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DEVELOPING ENTREPRENEURIAL ECOYSTEMS: INTEGRATING SOCIAL EVOLUTIONARY THEORY AND SIGNALING THEORY TO EXPLAIN THE ROLE OF MEDIA IN ENTREPRENEURIAL ECOSYSTEMS

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DEDICATION

This dissertation is dedicated to my family, including the family I have chosen for myself, whose support and faith in me led me to persevere and demonstrate the resilience that ultimately resulted in this document; to my mother and father, who always took my calls; to my sisters, Michelle and Kyla, who commiserated and helped out in small and large ways; to Elaine Seat, who provided me with guidance, mentorship, and a place to work; to the Huntsville crew, who never doubted and threatened to beat me up if I even thought about doing something else; to the Davidson crowd, who understood the trials and tribulations, listened, and supported; and finally to the Laura Madden, LaDonna Thornton, Nawar Chaker, and Laura D'Oria for making me laugh and making it fun.

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ABSTRACT

Entrepreneurship drives innovation, social change, and economic development locally, regionally, nationally, and worldwide (Konczal, 2013). The activities, relationships, and entities utilized to enhance entrepreneurial activity are just one important part of what scholars have termed the entrepreneurial ecosystem (EE), in acknowledgement of the interconnectedness of these factors with other market dimensions.

This dissertation integrates previous definitions of the EE and proposes a new definition that emphasizes the importance of the social environment and the role of communication for change and EE development. Building on evidence from diverse streams of research to further our understanding of entrepreneurial ecosystem activity, this dissertation argues that an overlooked explanation for EE change is social evolutionary theory (SET). Further, in exploring the mechanisms behind EE change, the dissertation explores the role of media signals on the pattern of firm formation and failure EEs. Doing so, the dissertation proposes a theoretical approach and model primarily based on SET (Margulis, 1971) and utilizes signaling theory (Spence, 1973) to address a gap in SET and thus explain how changes in EEs over time occur.

Using a sample of U.S. metropolitan statistical areas (MSAs) as EEs, data about media signals, industry diversity, resource availability, new venture formation, and firm failures over a ten year period were analyzed to test the formal model. Results support SET and signaling theory explanations for EEs but also offers some counterintuitive extensions of SET. This study contributes to literature on EEs by providing and testing a model of change specifying mechanisms that social actors use to coordinate entrepreneurship-related activities. The study also provides insights for policymakers and entrepreneurs in EEs about the importance of communication frequency and content for motivating potential entrepreneurs to pursue new ventures.

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CHAPTER 1: INTRODUCTION

Chapter Overview

> Entrepreneurs and their small enterprises are responsible for almost all the economic growth in the United States.
>
> -Ronald Reagan, Speech at Moscow State University, 1988

Entrepreneurship drives innovation, social change, and economic development locally, regionally, nationally, and worldwide (Konczal, 2013). Politicians talk about the importance of entrepreneurship, and the topic receives a considerable amount of coverage in the media (Markusen, 2013). Because of the importance of entrepreneurship, leaders at all levels are interested in ways they can influence entrepreneurial activity among their constituents. This has led to a variety of approaches to increasing entrepreneurial activity, many of which are not successful, while others have succeeded beyond expectations (Lichtenstein & Lyons, 2010). For example, research has found that training and events that increase the skills and social networks of entrepreneurs tend to be more successful than providing money directly to (potential) entrepreneurs in the form of grants (Lichtenstein & Lyons, 2010). The activities, relationships, and entities utilized to enhance entrepreneurial activity are just one important part of what scholars have termed the entrepreneurial ecosystem (EE), in acknowledgement of the interconnectedness of these factors with other market dimensions. This dissertation focuses on the entrepreneurial ecosystems of the U.S. economy and a subset of activities, specifically media-related, influencing new business formation.

The research to date on entrepreneurial ecosystems has addressed components such as human capital (Florida et al., 2002), investment capital (Lerner, 1999) and industry agglomeration (Glaeser et al., 1992). Despite these substantial bodies of research, more research is needed to investigate antecedents that contribute to increasing entrepreneurial activity, specifically venture formation and failure, in entrepreneurial ecosystems. Such antecedents include the role of media and communication as they influence (potential) entrepreneurs and other ecosystem actors (Aldrich & Yang, 2012). Past research has theorized how ecosystems change over time, but has not investigated the specific mechanisms, such as communication. Thus, additional research is needed on how these changes take place as well as on the specific mechanisms driving these changes. By incorporating the notion of EEs as ecosystems, this dissertation builds on evidence from different streams of research to further our understanding of entrepreneurial ecosystem activity by arguing

that a critically overlooked driver of EE changes is the role of media signals on the formation and failure of firms in an entrepreneurial ecosystem.

In designing and conducting a study on the role of media signals on EE, I outline the foundational elements of this proposed dissertation as follows. First, I review the set of existing definitions of entrepreneurial ecosystems along with the definitions of closely related concepts. I synthesize a definition of entrepreneurial ecosystems from extant, related definitions. This synthesized definition emphasizes the role of (potential) entrepreneurs as social actors and the importance of coordinating activities through communication. Second, I review the literature on entrepreneurial ecosystems and related literature streams such as agglomeration (Beaudry & Schiffauerova, 2009), population ecology (Breslin, 2008), and industrial ecology (Korhonen, 2001) to identify relevant findings and constructs for both the proposed definition and the current study. Third, I integrate social evolutionary theory (Margulis, 1971) and signaling theory (Spence, 1973) to develop a model and hypotheses for the effects of signals in the media on (potential) entrepreneurs' decisions to start or terminate firms. Then, I discuss methodology for testing the hypotheses developed.

Following, in Chapter 1, I address the primary research question of the dissertation. I outline the theories I use in the dissertation to develop hypotheses. I discuss the objectives, assumptions, and scope of the dissertation. Then, I identify the research methodology used to test the hypotheses. Next, I identify expected contributions and implications of the research for theory, practice, and policy. Finally, I conclude with a summary of the chapter and an outline of the organization of the dissertation.

Research Question and Research Objectives

Research Question

How do signals in the media influence (potential) entrepreneurs to start new ventures or terminate existing ventures in entrepreneurial ecosystems? To answer this question, I focus on the social actors in the ecosystem and the media as a channel for sending signals to (potential) entrepreneurs. This approach focuses primarily on social evolutionary theory (SET) (Margulis, 1971) as an explanation for the behaviors exhibited and utilizes signaling theory (Spence, 1973) logic to fill a gap in the existing SET framework. SET provides a set of evolutionary processes that

result in continuous change in actors and ecosystems, and offers a set of logics that explain why actors engage in cooperative activities when competition is the baseline (Margulis, 1971; Nowak, 2006). SET also provides the expected set of cooperative and competitive relationships in which social actors engage. However, little work in SET has addressed how social actors invoke the rules to develop the relationships. Signaling theory provides the explanation for how the transmission of information between signalers and receivers results in these relationships. Specifically, the signal reduces information asymmetry between signaler and receiver, allowing the receiver to choose the appropriate cooperative or competitive relationship (Spence, 1973; Connelly et al., 2011). Alone, SET does not explain mechanisms to induce cooperation. When the two theories are combined in this way, they provide an explanation for both cooperative behaviors and the mechanisms utilized by social actors to induce the cooperation.

Objectives of this Research

In conjunction with the previously stated research question, I aim to meet the following research objectives:

- To develop a comprehensive and inclusive definition of entrepreneurial ecosystems incorporating past research, one that emphasizes a multi-theoretical approach to the phenomenon;

- To integrate social evolutionary and signaling theory in the context of entrepreneurial ecosystems to explain not just why cooperation occurs, but also the mechanisms used to induce cooperation;

- To explore and understand the role of signals and communication in entrepreneurial ecosystems;

- To provide support for the entrepreneurial ecosystem as an appropriate level of analysis for entrepreneurship research

Problem: Incomplete Theoretical Explanation of EE Development

At the close of World War II, River City, Alabama was a bustling town of fifty thousand people. River City had ship building facilities, was an intermodal shipping hub between rail and waterways, hosted major repair yards for railroads, bottling plants, and manufactured lumber. A nearby city of only twenty thousand inhabitants hosting only chemical munitions facilities from the war and a munitions dump would soon eclipse the River City and become the Rocket City. At the close of World War II, Rocket City had none of the natural resources of River City, no river access and only a single railroad spur for the munitions dump. In terms of human capital, Rocket City had seven thousand temporary workers brought to the region by the Army. River City had some industry diversity, focused around manufacturing and transportation, while Rocket City had none. In 2010, the River City MSA had approximately 154,000 residents and 2945 firms, 235 of which were newly established, while the Rocket City had approximately 418,000 residents and 8726 firms, 771 of which were newly established. Why did River City have so little growth while Rocket City had so much?

Explanations of traditional approaches to the phenomenon of entrepreneurial ecosystem growth and development, in terms of agglomeration, or resources would seem to favor River City. Research in the area suggests that access to resources and diverse industries should result in economic growth as firms choose to co-locate with both related and unrelated firms to benefit from reduced vulnerability to environmental shocks and knowledge spillovers (Jacobs, 1969; McCann & Folta, 2008). Yet, contrary to these predictions, Rocket City – and its EE - clearly grew more than River City. Another explanation is needed. In comparison case studies examining the change in EEs over time, such as Silicon Valley in California and Route 128 in Massachusetts, researchers have explored the difference between an EE that thrived (Silicon Valley) and one that did not (Route 128) (Saxenian, 1996). This research suggested that part of the difference in growth could be attributed to differing attitudes, beliefs, and the structure of the organizations in the regions (Saxenian, 1996). However, River City and Rocket City are neighbors only thirty-five miles apart, so regional differences in culture seemingly do not explain how these two MSAs developed so differently.

