman & Zinner, 2008; Isaacson, 2012; McDermott & Stock, 2011; Porter, 1980; Siggelkow, 2003; Skinner, 1974; Tsikriktsis, 2007).

Building on prior research, this study argues that a third approach, referred to as the unbalanced approach, may work better for new ventures. In this approach, new ventures emphasize one type of search but do not completely ignore the other type (see also McDermott & Stock, 2011). Combining insights from both the ambidextrous and focus approaches, the unbalanced approach recognizes the importance of both synergy and focus. At the same time, the unbalanced approach recognizes that resource constraints do not allow for equal allocation of resources to both types of search and that areas that are not the focus of the new venture should not be ignored. Drawing insights from both the ambidextrous and focus approaches, the unbalanced approach takes into account the benefit of ambidexterity and the need for focus in new ventures.

In this study, we examine how unbalanced search impacts new venture performance. We recognize that organizational search may affect not only performance
level but also performance variability (He & Wong, 2004; March, 1991), which may result in heteroskedasticity (Greene, 2012; Wooldridge, 2013). Many prior studies predominantly consider the impact of search on performance level, neglecting its impact on performance variability. We use the multiplicative heteroskedasticity model (Harvey, 1976) as our econometric framework and model the impacts of unbalanced search on both performance level and performance variability in a single model. The results support our hypotheses that unbalanced search increases both performance level and performance variability.

We make several unique contributions to the organizational search literature and entrepreneurship literature. First, we identify organizational search as a core process in new ventures and examine the impacts of organizational search on new venture performance. The lean startup literature has suggested that, unlike established businesses that are mostly concerned with the implementation of well-established alternatives, new ventures are primarily concerned with the search for feasible alternatives (Blank, 2013a). However, this literature is mostly practice oriented and lacks a solid theoretical foundation. In this study, we demonstrate the value of drawing on the organizational search literature to examine the search process in new ventures, opening up many new directions for future research. Second, we acknowledge that there are different ways to allocate resources to organizational search and argue for the benefits of an unbalanced approach to organizational search. The unbalanced approach takes into account the promise of synergy and complementarity as well as the need for focus. Third, we recognize the impact of organizational search on both performance level and performance variability.
variability. Prior studies have documented ways to increase either performance level or performance variability, but few have documented ways to increase both. Overall, we believe that this study will contribute to our understanding of organizational search in new ventures.

**Hypotheses**

**Organizational Search in New Ventures**

Although organizational search is a core process in new ventures (Blank, 2013a), prior research in this area has centered mostly on established firms. In established firms, organizational search is primarily problem driven; it is triggered by the identification of organizational problems and suppressed by the resolution of problems (Cyert & March, 1963; Gavetti et al., 2012; Greve, 2003b). However, organizational search in new ventures may be quite different. Lacking well-established strategies, structures, processes, products, and customer relationships (Aldrich & Ruef, 2006; Stinchcombe, 1965), new ventures may need to constantly engage in organizational search to discover and evaluate possible alternatives (Blank, 2013b, 2013a; Blank & Dorf, 2012; Ries, 2011). The need to discover and evaluate alternatives is driven less by the identification of problems than by the nature of establishing a new business (McGrath, 2010).

In order to establish their businesses, new ventures need to experiment with different market needs and product solutions. New ventures need to constantly search for ways to understand and define what the market may need and design potential solutions to satisfy those needs (Blank, 2013b, 2013a; Blank & Dorf, 2012; Ries, 2011). When a new venture has discovered an important customer need and designed a feasible product
solution to satisfy that need, it has reached an important stage of product-market fit (Blank & Dorf, 2012; Ries, 2011; Ruekert & Walker, 1987).

The search for product-market fit is not a one-off event but a continuous effort (McGrath, 2010; Ries, 2011), the success of which rests upon the product, the market, and the fit between the two. In the process of finding such a fit, new ventures need to continuously explore different alternatives and look for fit and synergy between them (McGrath, 2010). It is difficult to precisely measure product-market fit, but sales revenue is one good indicator (Ries, 2011). If a new venture has found a feasible product that fits a large market, its sales revenue will generally be high and increasing (Ries, 2011).

Technological Search and Market Search

Both technological search and market search are of critical importance to new ventures when they are trying to find product-market fit. Technological search helps new ventures understand their technological environments and create technological solutions (Chen & Miller, 2007; Greve, 2003a; Vissa et al., 2010). In the early years of new ventures, technological search is directed toward the search for a feasible product solution that may fit the market (Blank & Dorf, 2012; Chen & Miller, 2007; Greve, 2003a), making it essential on the product side of a product-market fit.

Market search helps new ventures understand market environments and design effective marketing activities (Day, 1994; Dougherty, 1990, 1992; Gruber et al., 2008; Spanjol et al., 2011; Vissa et al., 2010). New ventures generally lack well-established customer relationships (Stinchcombe, 1965), and they therefore need to search for ways to understand, attract, and retain customers (Christopher, Payne, & Ballantyne, 2002;

The Combined and Unbalanced Dimensions

What are the interrelationships between technological search and market search? Does market search influence the effectiveness of technological search and vice versa? In this study, we draw on the organizational ambidexterity literature to explore these questions.

The organizational ambidexterity literature suggests that there are two dimensions to consider: the combined dimension and the unbalanced dimension (Cao, Gedajlovic, & Zhang, 2009; He & Wong, 2004). The combined dimension is concerned with the combined magnitude of technological search and market search (Cao et al., 2009; He & Wong, 2004). The unbalanced dimension is concerned with the relative imbalance between the two types of organizational search (Cao et al., 2009; He & Wong, 2004).