To explain the differences in these two EEs over time, as well as others like them, new theory is needed. Evolutionary theory has been proposed as one explanation for how these communities develop and change over time (Aldrich & Martinez, 2010). It has been used to conceptually explain

how different institutions, beliefs, norms, and attitudes develop through repeated interactions (Aldrich & Martinez, 2010). This perspective acknowledges the interrelatedness of the actors in the ecosystem and how their interactions result in institutional changes. However, this perspective has not fully considered the importance of communication in changing ecosystems, generally assuming that communication happens, but not investigating the specific mechanisms that lead to the change. I argue that communication differentiates successful ecosystems in that those that are more effective at coordinating efforts to produce entrepreneurship have more effectively communicated messages about entrepreneurship to other social actors in their entrepreneurial ecosystems.

Challenge: Definitional Inconsistency

The literature examining entrepreneurial ecosystems was virtually non-existent ten years ago. As an emerging literature stream, there is little consistency or communication among the papers as yet, though a forthcoming special issue seeks to address some of these issues (Autio et al., 2015). The recent work in the area of entrepreneurial ecosystems still utilizes some case study methodology (Bosma & Hoevet, 2015; Marti, Courpasson, & Dubard, 2013), but has also begun to make comparisons between ecosystems (Parker, 2008), and to use large data sets, such as the Global Entrepreneurship Monitor (GEM) (Szerb, Acs, & Ortega-Argile, 2015) to conduct systematic research. The increased interest in the topic has led to a proliferation of and inconsistency among definitions (Krueger, 2012; Stam, 2015). The definitions used leave questions as to the appropriate level of analysis, whether city (Watkins, Ozkazanc-Pan, Clark, & Motoyama, 2015), region (Duval-Couetil & Hutcheson, 2015), or nation (Isenberg, 2010; Acs, Estrin, Mickiewicz, & Szerb, 2014). The definitions used also leave some question as to the appropriate scope, which actors to include or exclude, and the relevant features of the ecosystem. The definitions leave some question as to the role of some members of an ecosystem, such as the degree to which government might be considered to be an actor. Integrating the definitions proposed and utilized by various researchers (Bahrami & Evans, 1996; Aldrich & Martinez, 2010; Stam, 2015), in the following chapters, I synthesize a definition that offers insight into these elements.

Gaps and Limitations: Many Disciplines, Many Conversations

Studies in the area of entrepreneurial ecosystems have not consistently spoken to one another, remaining heavily siloed within their disciplines of economics (Glaeser et al., 1992), sociology (Flora et al., 2005), and political science (Barthik, 1991). Research in management journals has generally been more comprehensive, but still relies heavily on single streams, often from other disciplines. This creates problems for scholars interested in researching entrepreneurial ecosystems, not only in determining which literature should be used – sociology, economics, political science – but also with identifying the gaps in the literature. A researcher taking a sociological perspective might intend to explore questions related to knowledge transfer, and propose a novel relationship to their literature stream, and may unintentionally overlook literature in another stream that addresses closely related questions which could provide insight into their own research and have been explored in knowledge-spillover in agglomeration (Beaudry & Schiffauerova, 2009). Similarly, entrepreneurship policy researchers focused on economics literature may not realize the relevance of economic development policy research from political science for their own research. As such, identifying relevant literature for entrepreneurial ecosystems and key findings benefits all those interested in the topic, so that they may incorporate findings from other literatures and also advance our understanding without a duplication of effort.

Research Agenda

Theoretical Underpinnings

I use logic from signaling theory to explain the specific mechanisms through which SET rules and outcomes occur. Then, I develop a model of signaling behavior in entrepreneurial ecosystems. Specifically, I consider the influence of highly visible signals transmitted through the media and the influence of the signals on the formation and failure of firms in the entrepreneurial ecosystem. I develop hypotheses based on specific mechanisms of signaling behavior, including signal frequency (volume), signal attributes (content), and signal valence (tenor) and how they influence firm formation and failure. Further, I explicate the mechanisms through which environmental factors of industry diversity and resource availability might affect the interpretation and influence of these signals by receivers.

Methodological Approach

I test the hypotheses by designing a study and collecting data from a sample of entrepreneurial ecosystems. For the purposes of the study, I operationalize entrepreneurial ecosystems as Metropolitan Statistical Areas (MSAs) as defined by the U.S. Bureau of Labor & Statistics (BLS). I use archival data provided by the BLS, Kauffman Foundation, and collected from the Factiva Database. I leverage QDA Miner and validated content analysis dictionaries (Pennebaker et al., 2007; Short et al., 2009) with the data from Factiva with to generate variables of signal frequency (number of articles), signal content (entrepreneurial orientation), and signal valence (positive or negative affect). Combining these variables with the archival data, I create a ten year cross-sectional time-series dataset, or panel. I utilize pooled ordinary least squares regression to test the proposed model and relationships

Implications and Contributions

Implications for Research

The research I perform in this dissertation has several implications for researchers. First, I contribute to our understanding of how entrepreneurial ecosystems can develop differently over time, based on new theory predicting the pattern of cooperative and competitive behaviors in EEs and utilize communication as a mechanism for motivating change in EEs. Then, I integrate various definitions of EE across literatures to derive a single definition that encompasses the prior definitions, acknowledges the dynamic nature of the actors and the outcomes, and emphasizes the role of all members of the EE as social actors who engage in some form of communication to coordinate activities (Stam, 2015; Aldrich & Martinez, 2010). This updated and integrated definition motivates the use of social evolutionary theory (Margulis, 1971) in entrepreneurship research and specifically applies it to the concept of the entrepreneurial ecosystem as an explanation motivating cooperation and the logics behind cooperation. This builds on prior work using evolutionary theory and the evolutionary approach in entrepreneurship research (Aldrich & Ruef, 2006; Breslin, 2008). While past research has identified the types of relationships that emerge, cooperative and competitive (Aldrich & Martinez, 2010), social evolutionary theory has specific logics for cooperation that enhance our understanding of the phenomenon.

In addition to the application of social evolutionary theory, I utilize logic and insights from signaling theory to provide a clearer theoretical understanding of the specific mechanisms social actors can utilize, in the form of signals and communication, to induce cooperation. Further, integrating elements of social evolutionary theory from evolutionary anthropology highlights the role of signaling to induce desired cooperative behavior on the part of intended receivers (Sosis & Alcorta, 2003). In purely competitive environments, signaling could reduce competitive advantages of the signaler. Yet, the use of such communication between social actors in entrepreneurial ecosystems becomes clearer in this light – signals for coordinating activities (Stam, 2015).

Implications for Practice

The present study highlights the role of communication for social actors in the entrepreneurial ecosystem. The definition of an EE emphasizes that all participants in the EE, from policy-makers, politicians, universities, firms, and (potential) entrepreneurs, are social actors and they are part of co-evolving population that rely upon one another and are affected by the decisions and actions of other social actors. As such, communication is important, both as a signaler and receiver of information, for all parties, as a mechanism to influence the actions of other social actors in ways that benefit the signaler by inducing cooperative behaviors. Social actors who ignore communication place themselves at risk of both losing out on potential partners and missing important signals about the EE itself. While identifying the appropriate signals can be difficult, due to many factors, it may prove rewarding if the signalers and receivers are calibrated.

Implications for Policy

As noted previously, communication matters, and this is especially true for those engaged in the formulation of policy. While the present study does not deal directly with the communication of policy, it does have implications for those engaged in policy formulation and implementation. Because many policies require those who would benefit to take some form of action to request the benefits of the intervention, communicating the presence and intentions of the policy to the intended recipients is crucial (Saiz, 2001). If no one knows what aid might be available, how it could benefit them, or how they can access it, entrepreneurial activity in the ecosystem can suffer. The study demonstrates that merely sending the signal is insufficient. Signals must be frequent, consistent,

and calibrated in terms of signal attributes and valence to successfully reach the receivers with the message intact. Lack of these factors of the signal results in a failure to induce cooperation with the policy-maker or intended partner and the policy may fail to be effective.

Organization of Dissertation

I have organized the dissertation as follows. In Chapter 2, I review the limited literature on entrepreneurial ecosystems and provide an integrated definition of the concept. Then I provide a multidisciplinary survey of related literature streams covering topics of importance for entrepreneurial ecosystem researchers, consistent with the definition I develop. In Chapter 3, I describe the key tenets and assumptions of social evolutionary theory and signaling theory. Then, I develop a model of signaling behavior in entrepreneurial ecosystems as it influences patterns of entrepreneurial activity in the form of new firm formations and firm failures. In Chapter 4, I describe my sample frame and data collection procedures, as well as the analytical techniques I employ to test the hypotheses developed in Chapter 3. In Chapter 5, I provide the results on my analyses and summarize the findings. Finally, in Chapter 6, I discuss the findings, the contributions, and implications of the present study.

CHAPTER 2: LITERATURE REVIEW

Chapter Overview

In this chapter, I have three primary goals. First, I will identify current definitions of the entrepreneurial ecosystem and describe some of their strengths and weaknesses, as well the overlaps and inconsistencies. Then, I will integrate the definitions for the purpose of this dissertation. While researchers generally agree on certain aspects of the definition, there are unresolved differences in other aspects which are relevant to the present study. Second, in the absence of a single, well-established literature stream focusing on entrepreneurial ecosystems, I will review the disciplines of economics, political science, sociology, management, and industrial ecology. The purpose of this survey of the literature is to highlight the components of entrepreneurial ecosystems which have been studied in prior research and to integrate insights from these diverse disciplines which seldom speak to or acknowledge the research of the other streams, due to the focus on their respective questions of interest, questions more aligned with discipline than with the phenomenon and development of the entrepreneurial ecosystem concept. Finally, I will provide a justification for examining the entrepreneurial ecosystem as a system, one in which all of the diverse perspectives should be considered because of their influence not just on the ecosystem as a whole, but also because of the influence each of them may have on each another.

Entrepreneurial Ecosystems

The literature examining entrepreneurial ecosystems was virtually non-existent ten years ago, when only a few case studies had been published about the emergence of Silicon Valley (Bahrami & Evans, 1995) and comparisons between Silicon Valley and Boston's Route 128 (Saxenian, 1996). A search of the Web of Science SSCI using '*entrepreneur**' and '*ecosystem**' identified only 14 papers prior to 2011, while 81 had been published by 2015 (Autio et al., 2015). As an emerging literature stream, there is little consistency or communication among the papers as yet, though a forthcoming special issue seeks to address some of these issues (Autio et al., 2015). Conversely, literatures on related topics such as economic geography (Krugman, 1991) and clusters (Porter, 1990) gained momentum and had been researched more consistently over the same time period (Beaudry & Schiffauerova, 2009). This recent work in the area of entrepreneurial

ecosystems still utilizes some case study methodology (Bosma & Hoevet, 2015; Marti, Courpasson, & Dubard, 2013), but has also begun to make comparisons between ecosystems (Parker, 2008), and to use large data sets, such as the Global Entrepreneurship Monitor (GEM) (Szerb, Acs, & Ortega-Argile, 2015) to conduct systematic research. Recent work has also theorized and studied the entrepreneurial ecosystems of nations (Isenberg, 2010; Acs, Estrin, Mickiewicz, & Szerb, 2014), regions (Duval-Couetil & Hutcheson, 2015; Fishman, O'Shea, & Allen, 2015), and cities (Watkins, Ozkazanc-Pan, Clark, & Motoyama, 2015) in both established economies such as the U.S. (Hechavarria & Ingram, 2014) and in emerging economies (Manimala & Wasdani, 2015). The increased interest in the topic has led to a proliferation of and inconsistency among definitions (Krueger, 2012; Stam, 2015).

While the term ecosystem was first coined by Moore (1993), one of the first definitions to emerge of the concept that would become the entrepreneurial ecosystem was, "a community of independent players that operate inter-dependently, that feed off, compete and collaborate with one another and that operate within a common climate (Bahrami & Evans, 1995)." The limitations of the definition are that it does not offer an explanation of why communities of players would compete or collaborate, it does not propose any particular outcome, and there is no explanation for how such a community would develop. This last point is particularly salient, because recent studies have been interested in how entrepreneurial ecosystems can be built.

More recent work has further developed and refined the definition of an organizational community or entrepreneurial ecosystem as:

> a set of co-evolving organizational populations joined by ties of commensalism and symbiosis through their orientation to a common technology, normative order, or regulatory regime (Aldrich & Martinez, 2010 p 408).

This definition explains that the population works together to a degree, through symbiotic relationships, and that the community develops around a common, shared technology or institution. The above definition also acknowledges the dynamic nature of entrepreneurial ecosystems through the process of co-evolution. Further, this definition allows researchers to identify the appropriate boundaries, stakeholders, inputs, and outcomes related to the study of an entrepreneurial ecosystem. Authors appealing to the non-academic audiences and policy-makers seeking solutions for economic development have utilized a similar definition to this one,

marketed as start-up communities, that suggest creating a technology base or regulatory regime in the form of incentives or university involvement in the ecosystems would be the appropriate base for building such communities (Feld, 2012).

Researchers have noted that the literature published over the last few years has generally failed to use a consistent definition of an entrepreneurial ecosystem, with some authors citing studies that either invoke the term as a buzz word or fail to define the term at all (Krueger, 2012) and other authors noting the definitions used across related literatures do not often speak to one another and thus have no shared definition (Stam, 2015). Further, a recent call for papers for a special issue notes that the theoretical underpinnings of the entrepreneurial ecosystem concept seem to be lacking (Autio et al., 2015). A recent critique of the concept noted three important issues that need to be resolved in many of the definitions in the literature: 1) that the definition of an entrepreneurial ecosystem many studies use is largely tautological because entrepreneurial ecosystems are defined as systems that produce entrepreneurs, 2) that many studies, for lack of a theoretical framework, provide laundry lists of relevant topics, and 3) that the appropriate level of analysis for an entrepreneurial ecosystem has not yet been identified (Stam, 2015). The critique synthesizes several approaches to entrepreneurial ecosystems in an effort to resolve the first and second points (Stam, 2015). The author highlights the importance of entrepreneurial activity value creation and economic growth, proposing that the ultimate outcome of an entrepreneurial ecosystem should be productive entrepreneurship, and any activities, even firm failures that result in net value creation for the ecosystem should be considered (Stam, 2015; Davidsson, 2005; Baumol, 1993). The definition proposed for an entrepreneurial ecosystem is "a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship (Stam, 2015 p 1765)." This definition addresses concerns about the tautological nature of the definition, in that productive entrepreneurship is defined as economic value creation (Stam, 2015). It also solves certain aspects of the laundry list approach in prior studies, in that these studies might be categorized as they relate to actors and factors (Stam, 2015). The definition still lacks a theoretical underpinning, however, being largely focused on integrating prior empirical work.

However, an examination of the definitions of entrepreneurial ecosystems, based on case studies (Bahrami & Evans, 1995), theoretical work from an evolutionary perspective (Aldrich & Ruef, 2006), and this integration of recent empirical work (Stam, 2015) yields certain insights and

commonalities. First, all of the definitions implicitly acknowledge the social nature of the actors in the ecosystem and indeed, theoretical work has identified entrepreneurship as an activity of social construction (Aldrich & Martinez, 2010). Second, there is consistency among the definitions in terms of interdependence and the need for coordination, or cooperation, in addition to an underlying assumption of some form of competition. What these definitions lack, however, is the logic for cooperative behaviors and the mechanisms through which the actors organize (coordinate) and cooperate. As such, I propose to integrate the definitions such that:

> an entrepreneurial ecosystem is a co-evolving population of interdependent social actors and factors coordinated (cooperating) ***through communication*** in such a way that they enable productive entrepreneurship (Baumol, 1993; Aldrich & Ruef, 2006; Stam, 2015).

This definition incorporates the logic for cooperation as productive entrepreneurship and the mechanism of cooperation and coordination as communication. Further, through the consideration of co-evolving populations of social actors, as well as the outcome of productive entrepreneurship, the definition addresses the dynamic nature of entrepreneurial ecosystems. Additionally, social actors and factors can refer to a broad range of entities, policies, institutions, culture, and can be incorporated into the examination and study of the ecosystem as a whole. The nature and definition of the outcome is also sufficiently broad that it allows the use of such ecosystem-level outcomes as firm formation, firm failure, or even regional growth. Finally, the definition also addresses the issue of level of analysis. To the extent that a co-evolving population of interdependent social actors can be identified for study, the definition provides justification for several levels of aggregation. Because this definition emphasizes the social nature of entrepreneurship and the systems in which they operate as social systems, the definition highlights a number of potential theories to explain what happens in the formation and change of entrepreneurial ecosystems, including institutional theory (Meyer & Rowan, 1991; Scott, 2000), social cognitive theory (Bandura, 2001), and social evolutionary theory (Margulis, 1971; Nowak, 2006). Further, because the definition also emphasizes communication as the mechanism for coordination, theories of communication, such as signaling theory (Spence, 1973; 1974), agenda-setting theory (McCombs & Shaw, 1978) and mass media theory (Bittner, 1977) could provide insight and explanations to develop our understanding of the phenomenon of entrepreneurial ecosystems.

In the following sections, I identify relevant topics of interest for entrepreneurial ecosystem research, the theoretical basis, level of analysis, and findings. Consistent with my definition of an entrepreneurial ecosystem, I also identify the relevance of the literature in terms of applicability to social actors, factors, communication, and cooperation. Topics of interest include: the definition and study of entrepreneurship (Shane & Venkataraman, 2000; Baumol, 1990), literature on agglomeration (Glaeser et al., 1992) and clusters (Porter, 1990), entrepreneurship policy (Gilbert et al., 2004), economic development policy (Bartik, 1991; 2015), resources (Barney, 1991), institutions (Thornton & Ocasio, 2012), media studies (Rindova et al., 2006), population ecology (Aldrich, 1990), and industrial ecology (Frosch & Gallopoulos, 1989; Korhonen, 2001). These relevant topics are drawn from economics (Krugman, 1991), sociology (Zucker, 1989), and communications (McCombs & Shaw, 1978), as well as from management studies (Aldrich & Martinez, 2010; Audretsch & Keilbach, 2004) and because many topics may be covered by more than one field, I organize them by concept.

Entrepreneurial Ecosystem Relevant Concepts

Entrepreneurship

The phenomenon at the heart of the entrepreneurial ecosystem concept is entrepreneurship, specifically productive entrepreneurship. To understand the impact of social actors, factors, and communication on entrepreneurship in an ecosystem, the concept must be defined. Further, because entrepreneurship does not occur without the actions of an entrepreneur, exploring the role of the entrepreneur is necessary. Entrepreneurs are social actors, situated in the entrepreneurial ecosystem, coordinating many activities and roles to create value through communication with other social actors in the ecosystem, and researchers have identified many of the activities and roles needed for success.

Researchers have used many definitions for entrepreneurship, including entry into new products or processes (Schumpeter, 1934; Baumol, 1993), entry into new markets (Lumpkin & Dess, 1996), the creation of new organizations (Gartner 1985; 1988) and new enterprise creation (Low & MacMillan, 1988). More broadly, entrepreneurship has been defined as the process of opportunity recognition (Shane & Venkataraman, 2000), a process in which entrepreneurs take advantage of opportunities through new combinations of resources (Wiklund, 1998), or pursue opportunities

without regard to their controlled resources (Stevenson & Jarillo, 1990). Opportunities are defined as "chances to meet market needs through creative combinations of resources to deliver superior value (Ardichvili, Cardozo, and Ray, 2003 p 108)." Opportunities, by this definition, include many activities that have been previously considered to be the focus of entrepreneurship besides just the creation of new businesses (Gartner, 2001).