Combined Dimension

Is the combined dimension positively associated with the level of new venture performance? We contend that the answer is probably yes. The combined dimension recognizes the synergy between technological search and market search (Song, Droge, Hanvanich, & Calantone, 2005), implying that they are complementary and that new ventures should invest resources in both types of search. Achieving a product-market fit is more about finding a fit than about finding the best product or the largest untapped
market and may rest upon the synergy and complementary between technological search and market search (Song et al., 2005; Tian, Wang, Chen, & Johansson, 2010).

As the combined dimension increases, the possibility of achieving a product-market fit increases. On the one hand, market search increases the effectiveness of technological search (Cao et al., 2009; Song et al., 2005). Technological search helps new ventures explore different product solutions; however, the impact of technological search on new venture performance rests not only on the superiority of the product design but also on its acceptance in the market (Song et al., 2005). Market search identifies attractive market opportunities and directs technological search to solve important customer problems, thus reducing the risks of developing a solution that has no market (Day, 1994; Dougherty, 1990, 1992; Gatignon & Xuereb, 1997; Han, Namwoon, & Srivastava, 1998; Song, Wang, & Parry, 2010). After a technological solution for an important customer problem has been developed, market search also helps new ventures find ways to communicate with potential customers to persuade them to try and adopt new solutions (Blank & Dorf, 2012; Day, 1994). Market search therefore increases the effectiveness of technological search by identifying fruitful directions for search and by enhancing the acceptance of the technological solution.

On the other hand, technological search increases the effectiveness of market search (Cao et al., 2009). Technological search informs market search of technology solutions that a new venture may have, and thus market search can become more directed and focused. There are so many possible customer problems that new ventures may not know which one to focus on without first having some ideas about possible solutions.
(Cohen, March, & Olsen, 1972). If a new venture has a good understanding of some technologies, the search for market opportunities can be more directed, focused, and effective. Therefore, there is synergy between technological search and market search, as one can inform the other of the promising direction of search (Song et al., 2005). We thus hypothesize:

Hypothesis 4.1. As the combined magnitude of technological search and market search increases, the level of new venture performance increases.

A defining characteristic of search is the uncertainty in its results (March, 1991; Nelson & Winter, 1982). The processes of discovering customer needs and designing product solutions are inherently uncertain and fraught with wrong turns and dead ends (McGrath, 2010; Ries, 2011). Therefore, the search for alternatives will affect performance variability (March, 1991). The higher the combined magnitude of organizational search is, the more uncertain the result may be, and thus the larger the performance variability may be (March, 2010). The combined dimension is associated with performance variability because a high combined magnitude of organizational search means that a lot of organizational resources are invested in organizational search; if the return to organizational search is uncertain, then a large combine magnitude is associated with a large variance in outcomes (He & Wong, 2004).

The value of the combined dimension is predicated on the synergy between technological search and market search; however, the formation and exploitation of such synergy is uncertain (Dougherty, 1992; Goold & Campbell, 1998). The pursuit of synergy can break down either because the potential for synergy does not exist (Goold &
Campbell, 1998) or because firms fail to realize the potential for synergy (Dougherty, 1992). Technological search and market search are very different activities, and the extent to which synergy can be achieved rests on the effectiveness of one informing the other. If one does not have the potential to inform the other, then synergy does not exist (Goold & Campbell, 1998). Even if the potential for synergy exists, new ventures can still fail to coordinate technological search and market search and thereby fail to realize that potential (Dougherty, 1992; Larsson & Finkelstein, 1999; Lawrence & Lorsch, 1967). As the combined dimension increases, therefore, uncertainty in return increases and the variability of new venture performance increases. We thus hypothesize:

Hypothesis 4.2. As the combined magnitude of technological search and market search increases, the variance of new venture performance increases.

Unbalanced Dimension

Do new ventures need to match the magnitude of technological search to the magnitude of market search? We contend that the answer is probably no, because doing so may result in the loss of focus. The unbalanced dimension is concerned with the relative magnitude of technological search and market search (Cao et al., 2009; He & Wong, 2004). The degree to which search is unbalanced is reflected in the absolute difference between the two types of search (Cao et al., 2009; He & Wong, 2004).

The unbalanced dimension recognizes the importance of focus, and focus is conductive to new venture performance, for two major reasons. First, the benefits of focus can result from the concentration of resources (McDermott & Stock, 2011). Most new ventures are resource-constrained. If resource-constrained new ventures concentrate
resources on a specific area, such as technological search or market search, the chosen area may still have sufficient resources to achieve excellence (Ambos & Birkinshaw, 2010). Technological search and market search are competing for the limited resources that new ventures may have, and new ventures that focus on one of them are better able to achieve excellence in the chosen area of search (Ambos & Birkinshaw, 2010; Huckman & Zinner, 2008; McDermott & Stock, 2011).

Second, the benefits of focus can result from the clarity of emphasis (McDermott & Stock, 2011). Even if new ventures are not limited by organizational resources, focus allows new ventures to be attentive to a specific area and thus configure strategies, structures, and processes to better serve that area (McDermott & Stock, 2011). Such clarity of emphasis can help achieve coordination and integration in new ventures, contributing to a higher level of new venture performance (Lawrence & Lorsch, 1967; McDermott & Stock, 2011; Skinner, 1974). We therefore hypothesize:

Hypothesis 4.3. As the unbalanced dimension increases, the level of new venture performance increases.

Although resource concentration and emphasis may increase new venture performance, they may also increase performance variability. When new ventures focus predominantly on one area of organizational search, they may achieve excellence in that area, but they may also receive no return at all from such efforts. Thus, focusing on one type of search is risky for new ventures. If a new venture prioritizes technological search, for example, the new venture could develop a technologically exceptional product; however, such focus may also increase the chance of developing a product that nobody
wants (Dougherty, 1990, 1992; Ries, 2011). New ventures can invest substantial time and resources in technological search and eventually figure out that, although their product is technologically superior, it does not fit market needs (Dougherty, 1990, 1992; Ries, 2011).

On the other hand, if a new venture focuses exclusively on market search, they could discover potentially lucrative market opportunities and develop potentially attractive marketing strategies. However, they may also end up discovering a market opportunity or developing a marketing strategy that cannot be supported by their technological capabilities (DeSarbo, Di Benedetto, Song, & Sinha, 2005; Han et al., 1998; Miles & Snow, 1978; Zuzul & Edmondson, 2014).

The unbalanced dimension is, therefore, associated with high uncertainty in potential returns and with large variability in new venture performance. We therefore hypothesize:

Hypothesis 4.4. As the unbalanced dimension increases, the variance of new venture performance increases.

The conceptual model of this study is displayed in figure 4.1. New ventures following the unbalanced approach to organizational search take into account both the combined dimension and the unbalanced dimension. As figure 4.1 shows, unbalanced search is associated with high performance level and high performance variability.
It is important to note that variability is not necessarily bad for new ventures, although high variability is doubtless associated with high level of risk. The benefit of an increase in performance level is obvious, but the benefit of an increase in performance variability may not be as apparent (March, 1991). In his seminal contribution, March (1991) convincingly demonstrates the benefits of both performance level and performance variability. He points out that “increases in either the mean or the variance have a positive effect on competitive advantage” (March, 1991, p. 83). He also points out that, as the number of competitors increases, the importance of conditional mean decreases, while the importance of variance increases (March, 1991, p. 83). March (1991) therefore suggests that the potential upside of a high-variance distribution may be critical to firms that are competing to achieve high performance (see also Taleb, 2012).

Established businesses may detest performance variability, because the downside risk may lead to the loss of their current positions. For new ventures that are competing to establish a position in the market, a high-variance approach may allow them to achieve
primacy (March, 1991), although such an approach also involves risk (Knight, 1921; March & Shapira, 1987). A high-variance approach is associated with a wide distribution of performance (March, 1991); the upside of the distribution would enable new ventures to thrive (March, 1991), while the downside of the distribution needs to be, and can be, contained in new ventures (Lee, Peng, & Barney, 2007; Taleb, 2012).

**Method**

**Sample and Data**

We drew our research sample for this study from the restricted-access data of the Kauffman Firm Survey (KFS). The KFS is a panel study of a national probability sample of 4,928 new businesses that were started in the United States in 2004 (Robb & Robinson, 2014; Robb & Watson, 2012). The KFS tracked the operations of these new ventures annually from their inception in 2004 to 2011, thus enabling researchers to examine the operations and performance of new ventures in the early life histories of new ventures (Robb & Robinson, 2014).

Compared with other datasets, the KFS has major advantages for researchers. First, all the new ventures in the KFS were founded in 2004, which eliminates the confounding effects of age and aging on new venture performance. In addition, the KFS is the only publicly available database of new ventures in the United States; consequently, researchers who examine new venture creation can build on each other’s work using data from the KFS.

In this study, we are interested in how organizational search impacts new venture performance. The KFS did not collect information about technological search (in terms of
expenditure on product design) and market search (in terms of expenditure on marketing and advertising) until 2009, although some data about R&D expenditure are available in earlier surveys. Our research therefore draws on data from the 2009–2010 surveys. After deleting observations with missing values, our final sample comprised 1,348 new ventures.

Measures

New Venture Performance

New venture performance is measured as the natural logarithm of average sales revenue in 2009 and 2010. Sales revenue is a widely used performance indicator of new ventures (Eisenhardt & Schoonhoven, 1990). In this study, we are interested in how new ventures gradually reach a product-market fit through technological search and market search. The degree to which a new venture has found a product that fits the market can be determined by its sales revenue, with higher sales revenue generally reflecting a higher degree of product-market fit.

Technological Search

Technological search is measured as the natural logarithm of average product design expenditure in 2009 and 2010 (e.g., Hall & Ziedonis, 2001; Ito & Pucik, 1993; Jaffe, 1988; Klette & Griliches, 2000; Leiponen & Helfat, 2010). In this study, we are interested in how technological search helps new ventures find a product that may fit the market. Although there are other ways to assess technological search, we believe that this measure meets our needs because it captures the amount of organizational resources that are allocated to the design of new and improved products and services.
Market Search

Market search is measured as the natural logarithm of average marketing and advertising expenditure in 2009 and 2010 (Basuroy, Desai, & Talukdar, 2006; Peterson & Jeong, 2010; Pirinsky & Wang, 2006; Shankar, Carpenter, & Krishnamurthi, 1999). In this study, we are interested in the impact of market search on product-market fit. Although there may be other ways to measure market search, we believe that this measure meets our needs because it captures the amount of organizational resources that are allocated to understand, attract, and keep customers.

The Combined Dimension

The combined dimension is operationalized as the multiplicative product of technological search and market search (Cao et al., 2009; He & Wong, 2004). In order to test the existence of the interaction between the two search types, we also include both constituent parts (i.e., technological search and market search) in the model (Brambor, Clark, & Golder, 2006; Jaccard & Turrisi, 2003). In this way, the combined dimension reflects the existence of synergy between technological search and market search (Cao et al., 2009; He & Wong, 2004).

The Unbalanced Dimension

The unbalanced dimension is operationalized as the absolute difference between technological search and market search (Cao et al., 2009; He & Wong, 2004). The unbalanced dimension captures the importance of focus in new ventures (McDermott & Stock, 2011): if more resources are allocated to one type of search than the other, then there is emphasis on that type over the other (McDermott & Stock, 2011).
Control Variables

We include several control variables in our model, all of which were measured using the 2008 survey data. A few control variables relate to technological and marketing resources (Song, Podoynitsyna, Van Der Bij, & Halman, 2008). R&D Employees and Marketing Employees are calculated as the number of research and development (R&D) and marketing employees, respectively. Patent, Copyright, and Trademark are calculated as the number of patents, copyrights, and trademarks, respectively, owned by each new venture.