Opportunity recognition is a process that has at least three key factors to consider, including the environment, resources, and the entrepreneur. All three factors contribute to the presence and recognition of unique, lucrative opportunities (Venkataraman, 1997). The environmental component of opportunities includes such factors as information availability and asymmetry (Ardichvili et al., 2003) as well as institutional factors relating to the legitimacy and desirability of a potential opportunity (Bruton et al., 2010). Institutional factors include whether entrepreneurship or innovation are viewed favorably, whether in the general environment or within a firm (Bruton et al., 2010; Shane, 2000; Hayek, 1945).). Legitimacy refers to the degree to which an entrepreneur's venture is accepted (Aldrich & Fiol, 1994) or has a right to exist in the environment (Suchman, 1995). Cognitive legitimacy is the degree to which a venture has become taken for granted, or become part of the landscape, while sociopolitical legitimacy is the degree to which key stakeholders accept the venture (Aldrich & Fiol, 1994). The legitimacy of the venture influences access to a range of important factors, such as support from government, funding, and resource access, as well as access to markets and customers.

Resources are important for the recognition and exploitation of an opportunity. From resource-based perspectives (Barney, 1991), resources should be rare, valuable, inimitable, and organized in order to provide a basis for capabilities (Hitt, Ireland, and Hoskisson, 2013). These capabilities arise from the unique combinations a firm or entrepreneur is able to imagine and implement and are then able to provide a basis for sustained competitive advantage to an organization (Hitt et al., 2013). The heterogeneity of resources across firms has been proposed as the true key to understanding superior performance among entrepreneurs (Alvarez & Busenitz, 2001; Alvarez & Barney, 2007). Several definitions of entrepreneurship highlight the role of resources (Wiklund, 1998; Stevenson & Jarillo, 1990).

The third component of the opportunity, according to Venkataraman (1997) is the entrepreneur, the individual responsible for recognizing the opportunity and taking the actions

that constitute entrepreneurship. Entrepreneurs are social actors engaged in a process of social construction, one in which they create a new social entity, a new venture based on an opportunity (Aldrich & Martinez, 2010). To recognize opportunities, entrepreneurs engage in information search (Cooper, Folta, & Woo, 1995) in which they leverage information from the environment (Archdivili et al., 2003) and from their personal networks through social capital (Baron, 2000; Westlund & Bolton, 2003). The purpose of the information search is to gain new information about such topics as customer needs, new technologies, or new markets (Archdivili et al., 2003). Entrepreneurs also receive information from other sources, in the form of coaching from incubators (Audet & Couteret, 2012) and information about entrepreneurship generally from the media (Aldrich & Yang, 2012). Entrepreneurs also need to coordinate activities and communicate to stakeholders in their venture, such as venture capitalists (Shepherd & Zacharaki, 2001; Balboa & Marti, 2007) or followers who participate in the activities of the venture (Baum, Locke, & Kirkpatrick, 1998; Michael, 2009).

Combining the environment, resources, and the entrepreneur, an opportunity is created. Because of the focus of the present study on the ecosystem-level of analysis, rather than the individual, and consistent with the definition of an entrepreneurial ecosystem, the present study uses the definition from the literature that has considered entrepreneurship to be the creation of new enterprise (Low & MacMillan, 1998) or new organizations (Gartner 1985; 1988). Other research has focused on entrepreneurship as a mechanism for innovation, the creation of new products or processes (Schumpeter, 1934; Baumol, 1993). These definitions overlap to an extent, but do not entirely cover the same set of phenomena, as some new ventures are not necessarily innovative. Similarly, new innovations do not necessarily result in new firm creation. Productive entrepreneurship, defined as economic value creation, can result from either form of entrepreneurship (Davidsson, 2005).

The role of entrepreneurship as the key outcome of entrepreneurial ecosystems research cannot be understated, thus examining research in entrepreneurship provides some insights that can be used in the study of ecosystems. Following Venkataraman (1997), I define entrepreneurship as opportunity recognition which incorporates the environment, resources, and the entrepreneur. Although other definitions of entrepreneurship and the intersection of the individual and opportunity vary significantly (Alvarez & Barney, 2007; Baker & Nelson, 2005; McMullen &

Shepherd, 2006; Sarasvathy, 2001), the definition of entrepreneurship relevant to this dissertation is one that identifies the importance of the environment, the entrepreneurial ecosystem, for the opportunity, in terms of information (Archdibili et al., 2003) and legitimacy (Aldich & Fiol, 1994). The research addresses the role of entrepreneurs as social actors engaged in the construction of new entities (Aldrich & Martinez, 2010) and the coordination and communication processes in which they engage to search for information (Archdivili et al., 2003; Cooper et al., 1995). Finally, the outcome of productive entrepreneurship was defined as new venture creation, one type of opportunity recognized, consistent with streams of research in the area of entrepreneurship (Gartner, 1985; Davidsson, 2005).

Agglomeration

Agglomeration research relates to the study of entrepreneurial ecosystems in at least three ways. First, agglomeration considers factors in the external environment and how they impact the performance of firms, including new ventures. Second, agglomeration research has examined the importance of the presence of both related and unrelated firms for the performance of firms in ecosystems. Other firms are key social actors with whom interdependencies may develop. Finally, the presence of knowledge spillovers as an explanation for firm performance benefits in this stream of research implies the importance and relevance of communication.

The focal research phenomenon of the field of economic geography is the spatial location of firms and economic activity (Krugman, 1991). While this literature has not always been a part of mainstream economics, it has nonetheless re-emerged as a thriving stream since relatively recent work has developed the theory of agglomeration and applied it to questions of firm (Audretsch & Feldman, 1996), cluster (Porter, 1990; Porter, 1998), regional (Baptista, 2000), and country economic performance (Isaksen & Onsager, 2010). Research in the area has additionally considered multiple performance measures, including growth (Glaeser et al., 1992; Rosenthal & Strange 2003), productivity (Almeida, 2006; Rao, 2004), and innovation (Feldman & Audretsch, 1999; Baptista & Swann, 1998). Recent reviews of the literature have found that there is broad consensus among published articles in the literature that agglomeration matters (Beaudry & Schiffauerova, 2009; McCann & Folta, 2008).

The literature on agglomeration can be categorized into two broad streams, based on the theoretical arguments, which tend to relate to the level of analysis being considered (McCann & Folta, 2008). The first stream examines the effects of agglomeration on diverse industries, seeking to explain why firms would choose to co-locate with unrelated firms, consistent with early work theorizing the existence of knowledge spillovers between industries and benefits to regions in terms of portfolio effects reducing vulnerability to environmental shocks (Jacobs, 1969; Montgomery, 1994; McCann & Folta, 2008; Beaudry & Schiffauerova, 2009). These types of effects, because they are external to the firms and industries benefitting, have been termed Jacobs's externalities (Jacobs, 1969). The theoretical argument for the mechanism of these externalities is that increased diversification increases spillovers between industries, which leads to more competition for resources, and that the increased competitive pressure increases the rate of innovation and technology adoption (Jacobs, 1969; Beaudry & Schiffauerova, 2009). Work in this area has tended to examine the regional level and has been less concerned with performance or competitiveness of firms, but rather the performance of the region (McCann & Folta, 2008).

The other literature stream in agglomeration research has focused more on the reasons that similar firms would choose to co-locate and the benefits they might derive from co-location (McCann & Folta, 2008; Beaudry & Schiffauerova, 2009). This behavior has been explained by factors exogenous to other economic actors in the region and by the endogenous creation of externalities (McCann & Folta, 2008). This framework was developed from the work of Marshall (1890), Arrow (1962), and Romer (1986) into the MAR (Marshall, Arrow, Romer) model of regional specialization (Glaeser et al., 1992). The exogenous factors proposed include access to factors of production that are regionally specific, such as natural resources (Marshall, 1920) and these factors have been found to explain certain types of agglomeration, such as those around natural transportation resources (e.g. navigable waterways) and resource deposits (e.g. coal deposits), although research has found that only about twenty percent of the variance can be explained by exogenous factors (Ellison & Glaeser, 1999; McCann & Folta, 2008). The endogenous creation of externalities, on the other hand, would be those benefits that accrue to a region such that the benefits are greater with the number of firms in the industry (Arthur, 1990; Marshall, 1920), for example labor market pooling and transaction cost reductions (Martin & Sunley, 2003; Beaudry & Schiffauerova, 2009).

Several interesting findings have emerged from agglomeration research that are of particular interest to the present study, beyond the agreement between both streams and prominent researchers that agglomeration matters (McCann & Folta, 2008; Beaudry & Schiffauerova, 2009). Research in both streams has overlapped to a degree, examining agglomeration at varying levels, including cities (Visser, 1990), MSAs (DeCarolis & Deeds, 1999), states and provinces (Shaver & Flyer, 2000; Baptista, 2000), and countries (Isaksen & Onsager, 2010) and the findings suggest that the level of agglomeration studied matters, such that the magnitude of the effect of agglomeration increases with smaller geographic units (Beaudry & Schiffauerova, 2009). Further, it appears that the effects of MAR and Jacobs's externalities differ according to industry characteristics. MAR variables have stronger influence on lower technology industries, while the MAR variables have been shown to hinder high technology industries under some conditions, although this may be an artifact of measurement inconsistency across studies (Beaudry & Schiffauerova, 2009; Frenken et al., 2005). Finally, Jacobs's externalities appear to have a positive effect across studies, but the effect is less pronounced in lower technology industries, meaning that some degree of the effects of a diverse region are important for all industries. These findings, among others, contribute to the literature on entrepreneurial ecosystems, especially the understanding of factors in the environment.

Clusters

The literature on clusters further develops the important relationships for entrepreneurial ecosystem research identified in the agglomeration literature, particularly the importance of related industries as social actors and for spillovers due to communication. Developed from the logic of agglomeration and economic geography, the cluster research differs from agglomeration in two ways (Porter, 1990; Lindqvist, 2009). First, a cluster is defined as a group of related industries and their supporting institutions, including non-market actors (Porter, 1990; Porter, 1998). Second, while agglomeration research views co-location as an outcome and influence on performance, cluster research has examined the mechanism through which the benefits of agglomeration accrue to clusters (Lindqvist, 2009). The appropriate unit of analysis for research in cluster research has been identified as the cluster, rather than individual firms or regions (Porter, 1990). Because of the specific definition of a cluster, research in this area has leaned toward economic policy and regional development policy (Porter, 1998; Lindqvist, 2009). This research has been focused on

the ways in which policy can influence and enhance the benefits of agglomeration for clusters (Delgado, Porter, & Stern, 2012; Porter, 2003). As evidence for the beneficial influence of clusters and to motivate policy decisions, other research has examined the effect of the presence of clusters on entrepreneurship (Delgado, Porter, & Stern, 2010), cluster innovation (Delgado, Porter, & Stern, 2014), and cluster economic performance (Porter, 2003).