Other control variables are included to account for the impacts of inputs on output (Cobb & Douglas, 1928). Total Employees is calculated as the number of full-time-equivalent employees, including owner-operators, full-time employees, and part-time employees (Chandy & Tellis, 2000; Tsai & Wang, 2008). The number of part-time employees is multiplied by 0.5 to convert to the number of full-time-equivalent employees (Card & Krueger, 1994). Capital is calculated as the natural logarithm of the value of a new venture’s equipment. Cash is measured by the natural logarithm of the average amount of cash holdings that a new venture had in 2007 and 2008.

Several control variables are included to account for the background of the new venture team (Klotz et al., 2014; Song et al., 2008). Education is calculated as the average education level of the members of the new venture team. Education is an indicator of a founder’s general human capital (Gang & Rivera-Batiz, 1994), which may contribute to new venture performance (Marvel & Lumpkin, 2007). Work Experience is calculated as the average number of working years of the members of the new venture.
team. Founders with more work experience may have both explicit and tacit knowledge about the operations of the industry, enabling their new ventures to perform well in the early years of operations (Keeley & Roure, 1990; Li & Zhang, 2007). entrepreneurial experience is calculated as the average number of ventures that were started by the members of the new venture team before 2008. Starting a new venture is a complicated enterprise, and founders with previous startup experience may be able to make fewer mistakes and get the new venture on the right track more quickly (Barringer, Jones, & Neubaum, 2005).

A few other variables are included to control for the effects of industry (Song et al., 2008): High-Tech is a dummy variable indicating whether a new venture is in the high-tech industries. Providing Product indicates whether a new venture provides products in the market.

Econometric Methods

We estimate our model using the multiplicative heteroskedasticity model (Greene, 2012; Harvey, 1976; Weesie, 1998). Unlike many other models that can only estimate conditional mean, this method allows us to jointly estimate conditional mean and variance in a single model (Harvey, 1976). Accordingly, we are able to examine the impact of organizational search on both performance level and performance variability (March, 1991; Sorenson & Sørensen, 2001). Specifically, the multiplicative heteroskedasticity model extends the ordinary least squares regression model to include a model estimating the variance of the disturbances (Greene, 2012; Harvey, 1976; Weesie, 1998). The general model is as follows:
In this model, \( y_t = \beta_0 + \beta_1 x_{t1} + \beta_2 x_{t2} + \cdots + \beta_k x_{tk} + u_t \)

\[ \sigma_t^2 = \exp (\gamma_0 + \gamma_1 z_{t1} + \gamma_2 z_{t2} + \cdots + \gamma_l z_{tl}) \]

In this model, \( x_{t1} \ldots x_{tk} \) are factors affecting the conditional mean of \( y_t \), and \( u_t \) is the disturbance term. Although \( u_t \) has a zero mean, its variance is influenced by an array of factors, including \( z_{t1} \ldots z_{tl} \). In this model, factors increasing the variance of the performance will have \( \gamma > 0 \). This model can be estimated by maximum likelihood methods (Harvey, 1976).

Specifically, the Stata `reghy` command is used to estimate the model (Weesie, 1998); robust standard errors are used throughout the regressions. Similar methods have been used in prior studies in strategic management, organization science, finance, and economics (Castro, Clementi, & Macdonald, 2009; Cohen & Levinthal, 1989; Sørensen, 2002; Sorenson & Sørensen, 2001; Sundaresan & Wang, 2009).

Results

Means, Standard Deviations, and Correlation Matrix

Table 4.1 presents the descriptive statistics and correlation coefficients for all variables. The average logged revenue is 11.899 and the average number of employees is 7.357. The average logged investment in technological search is 2.023, and the average logged investment in market search is 2.930. Revenue is positively correlated with technological search \((r = 0.227, p < 0.01)\) and market search \((r = 0.343, p < 0.01)\).
Table 4.1. Descriptive statistics

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<tr>
<th>Variablea,b</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
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<tr>
<td>1 Revenue (logged)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td>1.000</td>
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<td>0.384</td>
<td>0.227</td>
<td>1.000</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Marketing Employee</td>
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<td>0.074</td>
<td>0.168</td>
<td>0.205</td>
<td>1.000</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>6 Patent</td>
<td>0.102</td>
<td>0.295</td>
<td>0.078</td>
<td>0.465</td>
<td>0.086</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Copyright</td>
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<td>0.080</td>
<td>0.101</td>
<td>0.034</td>
<td>-0.011</td>
<td>0.000</td>
<td>1.000</td>
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</tr>
<tr>
<td>8 Trademark</td>
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<td>0.206</td>
<td>0.263</td>
<td>0.256</td>
<td>0.268</td>
<td>0.076</td>
<td>1.000</td>
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<td>9 Total Employees</td>
<td>0.418</td>
<td>0.107</td>
<td>0.128</td>
<td>0.189</td>
<td>0.383</td>
<td>0.110</td>
<td>0.018</td>
<td>0.184</td>
</tr>
<tr>
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<td>0.176</td>
<td>0.136</td>
<td>0.077</td>
<td>0.023</td>
<td>0.010</td>
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<td>0.082</td>
<td>0.090</td>
<td>-0.008</td>
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<td>0.023</td>
<td>0.119</td>
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<td>-0.028</td>
<td>0.011</td>
<td>0.003</td>
<td>0.034</td>
<td>0.015</td>
<td>0.018</td>
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<td>0.046</td>
<td>0.054</td>
<td>0.056</td>
<td>0.073</td>
<td>-0.009</td>
<td>0.095</td>
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<tr>
<td>15 High-Tech Industries</td>
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<td>0.089</td>
<td>0.209</td>
<td>0.005</td>
<td>0.080</td>
<td>0.051</td>
<td>0.119</td>
</tr>
<tr>
<td>16 Providing Product</td>
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<td>0.211</td>
<td>0.165</td>
<td>0.138</td>
<td>0.062</td>
<td>0.116</td>
<td>0.057</td>
<td>0.155</td>
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</table>

Mean 11.899 2.023 2.930 0.856 1.356 0.220 1.597 0.356

Standard Deviation 2.117 3.675 3.740 1.553 2.848 1.582 12.112 1.404

*table continued*
Table 4.1. Continued.

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<td>1</td>
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<td>2</td>
<td>Technological Search (logged)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Market Search (logged)</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>R&amp;D Employee</td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Marketing Employee</td>
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</tr>
<tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>8</td>
<td>Trademark</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Total Employees</td>
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<td>12</td>
<td>Education</td>
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<td>13</td>
<td>Work Experience</td>
<td>0.090</td>
<td>0.083</td>
<td>0.084</td>
<td>0.018</td>
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<td>Entrepreneurial Exp</td>
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<td>0.089</td>
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<td>High-Tech Industries</td>
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<td>0.044</td>
<td>0.088</td>
<td>0.185</td>
<td>0.083</td>
<td>0.017</td>
<td>1.000</td>
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<tr>
<td>16</td>
<td>Providing Product</td>
<td>0.023</td>
<td>0.076</td>
<td>0.055</td>
<td>-0.075</td>
<td>-0.039</td>
<td>0.042</td>
<td>0.049</td>
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<table>
<thead>
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<td></td>
<td>7.357</td>
<td>7.205</td>
<td>7.988</td>
<td>6.481</td>
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<td>1.081</td>
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<table>
<thead>
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<th>Standard Deviation</th>
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<td></td>
<td>14.623</td>
<td>4.644</td>
<td>3.672</td>
<td>1.957</td>
<td>9.665</td>
<td>2.614</td>
<td>0.351</td>
<td>0.499</td>
</tr>
</tbody>
</table>

Notes:
- \( n = 1348 \)
- Correlation coefficients greater than 0.54 are significant at the 0.05 level of significance (two-tailed tests).
Hypothesis Testing

We tested for heteroskedasticity by running an ordinary least squares model and conducting tests: the White’s test (statistic = 336.7, degrees of freedom [df] = 166, \( p < 0.01 \)) and the modified Bresch-Pagan test (statistic = 135.9, df = 17, \( p < 0.01 \)) showed that the null hypothesis of homoscedasticity is rejected. Given the existence of heteroskedasticity, we employed the multiplicative heteroskedasticity model (Harvey, 1976; Weesie, 1998) to study the impacts of organizational search on performance level and performance variability.

Our empirical results support all four hypotheses. The results are displayed in table 4.2.

Hypothesis 4.1 predicts that the combined magnitude of technological search and market search is positively associated with the conditional mean of new venture performance. Empirical result supports Hypothesis 4.1 (\( \beta = 0.084, p < 0.05 \)). We find that the combined dimension has a positive and significant impact on the conditional mean of new venture performance.

Hypothesis 4.2 predicts that the combined magnitude of technological search and market search is positively associated with the variance of new venture performance. Empirical result also supports Hypothesis 4.2 (\( \beta = 0.267, p < 0.01 \)). We find that the combined dimension has a positive and significant impact on the variance of new venture performance.
Table 4.2. Multiplicative heteroscedasticity models of new venture performance

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
<th>Model 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Technological Search</td>
<td>0.032 0.019 0.098</td>
<td>-0.029 0.031 0.337</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Market Search</td>
<td>0.135 0.020 0.000</td>
<td>0.062 0.027 0.023</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined Dimension</td>
<td>0.084 0.034 0.014</td>
<td>0.084 0.034 0.014</td>
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<td></td>
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<tr>
<td>Unbalanced Dimension</td>
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<td>-0.001 0.028 0.969</td>
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<tr>
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<td>0.513 0.045 0.000</td>
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<td>Capital</td>
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<td>0.156 0.021 0.000</td>
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<td>0.030 0.026 0.244</td>
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<td>0.017 0.018 0.349</td>
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<td>Providing Product</td>
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<td>0.039 0.018 0.032</td>
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Table continued
Table 4.2. Continued.

<table>
<thead>
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Table 4.2. Continued.
Hypothesis 4.3 predicts that the unbalanced dimension, the absolute difference between technological search and market search, is positively associated with the conditional mean of new venture performance. Empirical result supports Hypothesis 4.3 ($\beta = 0.187, p < 0.01$). We find that, as the imbalance between technological search and market search increases, the conditional mean of new venture performance increases.

Hypothesis 4.4 predicts that the unbalanced dimension is positively associated with the variance of new venture performance. Empirical result also supports Hypothesis 4.4 ($\beta = 0.378, p < 0.05$). We find that, as the imbalance between technological search and market search increases, the variance of new venture performance increases.

**Discussion**

The Benefits of Unbalanced Search in New Ventures

New ventures are in search of higher levels of product-market fit (Blank, 2013a). They carry out market search to understand customers and engage in technological search to design product solutions that may satisfy customers. Given the importance of organizational search to new ventures (Blank, 2013a), how should they allocate resources to search efforts?

The current thinking in management suggests that new ventures should be ambidextrous (He & Wong, 2004; Raisch et al., 2009) and should allocate resources to both technological search and market search (Atuahene-Gima & Murray, 2007). However, another stream of thought suggests that new ventures should have focus (Huckman & Zinner, 2008; McDermott & Stock, 2011), emphasizing one type of search over the other (Ambos & Birkinshaw, 2010). Taking into account these two seemingly
contradictory suggestions, we argue that new ventures can benefit from an unbalanced approach to organizational search, whereby they focus on one type of search, but do not neglect the other type (Ambos & Birkinshaw, 2010; Zuzul & Edmondson, 2014).