The impact of cluster research has been in the area of policy (Martin & Sunley, 2003; Lindqvist, 2009). Because clusters encompass more than a single industry, capturing links between firms, spillovers, technology, skills, and other supporting institutions as well as non-market actors, clusters provide a basis for collective action and government intervention (Porter, 2000). This has led to the development of numerous public-private partnerships to foster cluster development and improvement (Ketels, Lindqvist, & Solveil, 2006) and has led some researchers to conclude that the cluster concept has become a fad (Martin & Sunley, 2003). Cluster initiatives attempt to strengthen the relationship between agglomeration and the effects of proximity to other firms by increasing the number of firms and thus generating greater benefit from exogenous factors of location decision, as explained under the logic for agglomeration benefits (Arthur, 1990).

Research using the cluster concept as a proxy for agglomeration has found that firms in clusters have increased performance (Kukalis, 2009) and innovation (Bell, 2005). Other research in the area has suggested that firms in clusters perform better as a group than firms in other locations (Tallman et al., 2004). An interesting finding related to the present study is that regions with industry clusters may see higher failure rates but that the failure rates are offset with higher firm births (Sorenson & Audia, 2000). The cluster research also strengthens the role of non-market actors that support the related industries of the cluster indirectly. While the research in this area has examined the role of government and public-private partnerships, this same logic provides a basis for exploring the role of other non-market actors, including the media. Such public-private partnerships highlight the influence of social actors in the environment other than firms.

Entrepreneurship Policy

Research in the area of entrepreneurship policy focuses on the role of the government for the entrepreneurial ecosystem, both as an independent social actor, and as a facilitator for cooperation and communication. As a social actor, governments directly interact with other actors

in the ecosystem. As a facilitator, government can intervene with incentives to cooperate or share information. Further, governments can enact policies that influence the relationship between other social actors and environmental factors, from resource access to institutions.

From the neoclassical economics perspective, no role for entrepreneurship exists, because of the assumptions of perfect competition and the expectation that markets will reach equilibrium (Baumol, 1990; Kirzner, 1997). However, other schools of thought in economics examine entrepreneurship and economic activity (Knight, 1921; Schumpeter, 1934; Hayek, 1945; Baumol, 1990). Austrian economists theorize that entrepreneurs are the engines of the economy, agents seeking to learn more about the preferences of other actors under conditions of imperfect knowledge, leading to continual change in the preferences of all market actors as the market tries to reach an equilibrium which cannot be achieved (Kirzner, 1997; Hayek, 1945). Other economists, not of the Austrian school, also recognized the importance of entrepreneurship for economic activity, proposing that entrepreneurs are those individuals who are willing to bear uncertainty and thus profit as a reward (Knight, 1921), while others focus on the difference in motivations of entrepreneurs, given equivalent perceptions (Schumpeter, 1934).Theorists have made efforts to reconcile the differences between these perspectives and entrepreneurship is widely recognized by economists as an important process (McMullen & Shepherd, 2006).

Empirical research in the area of entrepreneurship has covered a diverse range of economic outcomes, including unemployment rates (Tervo, 2006), individual maximization decisions (Parker, 2004), personal characteristics of entrepreneurs (Djankov et al., 2006), and social capital (Minniti, 2004). An area of entrepreneurship research that has studied regional impacts, specifically, has been research concerning the knowledge spillover theory of entrepreneurship, which has investigated the impact of entrepreneurship on regional innovation, in which knowledge spills over between individuals who then engage in entrepreneurship, increasing regional economic growth (Audretsch & Keilbach, 2004, 2005; Audretsch, Bonte, & Keilback, 2008). The consensus of entrepreneurship policy research has demonstrated the impact of entrepreneurship on employment, productivity, and innovation, as well as generating the spillovers, particularly due to start-up activity in cities and regions (Acs & Armington, 2006; Fritsch, 2004). Such research leads to prescriptions for increasing entrepreneurship and entrepreneurial activity in regions as a mechanism for improving economic growth (Gilbert et al., 2006).

The economics literature and research on the topic of entrepreneurship most relevant to the present study is in the area of entrepreneurship policy. Combining insights from the findings of various streams of economics literature, including agglomeration (Glaeser et al., 1992), clusters (Porter, 2003), and knowledge spillovers (Acs & Armington, 2006; Audretsch & Keilbach, 2004), entrepreneurship policy literature both makes recommendations for leveraging these mechanisms to increase innovation and entrepreneurship for regional growth and assesses the degree to which such policies are effective (Gilbert et al., 2004). Economic policy research has examined the effectiveness of policies at various levels of government, including city (Sternberg, 1996), state (Braunerjhelm & Carlsson, 1999), and federal interventions (Lerner, 1999) in the U.S. (Lugar & Goldstein, 1991; Saxenian, 1994) and worldwide (Kim & Nugent, 1999; Acs et al., 2014).

Entrepreneurial policy research has further identified channels through which entrepreneurship policy operates to influence decisions made at the individual, industry, and regional levels (Audretsch, Grilo, & Thurik, 2007). According to this research, a policy falls into one of six broad categories, depending on which aspect of the entrepreneurial ecosystem it influences (Carree, van Stel, Thurik, &Wennekers, 2007). Policy can increase the 1) demand for entrepreneurship (e.g., technology transfer policies), 2) the supply of potential entrepreneurs (e.g., immigration policy), 3) the knowledge, skills, and abilities of potential entrepreneurs (e.g., training programs), 4) the preference of individuals to pursue entrepreneurship (e.g., values and attitudes about entrepreneurship), 5) the attractiveness of entrepreneurial vs. non-entrepreneurial decisions (e.g., taxation policy benefitting self-employment), and 6) the market access for potential entrepreneurs (e.g., property rights protections) (Audretsch, Grilo, & Thurik, 2007; Thurik, 2009). The conclusion has been that it is the portfolio of policy decisions, rather than any particular policy that influences the development of entrepreneurship in a region (Thurik, 2009). All of these mechanisms are also related to the role of the government as either a social actor or facilitator in the entrepreneurial ecosystem, whether influencing cooperation, communication, or factor access.

Economic Development Policy

Economic development policy literature explores additional and alternate mechanisms through which the government takes social action and acts as a facilitator. In addition, this literature also explores the role of individual politicians and the public as social actors with

influence on entrepreneurial ecosystem decisions and actions. Separate from, yet complementary to entrepreneurship policy, is the study of economic development policy, a stream of literature from the discipline of political science. Political scientists study the effects of political activities and political behaviors, including politicians and governments, as well as the outcomes of such activities, from their influence on public opinion to the performance of the economy as indicated by growth and employment (Vaughn, Pollard, & Dyer, 1985). Theories of political science regarding the role of government in fostering economic development emphasize the role of voting, interest groups, public opinion, and bureaucracy on these decisions (Bartik, 1991). Economic development policies contribute to the business climate either because they provide direct assistance to firms or indirectly change conditions (e.g., public schools) (Bartik, 1991). Economic development policy research linked to economic performance of the region has focused on direct interventions. These direct policies have been further categorized into traditional and entrepreneurial approaches.

Traditional approaches tend to focus on attracting outside businesses to a region through marketing, financial incentives, and non-financial incentives and have been called smoke-stack chasing policies (Daneke, 1985; Bartik, 1994). Entrepreneurial approaches focus on improving the local capital markets, education for small businesses, research, and other non-financial assistance, to grow business from within the region (Bartik, 1991). In spite of findings that traditional approaches do not often result in long-term economic growth or benefits for the region, such approaches are easier for politicians to understand, to employ, and to explain to voters (Wolman, 1988). Political science research has found that these visible public figures are evaluated by their constituents on easy to understand information, especially job growth and unemployment, rather than on regional output or more abstract measures of economic growth (Bartik, 1991; Bartik, 2015).

In seeking to understand why traditional policies for economic development fail in their growth goals, political scientists explicitly acknowledge the trade-offs and costs associated with economic development, costs related to supporting a larger population of individuals and firms demanding services and utilizing infrastructure (Wolman, 1988). Indeed, the literature in political science has found that economic development policies are inherently risky for political actors, because they do not know whether benefits will exceed costs when they implement policies (Reigeluth, Wolman, & Reinhard, 1980). As the paradigm of local government has shifted to the point where urban and state governments now compete to attract firms, governments have chosen

to offer additional incentives and the larger these incentives to attract firms and increase jobs, the less likely the region is to see benefits (Wolman, 1988; Bartik, 2015).

Perhaps the most important contribution of economic development policy literature to the topic of entrepreneurial ecosystems is the acknowledgement that, in spite of objective criteria measuring increases in innovation, social benefits, and per capita income of economic development policies, the decision-makers rely primarily on job creation and employment as an indicator of success (Bartik, 2011). Convincing voters and politicians of the importance of certain types of policies is perhaps as important as identifying and implementing effective policies. Voters and politicians are important social actors for the entrepreneurial ecosystem, actors largely ignored in other research streams, and they are actors whose decisions and judgments can have disproportionate impacts on entrepreneurship in an ecosystem through changing rules and access to factors.

Resources

In entrepreneurial ecosystems, resources are the factors of production available for the production of goods or services by current and potential entrepreneurs. As such, they are the quintessential factors of the entrepreneurial ecosystem definition. Research into agglomeration and clusters has identified resource availability as a benefit of co-location of firms (Glaeser et al., 1992). In the structure-environment-performance paradigm, resources are assumed to be largely homogenous among firms (Porter, 1981). From this perspective, resource heterogeneity, if it developed, would quickly be eliminated by the market because resources were assumed to be immobile (Barney, 1991). An alternative to this perspective, the resource-based view (RBV), assumes that resources are mobile and heterogeneous across firms (Barney, 1991). It is through leveraging asymmetrical resource bundles that firms are capable of creating sustainable competitive advantage and thus provide above-average returns to shareholders (Sirmon, Hitt, & Ireland, 2007). Under RBV, resources are capable of contributing to sustained competitive advantage when they are valuable, rare, inimitable and non-substitutable (Barney, 1991). Valuable resources are those that allow firms to increase efficiency or effectiveness. Rare resources are not homogenous among competitors and do not have near substitutes, hence they are non-substitutable. Inimitability may be the most interesting dimension of a resource, because of the importance of causal ambiguity, meaning that a firm, itself, might not fully understand its resource (King, 2007; Reed & DeFillippi,

1990). Firm location within a particular ecosystem affects resource access, from natural resources (Marshall, 1920) to knowledge (Glaeser et al., 1992).

Ecosystem resources may follow assumptions of either the structure-environment-performance paradigm or the RBV, depending on the characteristics of the resource. For the individual firms operating in the industry, however, these ecosystem resources may be taken-for-granted characteristics of the environment. Infrastructure improvements, including roads or high-speed internet availability, offer ecosystems advantages over competitors, and are highly immobile between ecosystems, while firms in the ecosystem have equal access to them. Human capital in the ecosystem, improved through the quality of education and presence of institutions of higher education, moves between ecosystems more freely, as well as moving freely between firms in the ecosystem. Thus, decision-makers managing the ecosystem often face a problem known as the tragedy of the commons in choosing which resources to develop. These resources contribute to the public good and are expensive to develop and maintain, however the benefit of the resources can be reaped unequally by constituent groups, or not at all.

Transforming these resources into performance, whether through economic growth or additional jobs, requires action as the mere possession of resources does not contribute to superior performance (Priem & Butler, 2001). Ecosystems depend on successful firms to determine their own performance, thus knowledge of how these resources are utilized is relevant for ecosystems. Resource management, or orchestration, proposes the mechanisms through which resources are transformed into superior performance, because, contrary to some arguments, the actions necessary are not self-evident (Sirmon et al., 2007; Sirmon et al., 2011). The dynamic resource management model proposes three types of actions for resource management, structuring the resource portfolio, bundling resources to form capabilities, and leveraging capabilities to exploit market opportunities (Sirmon et al., 2007). If a firm possesses resources and effectively manages them, they should have superior financial performance. Research supports the idea that superior sustained performance extends from resources (Wiggins & Ruefli, 2002) and that they explain at least some of the variance in firm performance (Crook et al., 2008). Following this logic, resources should also explain a degree of the performance for ecosystems, mediated by the performance of firms, although with the added costs ecosystems incur for maintaining public goods, the relationship may not be as strong.

The development and utilization of resources incurs a cost for the entrepreneurial ecosystem. The cost can be financial for resources such as public transportation or hi-speed internet service. In other cases, the cost may be environmental, such as with the extraction of resources or the pollution associated with manufacturing. For the ecosystem, opportunity costs are also important to consider, because resources currently engaged by firms may be unavailable for entrepreneurship. Resources that are highly mobile are also subject to the tragedy of the commons, in which an ecosystem's activities have developed these resources, but then the ecosystem does not benefit from them because they leave (Hardin, 1968, 2009; West et al., 2007). Human capital development, such as investment in higher education, typifies this problem for ecosystems. An educated workforce benefits high quality, high technology ventures, however the education they received also creates more opportunities for the workers and provides them with higher levels of mobility (Maston, 1985). It is vital for ecosystems to develop resources and also to maintain resources within the ecosystem.

Entrepreneurial Culture

For the purposes of the present study, entrepreneurial culture encompasses a set of related constructs in the literature at the ecosystem level that triangulate on the socially constructed environment of the firm, including an entrepreneurially-supportive regional culture (Beugelsdjik, 2007), entrepreneurial capital (Audretsch & Keilback, 2004), and entrepreneurial social infrastructure (ESI) (Flora et al., 1997). These constructs are grounded in a rich history of research into values, norms, and beliefs, all of which contribute to and shape the interpretation of the environment by potential entrepreneurs. Entrepreneurial culture influences the perceptions of social actors in the entrepreneurial ecosystem about entrepreneurial action. It can also play an important role in shaping aspects of the environment that would be included under factors, such as institutions, norms, and beliefs. Finally, entrepreneurial culture may affect the desirability of cooperation and communication among social actors in the entrepreneurial ecosystem.

Entrepreneurship capital includes institutions, policies, demographics, history, and a host of other sociological factors (Audretsch & Keilbach, 2004). Entrepreneurship capital, constructed through social interactions of actors in the environment, develops social networks and a sense of belonging and trust which facilitate the transfer of knowledge and leads to higher levels of start-

up activity as entrepreneurs innovate and create firms almost as a by-product of their innovation (Audretsch & Keilbach, 2004). Sociologists aggregated individual-level opinions and argue that these beliefs, combined, reflect the entrepreneurial social infrastructure (ESI) of an entrepreneurial ecosystem (Flora, Sharp, Flora, & Newlon, 1997). Basing the argument on collective action by the community to facilitate economic growth, these scholars argue that ESI facilitates the legitimacy of entrepreneurship, mobilization of community resources for entrepreneurship, and improves networks of entrepreneurs (Flora et al., 1997). The definition of entrepreneurial capital and the definition of ESI both acknowledge the social construction of many important aspects of the environment of the individual entrepreneur.

Another area of research has concentrated on linking work at the country level to regional level culture, specifically through utilizing dimensions of a national culture scale theoretically relevant to entrepreneurship (Hofstede, 2001; Beugelsdijk et al., 2013). Related research has developed a definition-agnostic scale of entrepreneurial culture based on archival data, through identification of the differences in responses between entrepreneurs and non-entrepreneurs on a national values scale (Beugelsdijk, 2007). Although such a measure is certainly valuable and was demonstrated to relate to economic growth, it neglects the importance of the views of non-entrepreneurs for entrepreneurship in a region as well (Beugelsdjik, 2007).

Research in this area has been critical of the perceived failure of past research to theoretically identify the specific mechanisms through which entrepreneurial culture influences business formation and economic growth of ecosystems (Beugelsdijk, 2007). This research suggests that entrepreneurial culture may create conditions for economic dynamism, including increased variety, competition, and innovation, which then lead to economic growth (Carree & Thurik, 2003). Support for this link has been found in research identifying a relationship between the presence and size of a creative-class and firm creation (Florida, 2002), as well as research linking new firm formation rates to regional entrepreneurial values (Davidsson, 1995). Research in ESI linked dimensions of legitimacy of alternatives, resource mobilization as a collective, and network quality to economic growth, using the aggregate of individual survey responses, suggesting that these are potential indicators of entrepreneurial culture (Flora et al., 1997). Studying entrepreneurial culture across a broad range of contexts requires measuring it quantitatively, and the research to date has made excellent progress in this direction.

Research has provided evidence for the shift in culture over time, although the specific mechanisms and expected directionality are not well understood (Beugelsdijk et al., 2013). When considering the signs and artifacts that embody entrepreneurial culture, the mechanism for intentional shift seems clearer. Research demonstrates a link between public opinion and changes in policy, although this literature also shows a distinct delay in how quickly policy changes (Phillips, 2013). Because culture has enduring qualities, shifts in one sign alone will only move it so far, and such a delay or resistance would be expected. And of course, the role media plays in the convergence of cultures internationally has received considerable attention (Jenkins, 2006). The media introduces new stories and myths as signs and also has the potential to shape their interpretation. When signs pertaining to entrepreneurial culture shift in multiple domains at once, and in the same direction, reinforcing one another, the entrepreneurial culture should move more rapidly in that direction. The preferred components of entrepreneurial culture include signs encouraging acceptance and legitimacy of alternatives (Flora et al., 1997; Aldrich & Martinez, 2011), collective action (Flora et al., 1997), and favorable network and social interactions (Flora et al., 1997; Audretsch & Keilbach, 2004).

Legitimacy of alternatives refers to the degree to which an entrepreneurial culture exhibits openness to discussion of new ideas, individuals not taking discussion personally, and focusing on process as opposed to solutions (Flora et al., 1997). These types of entrepreneurial cultures make it easier for new firms to attain cognitive legitimacy, the acceptance of new ventures as a normal event, and sociopolitical legitimacy, the acceptance by entrepreneurial ecosystem stakeholders of the new venture as appropriate (Aldrich & Fiol, 1994). Research has further identified two domains of sociopolitical legitimacy: moral acceptance, or the conformation to norms and values, and regulatory acceptance, or the conformation to rules and regulations (Aldrich & Martinez, 2011). Entrepreneurial cultures should have lower thresholds of acceptance for new ventures in many of these areas, easing their births. Collective action refers to the mobilization of community resources toward community support and development and the degree to which a community and individuals in the community are willing to support public goods (Flora et al., 1997). Entrepreneurial cultures support public goods and focus on the development of resources for the benefit of the community, although the source of the backing can be from public or private sources,

depending on the ecosystem, (Flora et al., 1997). The development of these resources contributes to entrepreneurship as described previously.

Entrepreneurial cultures also encourage favorable network qualities that facilitate the transfer of information and knowledge among diverse groups, and include diversity of community networks for each individual, inclusivity, horizontal linkages to other communities, vertical linkages (to regional, state, and federal governments), and broad definitions of community with permeable boundaries (not insular, essentially) (Flora et al., 1997). Diverse individual networks allow more people to bridge structural holes with their weak ties (Granovetter, 1974; Flora et al., 1997), while inclusivity leads to a broader range of backgrounds and perspectives in the network. Linking to other communities, working with higher tier governments, and broadly defining the boundaries of the community all increase network size and access, resulting in better chances for knowledge spillovers (Audretsch & Keilbach, 2004), partnerships, and mobile resource acquisition (Flora et al., 1997).