Focusing on one search area allows new ventures to concentrate organizational resources on and give emphasis to the area of focus; not neglecting either type of search allows new ventures to capture the benefits of the synergy between technological search and market search. By adopting an unbalanced approach to organizational search, new ventures can score relatively high on both the combined and the unbalanced dimensions, which can translate into higher performance level and greater performance variability.

In Search of a Product-Market Fit

The lean startup literature, which is mostly practice oriented, suggests that search is what distinguishes new ventures from established businesses (Blank, 2013a): new ventures are in search of a product-market fit (Blank, 2013b; Blank & Dorf, 2012; Osterwalder & Pigneur, 2010; Ries, 2011). In the search for such a fit, new ventures need to ascertain who the customers will be, what customers may need and want, and how to reach and communicate with targeted customers (Blank & Dorf, 2012). In addition, new ventures need to determine what product features will appeal to customers and how to develop those features (Blank & Dorf, 2012).

Given the role of organizational search in establishing a product-market fit, organizational search may be a core process in new ventures, and the construct of organizational search may serve as a theoretical foundation for studying new venture creation. Examining this process from a search perspective would raise new questions
and propose new answers (Blank, 2013a; Curley & Formica, 2013). Therefore, it would be interesting to view the process of new venture creation as a search process and to study how new ventures manage this process.

Furthermore, new ventures are an ideal context for further enriching the theory of organizational search. Prior studies have investigated the drivers of organizational search, but they tend to focus less on the process of organizational search (Maggitti, Smith, & Katila, 2013). Although it still lacks a strong theoretical foundation, the practice-oriented lean startup literature offers important insight into the process of organizational search in new ventures (Blank, 2013b; Blank & Dorf, 2012; Ries, 2011). We believe that ideas from the lean startup literature can be combined with the theory of organizational search to further our understanding of the search process in organizations.

Limitations and Future Research Directions

We acknowledge several limitations in this study. First, although we are aware of the many different conceptualizations of organizational search (Gruber et al., 2008; Katila & Ahuja, 2002), we are limited by our data source to using expenditure as our indicator of organizational search (Chen & Miller, 2007; Vissa et al., 2010). Future research should examine other dimensions of organizational search, such as search effort (Li et al., 2013; Weiss & Heide, 1993), search direction (Li et al., 2013), search scope (Katila & Ahuja, 2002; Zhang & Li, 2010), and search duration (Weiss & Heide, 1993).

Although technological search and market search are of critical importance to new ventures, new ventures may also need to engage in other areas of organizational search to establish a feasible and desirable business model (Osterwalder & Pigneur,
2010). For example, future research should explore how new ventures search for alliance partners (Colombo, Grilli, & Piva, 2006; Ozcan & Eisenhardt, 2009), suppliers (Song & Di Benedetto, 2008), investors (Hallen, 2008; Hallen & Eisenhardt, 2012), or employees (Cardon & Stevens, 2004). A search perspective allows us to recognize the possibilities of wrong turns in these trial-and-error processes and the importance of fit and consistency among different types of search (Blank, 2013a; Curley & Formica, 2013). We believe that there are many opportunities to explore different types of organizational search in new ventures. Such exploration would enrich our understanding of new ventures and organizational search.

Finally, although we are aware of the roles of time and timing in organizational search, we do not explicitly incorporate time and timing in our model. Future research should address this limitation by taking into account the temporal dimension of organizational search in new ventures. For example, future research can examine how organizational search is affected by organizational life histories (Ambos & Birkinshaw, 2010; Kazanjian, 1988; Sørensen & Stuart, 2000), synchronization with other organizations (Katila & Chen, 2008), or synchronization with environmental changes (McCarthy, Lawrence, Wixted, & Gordon, 2010).

**Conclusion**

Organizational search is an important organizational process in new ventures, as new ventures need to construct and evaluate alternatives in the process of establishing a new business. But how should new ventures allocate resources to the different types of organizational search? In this article, we focus specifically on two types of organizational
search—technological search and market search—and showcase the benefits of an unbalanced approach to organizational search. We suggest that new ventures should focus on either technological search or market search, but not ignore either type of search type. More broadly, we argue that studying the process of new venture creation from a search perspective can provide new insight into entrepreneurship and organizational search. We hope that more scholars will join us in establishing such a perspective. We believe that, by highlighting the search process, we can help identify the fundamental characteristics of new ventures and thus further improve our understanding of new venture creation. Such a focus may also enable entrepreneurship scholars to be more closely connected to organization theory and contribute to the further developments of organization theory through enhancing our understanding of the process of organizational search.
CHAPTER 5
CONCLUSIONS

The search perspective on entrepreneurship combines insights from the behavioral theory of the firm (Cyert & March, 1992; Greve, 2003b; March, 1994; March & Simon, 1993; Simon, 1955, 1997) and ideas from the lean startup literature (Blank, 2013b, 2013a; Blank & Dorf, 2012; Ries, 2011). It recognizes search as a distinguishing feature of new ventures and emphasizes the central roles of learning, search, and discovery in the entrepreneurial process (Arend & Chen, 2012; Blank, 2013a). New ventures, unlike established businesses, lack well-established strategies, structure, processes, products, and customer relationships. In the early years of existence, new ventures need to explore different alternatives and gradually discover a business model that may work.

Implications for Theory

The search perspective on entrepreneurship contributes to our understanding of the learning and searching processes in new ventures. First, performance feedback is an important mechanism guiding organizational search and organizational growth. Prior studies have shown that performance feedback affects risk taking, organizational search, and organizational change, among other organizational actions (Bromiley & Harris, 2014; Greve, 2003b; Shinkle, 2012). However, performance feedback has not been explicitly recognized as a mechanism of growth in prior research (see Greve, 2008a for an important exception). The practice-oriented lean startup literature, however, places learning from feedback at the center of the entrepreneurial process (Blank, 2013a; Ries,
In this dissertation, we draw on the behavioral theory of the firm, especially the performance feedback theory, to examine the role of performance feedback in new venture growth.

We find that performance feedback is an important mechanism of organizational growth. When organizational size is lower than the aspiration level for size, new ventures focus organizational attention on organizational growth and search for ways to achieve organizational growth. We also find that the effectiveness of this mechanism is contingent on whether new ventures have achieved satisfactory survival outcome (Greve, 2008a). The relationship between performance feedback on organizational size and organizational growth is stronger when survival outcome is satisfactory than when it is unsatisfactory.

These findings have important implications for a behavioral theory of new venture growth. Organizational growth has been extensively studied from many theoretical perspectives, such as the resource-based view (Penrose, 1959) and the industrial organizational economics (Coad, 2009). The behavioral theory of the firm, however, has not played an important role in shaping our understanding organizational growth (Greve, 2008a). We hope that this dissertation can shed new light on the behavioral theory of new venture growth and open new directions for future research.

Second, this dissertation also contributes to our understanding of how organizational factors and environmental factors interact to affect new ventures’ R&D search behavior. Prior studies have shown that R&D search intensity is influenced by organizational factors, including situational factors and institutional factors (Chen &
Miller, 2007; Greve, 2003a; Lim & McCann, 2014). Some prior studies also have shown that R&D search intensity is also affected by environmental factors (Campello et al., 2010). However, prior studies have not explicitly explored how organizational and environmental factors interact to influence R&D search intensity. Recognizing such interaction is important because environmental jolts affect how new ventures learn from performance feedback, interpret the distance from bankruptcy, and carry out institutionalized search (Greve, 2003b).

In this dissertation, we find that environmental jolts make high-tech new ventures more responsive to social aspiration. We also find that, under normal circumstances, the distance from bankruptcy has an inverted U-shaped relationship with R&D search intensity; under environmental jolts, this inverted U-shaped relationship has a higher peak and a stronger decline. In addition, environmental jolts strengthen, rather than weaken, the impact of institutionalization on R&D search behavior. These findings have implications not only for organizational search under environmental jolts but also for learning from performance feedback.

Third, this dissertation also sheds light on the nature and benefits of unbalanced search in new ventures (Ambos & Birkinshaw, 2010). Prior studies offer divergent opinions about how to allocate resources to organizational search. Some studies advocate an ambidextrous approach (Atuahene-Gima & Murray, 2007), suggesting that new ventures should allocate similar amount of resources to different types of organizational search in order to capitalize on the potential of synergy and complementarity between different types of search. Other studies, however, argue that new ventures are constrained
by their resource endowments and should focus on a specific area of organizational search in order to achieve excellence in the area of focus (Ambos & Birkinshaw, 2010; McDermott & Stock, 2011). In this dissertation, we draw insights from prior studies and propose that new ventures should rely on an unbalanced approach to allocating resources to organizational search (Ambos & Birkinshaw, 2010; Zuzul & Edmondson, 2014). We argue that new ventures should emphasize one type of organizational search, while not ignoring other types of organizational search. In this dissertation, we focus specifically on technological search and market search and find that unbalanced search increases both performance level and performance variance.

Overall, we believe that the findings of this dissertation shed new light on our understanding of the learning and searching processes in new ventures. They make unique contributions to the behavioral theory of new venture growth, R&D search under environmental jolts, and unbalanced search in new ventures.

**Implications for Practice**

We believe that the findings from this dissertation have important implications for practice. First, in the early years of existence, new ventures need to learn from performance feedback in the process of searching for a feasible business model. Because of bounded rationality, new ventures cannot be certain about the outcome of a specific business model. Instead, they rely on organization search to experiment with different alternatives and draw on performance feedback to evaluate whether their business models may work (McGrath, 2010; Ries, 2011). Learning from performance feedback, however, is never easy. New ventures are pursuing multiple organizational goals, and performance
feedback on different organizational goals may reveal different organizational problems that require different organizational actions. Performance feedback on organizational size, for example, guides organizational growth. However, the effectiveness of this mechanism is contingent on performance feedback on organizational survival. When survival performance is unsatisfactory, survival may trump growth, and new ventures will have to pay attention to survival problems first. Survival problem is urgent and immediate (Greve, 2003b, 2008a) and thus may become a high-priority organizational goal. We also find that a large new venture team is especially helpful for new ventures that face both growth problem and survival problem.

Second, new ventures’ search behavior is significantly impacted by environmental jolts. Although performance feedback is generally important to new ventures, different sources of performance feedback may have different roles under environmental jolts. Because environmental jolts suddenly and transiently change organizational environments, environmental jolts may make historical aspiration obsolete and make social aspiration important (Greve, 2003b). Environmental jolts change how new ventures learn from and respond to different sources of performance feedback. In addition, we also find that institutional factors may also affects how new ventures adapt to environmental jolts. If new ventures institutionalize R&D search by dedicating a significant portion of employees to R&D activities, they may be less flexible in changing R&D search intensity even when they encounter environmental challenges.

Third, given resource constraints, new ventures may need to rely on an unbalanced approach to allocating resources to organizational search (Ambos &
According to the unbalanced approach, new ventures can choose an area of focus and concentrate resources on the area of focus (McDermott & Stock, 2011). Meanwhile, they cannot completely ignore other areas, so they can capitalize on the synergy between different areas of search. By so doing, new ventures may be able to achieve high performance level. However, unbalanced search is also associated with high performance variance and thus with high level of risk. Although it is risky, unbalanced search may help new ventures achieve primacy in the competition for establishing a position in the market (March, 1991; Taleb, 2012).