The most important findings of entrepreneurial culture research are in the impact culture can have on entrepreneurship. Entrepreneurial culture encourages individuals to ask questions of current processes and look for improvements. Entrepreneurial culture rewards those who take risks and pursue opportunities, awarding approval in the form of stories and accolades, financial rewards for success to reinforce behaviors, and power in the community through unofficial or official means. Entrepreneurial culture encourages autonomy and institutions and the bureaucracy of an ecosystem will likely reflect this with lower impediments and fewer regulations. As such, entrepreneurial culture mainly fits firmly into the factors, as far as the definition of an entrepreneurial ecosystem.

Institutions

Research in this area related to entrepreneurial ecosystems may touch on rules and regulations, as well as legitimacy of entrepreneurship, all of which are factors of the entrepreneurial ecosystem. These factors may influence the rules of communication and cooperation, the norms among social actors, and the perceptions about such activities as cooperation among actors.

Institutional theory addresses the setting and environment in which entrepreneurship occurs, including the basis for establishing and evaluating legitimacy of entrepreneurship (Tolbert

et al., 2011). Institutions consist of cognitive, normative, and regulative structures and activities providing stability and meaning to social behavior (Scott, 2000). Institutions are transported by various carriers – cultures, structures and routines – and they operate at multiple levels (Scott, 2000). Regulative structures establish rules, review conformity to the rules, and levy sanctions to influence future behavior (Scott, 2000). Normative structures introduce prescriptive, evaluative, and obligatory dimensions into social life, including values and norms, while cognitive structures frame the nature of reality and the ways in which meaning is created (Scott, 2000). These structures influence behavior through pressures to conform and to seek legitimacy.

Organizations are legitimized if they conform to expectations and yield to coercive, normative, and mimetic pressures (DiMaggio & Powell, 1991; Meyer & Rowan, 1991). Coercive isomorphism stems from formal and informal political influence and legitimacy, defined as the pressures experienced by organizations from other organizations or the overall organizational field to act in a certain way (DiMaggio & Powell, 1991). Mimetic isomorphism occurs when an organization mimics what other organizations do, often as a response to environmental uncertainty (DiMaggio & Powell, 1991). Organizations model their own behavior after that of successful firms in an attempt to capture similar success. Normative isomorphism emerges with increasing professionalization, the codification of specific trades or disciplines, which then influences those practicing within an organization (DiMaggio & Powell, 1991). Similar human capital inputs as a result of similar education or participation in professional network activities lead to similar organizational structures (DiMaggio & Powell, 1991). Researchers in this area highlight the limitations of the current literature, including a focus on culture, single-country studies, and a lack of consistency among streams of institutional theory being applied to entrepreneurship (Bruton et al., 2010). To better understand how institutions change, a new perspective emerged in the form of institutional logics.

Institutional logics are socially constructed patterns and rules of behavior that provide meaning to interactions (Ocasio & Thornton, 1999; Thornton et al., 2012; Thornton, 2002). This comprehensive definition incorporates the symbolic, normative, and structural aspects of institutional logics, corresponding to the three pillars of institutional theory (Scott, 1987) as well as synthesizing previous definitions (Jackall, 1988; Friedland & Alford, 1991; Townley, 1997). The institutional logics perspective, as a meta-theory (Thornton, Ocasio, & Lounsbury, 2012), offers

insights into how institutions at the societal level create underlying logics that guide the activities of organizations, lead to change, and not only explain how isomorphism exists, but heterogeneity in organizations as well (Thornton & Ocasio, 2008).

Different sources provide institutional logics, as identified by a typology of seven institutional orders: markets, corporations, professions, states, families, communities, and religions (Friedland & Alford, 1991; Thornton, 2004; Thornton et al., 2012). Each of the institutional orders consists of a set of taken for granted rules and norms, has an economic system, its own sources of legitimacy, learning mechanisms, control mechanisms, an organizational form, and logic of exchange (Thornton et al., 2012). Institutional orders serve as sources of rationality for individuals and organizations, such that it is no longer necessary for those using institutional logics, rather than institution theory, to suppose that isomorphism would be expected (Townley, 2002). Institutional logics may also develop at multiple levels, not just society-wide, often taking shape given activities at the society-level (Bhappu, 2000; Haveman & Rao, 1997).

Because the institutional orders often interact through the material and cultural perceptions of individuals and organizations, the orders are actually interdependent. The interplay of the material and cultural aspects are often interpreted through the lens of the particular institutional logic being employed by an individual, organization, or field at a particular time (Thornton & Ocasio, 1999). Various institutional orders may have more influence over the course of time (Lounsbury, 2002; Thornton & Ocasio, 2008). Research specific to the context of entrepreneurship has advanced the idea that the market logic is an entrepreneurial logic, and that the interaction of this entrepreneurial logic with other logics results in varying norms about entrepreneurship across contexts and individuals (Miller et al., 2011). The perspective has also been applied to the emergence and legitimization of types of entrepreneurship, such as that of social entrepreneurship (Nicholls, 2010).

Entrepreneurial ecosystems research must acknowledge the importance of institutions for the many effects they have on entrepreneurial activity. Findings indicate that institutions play key roles through normative, regulatory, and cognitive factors contributing the perceptions that entrepreneurship is a legitimate, desirable social outcome (Aldrich & Fiol, 1994). Recent work investigating the process of institutional change and the interaction of logics reinforces these conclusions. They play an important role, not only as factors, but for how they affect communication and cooperation among social actors in the entrepreneurial ecosystem.

Media Studies

The media acts as a conduit for communication in the entrepreneurial ecosystem and can also act as a non-market social actor as well. Communications theory in this area highlights the influence the media can have on directing public attention and shaping public perceptions (McCombs & Shaw, 1978). Previous studies have highlighted the importance of the media as an information mediator or infomediary, affecting sense-making processes and evaluations by organizational stakeholders (Deephouse, 2000; Pollock & Rindova, 2003), as well as providing a conceptual model for how media might influence entrepreneurship (Aldrich & Yang, 2012), and at least one study has examined the influence of mass media on entrepreneurial activity at the national level (Hindle & Klyver, 2007). Prior research has shown that media coverage of topics shapes public perception through several mechanisms, including the volume or number of articles in which a particular issue, organization, or industry is mentioned has been to shape public perception (Pollock & Rindova, 2003).

Research has related increased media attention to increases in organization and industry social approval, including legitimacy, reputation, and celebrity (Deephouse, 1996; Deephouse & Carter, 2005; Pollock & Rindova, 2003; Rindova, Pollock, & Hayward, 2006; Westphal & Deephouse, 2011; Zavyalova, Pfarrer, Reger & Shapiro, 2012). This line of research also examined the effect of media coverage on measures of organizational performance, including market share and financial performance (Deephouse, 2000), organizational survival (Rao, 1994) and IPO pricing (Pollock & Rindova, 2003).

In the area of entrepreneurship, conceptual papers have suggested that a link exists between stories of entrepreneurs portrayed in the media and the creation of wealth (Lounsbury & Glynn, 2001). This research has suggested that such stories mediate the relationship between available resources, entrepreneurial and institutional, and entrepreneurial identity and legitimacy. Other research in this area has looked at how media can affect the formation and legitimacy of industries (Navis & Glynn, 2010), the decision of entrepreneurs to enter new industries (Sine, Haveman, & Tolbert, 2005), and even the effect that media coverage can have on the success of entrepreneurial ventures in new technology areas (Benjamin et al., 2016). The effect of media on entrepreneurship has generally been theorized as altering perceptions of institutional legitimacy (Sine et al., 2005; Navis & Glynn, 2010; Aldrich & Yang, 2012) through changing public perceptions and attention

(McCombs & Shaw, 1978). Thus, the media is a social actor, a conduit for communication, and can affect the perceptions of coordinating and cooperating activities.

Population Ecology

In many ways, the population ecology literature aligns closely with the entrepreneurial ecosystem definition. The influence of the external environment, in terms of the factors, is important for both literatures. In addition, population ecology has often taken a population level approach and utilized evolutionary theory to explain behavior. Thus the definition of an entrepreneurial ecosystem draws heavily from population ecology.

Population ecologists have considered the questions of why and how organizations change over time and how new organizational forms emerge (Hannan & Freeman, 1977; Aldrich & Martinez, 2010). Researchers and theorists in this stream of literature rely primarily on the precepts of evolutionary theory to explain processes of change (McKelvey & Aldrich, 1983; Aldrich, 1979). As a theory of change, evolutionary theory explains how variation and adaptation behavior of individuals and firms leads to superior performance and thus their selection over their competitors, and then how these superior behaviors diffuse throughout a species, as only those firms with the superior behavior are retained while others fail (Aldrich 1979; Aldrich & Ruef, 2006). Although the theory explains change at individual, species, and population levels, the effects are most easily observed and measured at the species level, thus studies in this area have focused primarily on the species level of analysis, examining the change in species of firms over time (Carroll & Hannan, 1989; Lomi, 1995), although more recent studies have considered changes in firm characteristics (St-Jean, LeBel, & Audet, 2010; Cardozo et al., 2010).

Early studies examined the influences of environmental characteristics such as institutions (Carroll & Hannan, 1989) and legitimization (Barnett & Carroll, 1987) on the population distribution of firms in industries, finding that characteristics such as population density influenced the formation and failure of firms (Aldrich, 1990). The mechanisms of action proposed for population density were many, including the increase in knowledge density, social network contacts, and higher propensity for collective action with higher population density of firms (Aldrich, 1990). Criticisms of the population approach, however, called for further investigation into the socio-political elements contributing to legitimization (Powell, 1995). The link between legitimization

and population ecology outcomes has been explored, leading to research synthesizing institutional and population ecology approaches (Carroll & Hannan, 1989; Zucker, 1989).