**Future Research Directions**

In this dissertation, we have explored the roles of performance feedback on new venture growth. Performance feedback, however, is just one type of feedback. The lean startup literature has recognized the importance of customer feedback in guiding new venture evolution (Blank, 2013b, 2013a; Blank & Dorf, 2012; Osterwalder & Pigneur, 2010; Ries, 2011). It would be interesting to further incorporate other types of feedback in examining new venture growth and evolution in future research.

In this dissertation, we have explored how environmental jolts affect new ventures’ R&D search behavior. Environmental jolts, however, may also impact other organizational actions in new ventures, and it would be interesting to further explore such impacts. In addition, an environmental jolt is an extreme type of environmental changes. Future studies may explore the roles of other environmental factors in R&D search behavior and other organizational actions in new ventures.
In this dissertation, we have explored the potential benefits and risks of unbalanced search in new ventures. We have suggested that focus is important to new ventures; however, we have not explored what should new ventures focus on and how new ventures may shift their focus from time to time. Future research may explore what should new ventures focus on, what determine the focus of a new venture, and how new ventures shift from one focus to another focus (Ambos & Birkinshaw, 2010).

We believe that there are a lot of opportunities to combine insights from the behavioral theory of the firm and the lean startup literature to further examine entrepreneurial management and new venture creation from a search perspective. We also believe that findings from such research may significantly improve our understanding of entrepreneurial management and new venture creation and may have important practical implications for entrepreneurs and innovators.
## APPENDIX

### DESCRIPTIVE STATISTICS

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<td><strong>Revenue</strong></td>
<td>393,047 (7,455,565)</td>
<td>637,464 (8,487,469)</td>
<td>1,120,808 (17,536,325)</td>
<td>1,153,111 (9,866,644)</td>
<td>849,434 (4,486,916)</td>
<td>1,145,070 (12,883,408)</td>
<td>1,786,329 (22,942,326)</td>
<td>2,112,653 (22,035,248)</td>
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<td><strong>Net Income</strong></td>
<td>1,082 (456,758)</td>
<td>12,707 (575,509)</td>
<td>-82,923 (6,266,356)</td>
<td>50,375 (2,194,759)</td>
<td>6,221 (1,015,742)</td>
<td>2,505 (1,308,277)</td>
<td>116,234 (3,837,026)</td>
<td>324,964 (11,431,381)</td>
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<td>18 (18)</td>
<td>33 (23)</td>
<td>33 (22)</td>
<td>35 (24)</td>
<td>36 (25)</td>
<td>41 (25)</td>
<td>42 (26)</td>
<td>41 (26)</td>
</tr>
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<td><strong>R&amp;D Expenditure</strong></td>
<td>21,335 (262,240)</td>
<td>23,427 (278,983)</td>
<td>24,071 (1,009,718)</td>
<td>23,917 (238,440)</td>
<td>17,392 (333,301)</td>
<td>26,045 (1,999)</td>
<td>25,202 (403,603)</td>
<td>25,022 (1,994)</td>
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<td><strong>Product Design Expenditure</strong></td>
<td>33,259 (970,972)</td>
<td>11,340 (125,825)</td>
<td>2,379 (210,8)</td>
<td>3,108 (86,367)</td>
<td>8,066 (1,986)</td>
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<td><strong>Marketing Expenditure</strong></td>
<td>11,623 (194,210)</td>
<td>12,015 (273,225)</td>
<td>2,366 (2,095)</td>
<td>2,095 (1,986)</td>
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<td>Cash</td>
<td>36,039</td>
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<td>(673,539)</td>
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<td>4,381</td>
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<td>3,270</td>
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<td>63,750</td>
<td>(619,110)</td>
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<td>4,622</td>
<td>3,806</td>
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<td>1.4</td>
<td>(0.8)</td>
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<td>3,447</td>
<td>2,952</td>
<td>2,625</td>
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<td>2,429</td>
<td>(0.9)</td>
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<td>(6.1)</td>
<td>4.8</td>
<td>(9.6)</td>
<td>5.0</td>
<td>(20.6)</td>
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<td>(13.3)</td>
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<td>4,767</td>
<td>3,696</td>
<td>3,206</td>
<td>2,703</td>
<td>2,450</td>
<td>(2,039)</td>
<td>1,786</td>
<td>(2,450)</td>
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<td>R&amp;D</td>
<td>1.1</td>
<td>(1.2)</td>
<td>0.9</td>
<td>(1.4)</td>
<td>1.0</td>
<td>(2.4)</td>
<td>0.9</td>
<td>(2.0)</td>
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<td>3,048</td>
<td>2,900</td>
<td>2,556</td>
<td>2,039</td>
<td>1,786</td>
<td>(4,11)</td>
<td>1,790</td>
<td>(4,44)</td>
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<td>1.3</td>
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<td>(4.1)</td>
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<td>3,047</td>
<td>2,903</td>
<td>2,559</td>
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<tr>
<td>Patents</td>
<td>0.2 (2.7)</td>
<td>0.2 (2.9)</td>
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REFERENCES


VITA

Yan Chen was born on July 3, 1984, in Chaozhou, China. He received his Bachelor of Engineering degree in Computer Science from South China University of Technology in 2006 and his Master of Science degree in Management from Xi'an Jiaotong University in 2009. He began work toward his Ph.D. degree in Entrepreneurship and Innovation in the Henry W. Bloch School of Management at the University of Missouri-Kansas City in 2009. Upon completion of his degree requirements, he plans to start his academic career as an Assistant Professor at Stevens Institute of Technology.

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