Population ecologists are often interested in the births and deaths of firms and this creates a natural overlap between population ecology and entrepreneurship, especially in the case of entrepreneurship researchers interested in the importance of the environment (Low & MacMillan, 1988; Breslin, 2008). Entrepreneurship research utilizing the population ecology perspective examines the influence of the environment on populations of entrepreneurial firms (Breslin, 2008). Entrepreneurship research in the area has examined various relationships and individual mechanisms of the approach for entrepreneurship, including variation (Aldrich, 1999; Aldrich & Martinez, 2001), selection (McKelvey, 1982; Aldrich & Martinez, 2001; Delacroix & Carroll, 1983), and retention (Aldrich & Fiol, 1994). The streams also overlap in the consideration of the importance of legitimization, due in part to institutional theory studies that have combined them.

Most relevant to the present study, the importance of location dependencies was also identified, as well as heterogeneity between firms in different spatial and temporal locations (Hawley, 1986; Baum & Mezias, 1992; Lomi, 1995). Studies in the area had identified the level of aggregation as an important factor in the determination of effects, finding that city-levels seemed insignificant in some studies (Carroll & Wade, 1991), while regional or state aggregation was significant (Carroll & Wade, 1991; Hawley 1986; Lomi, 1995). Spatial location was found to be an important predictor of both births and survival (Lomi, 1995). Mechanisms of legitimization, the evolutionary processes that have been investigated and linked to actual phenomena, as well as the utilization of population-level measures of firm birth and survival also bear importance for the present study.

Industrial Ecology

From the system approach, to the relative newness of the field, industrial ecology and entrepreneurial ecosystems have several commonalities. The definition of an industrial ecosystem incorporates systems of people as social actors, for example, and similar to the definition of an entrepreneurial ecosystem, the definition of an industrial ecosystem acknowledges the dynamic nature of both the ecosystem and the outcomes. As a relatively new paradigm to the analysis of industrial systems, industrial ecology emerged from multidisciplinary approaches to studying industrial-environment interactions (Frosch & Gallopoulos, 1989; Lifset & Graedel, 2002). While

the primary focus of the field is on manufacturing and product design, researchers also situated their studies in the natural world and use the guidelines of studies in natural ecosystems to enhance their understanding and prescriptions for industrial ecosystems (Ehrenfeld, 2000). This approach is facilitated by several assumptions - 1) organizations are systems of people, and these systems must function within the constraints of the local ecosystem, 2) the dynamics and principles of natural ecosystems provide valuable insights, 3) high material and energy efficiencies generate competitive advantages and economic benefits, and 4) the ultimate source of advantage is the long-term sustainability of the natural ecosystem in which industry is situated (Lowe & Evans, 1995). The first assumption influences the variety of methodological choices, in that systems modeling approaches considering all aspects of the industrial ecosystem are the preferred method of analysis (Ehrenfeld, 2000). The second assumption influences the prescriptions for industrial ecosystem design because of the mechanisms identified in natural ecosystems. The third and fourth assumptions influence the goals and outcomes of researchers in this area.

The natural ecosystem principles applied to best design for industrial ecosystems include roundput, diversity, locality, and continuous change (Korhonen, 2001). Roundput in the industrial ecosystem is used to describe both the flow of energy and the use of materials by firms, such that waste materials used by one firm are used as inputs by other firms. Conceptual work investigating firm strategy in industrial ecosystems has identified the strategic benefits of firms engaging in roundput to be primarily through the reduction of costs of resources and increasing efficiency (Esty & Porter, 1998). Firms either increase the value of their available resources or find ways to lower the effective costs looking within the firm, within the value chain, or outside the value chain (Esty & Porter, 1998). Ecosystem diversity carries benefits analogous to biodiversity, in that the range of actors and interdependencies leads to more opportunities for cooperation and greater exchange of information, not unlike those benefits of economics literature on agglomeration (Jacobs, 1969). As diversity increases, the range of potential inputs and outputs for firms increases, leading to more opportunities for efficiencies (Korhonen, 2001). Locality describes the effect of the local environment on the adaptation and decisions of firms, which are locally situated and are constrained by geographic conditions, such as natural resource access or transportation infrastructure (Korhonen, 2001). Finally, this research assumes that change is continuous, often gradual, and can occur in institutions, culture, and among actors (Ehrenfeld & Gertler, 1997).

Because industrial ecology considers the system and all of the actors as situated within the natural systems, all of the principles of natural systems apply.

Research in the area of industrial ecology, using the above principles and guidelines as theoretical insight and explanation, has mostly developed in the direction of case studies and theoretical modeling at present and a systematic analysis across industrial ecosystems has not been conducted. However, the case studies and models do yield interesting results and avenues for future research. Research has examined the roles of firms and technology. Firm in industrial ecosystems exhibiting the best practices following the IE principles have been observed to act as policy-makers, rather than policy-takers, going beyond basic expectations of participation by stakeholders (Ehrenfeld, 2000; Socolow, 1994). Technology serves to enable efficient use of resources and to solve ecosystem problems and challenges (Ausubel & Langford, 1997; Lifset & Graedel, 2002). Further, a role for entrepreneurship has been identified in the research as well, because entrepreneurial activity enhances and increases the carrying capacity of the environment (Lowe & Evans, 1995).

Industrial ecology, as a new paradigm, has the potential to lend several findings and principles to the study of entrepreneurial ecosystems. Of particular interest is the systems approach to the study of the ecosystem, that it is not only constituted of systems and constrained by a local ecosystem, but that it must also be situated in a larger system context (Ehrenfeld, 2000). The application of complexity theory and complex modeling to industrial ecosystems suggests that similar methodological approaches might be appropriate for entrepreneurial ecosystems, as they are also emergent, self-organizing systems (Ehrenfeld, 2000). Finally, the application of biological ecosystem principles may provide a roadmap for researchers interested in entrepreneurial ecosystems to identify a framework for analysis, as has been done in the industrial ecosystems literature.

Conclusion

In broad terms, the preceding literatures have provided insight into the study of entrepreneurial ecosystems in one of several areas consistent with the definition. The study of social actors, factors of the environment, cooperative behaviors, and the importance of communication have all been considered across these concept areas and literatures. Whether through new theoretical approaches, identifying environmental factor variables, or the influence of non-market

social actors, each of the literatures examines the phenomenon of the entrepreneurial ecosystem from different levels of analysis and perspectives, but each literature provides a justification for the regional unit of analysis, and for considering regional outcomes (Porter, 1990; Kort, 1981). The diversity of the literatures also reinforces the importance of considering the ecosystem holistically, given that each has found relationships between differing, but often related variables - including agglomeration and resources, and institutions and media, for example.

Theoretical lenses include evolutionary approaches, institutional approaches, and media studies approaches. Evolutionary theory explains changes occurring at the individual, species, and population levels as variation, selection, and retention processes take place and influence the distribution of firms surviving in the ecosystem (Aldrich, 1990). Institutional approaches address normative, regulatory, and cognitive-cultural factors of the environment that may influence the selection processes of evolutionary theory or the decision processes of potential entrepreneurs (Scott, 1990; Carroll & Hannan, 1989). Media studies approaches examine the influence of non-market information carriers on the legitimization process and institutions surrounding entrepreneurship (Deephouse, 2000; Hayward et al., 2006). Entrepreneurs are subject to changing institutional environments which may affect their decisions as well as the survival of their firms and the synthesis of these theories provides an explanation and mechanism for altering the institutional environment.

Other factors identified in the research were not linked to the physical and competitive environment. These include agglomeration, clusters, and resources to which firms may belong or have access. Location decisions influence firm performance through access to resources (Marshall, 1920; Barney, 1991), social networks (Aldrich, 1990), and related industries for partnerships (Porter, 1990) and research has identified the presence of historical contingencies influencing firm performance that are related to spatial decisions as well (Lomi, 1995; Glaeser et al., 1992). Location decisions affect transportation and efficiency costs, as well as providing the potential for symbiotic interactions, from an industrial ecological perspective (Korhonen, 2001).

The influence of non-market stakeholders also matters to the performance of firms, whether those stakeholders are politicians (Bartik, 1991), government (Bartik, 2015), or the media (Hayward et al., 2006). These non-market players may influence the market through direct interventions, such as in the case of economic development policies targeting specific firms or industries, or through entrepreneurship policy designed to increase access to the market for entrepreneurs. They

may also indirectly affect the market through policies that increase human capital, or through the mechanism of changing public opinion. The research supports the conclusion that their influence makes a difference for the birth and survival of firms (Bartik, 2015; Stanley, 1996).

The research in these areas supports the examination of firm births and survivals as appropriate outcomes, though they also use different metrics within their literature streams, they have triangulated on births and deaths as a region appropriate measure. Population ecology (Hannan & Freeman, 1977), entrepreneurship policy (Gilbert et al., 2004), agglomeration (Glaeser et al., 1992), and some institutional studies (Carroll & Hannan, 1989) have considered it a reasonable measure. Integrating the preceding streams provides support for the regional level of analysis (Gilbert et al., 2004), outcomes of firm birth and survival (Carroll & Hannan, 1989), investigation into sociopolitical precursors of entrepreneurship (Powell, 1995; Aldrich & Martinez, 2010), as well as consideration of physical and competitive conditions in the regional environment (Glaeser et al., 1992) and for considering it as a system (Ehrenfeld, 2000).

The diverse literatures highlight the importance of social actors and communication to motivate coordination and cooperation in the entrepreneurial ecosystem. Social actors as diverse as potential entrepreneurs, industry competitors, government, politicians, and the media all influence the outcome of productive entrepreneurship in the ecosystem. These social actors also have varying influences on the factors that comprise the environment of the entrepreneur and this influence leads to the evolution of both the environment in terms of social systems, institutions, and culture, as well as the social actors and their perceptions. A theoretical approach at the system level incorporating the social aspects of the entrepreneurial ecosystem and the mechanisms of communication is needed to provide a theoretical explanation for cooperation.

Chapter Summary

In this chapter, I set out to accomplish three goals. First, I reviewed the emerging literature on entrepreneurial ecosystems and identified the primary definitions of the concept. I then integrated the definitions and further explicitly identified the social role of actors in the ecosystem as well as the mechanism of communication for coordinating activities and cooperation to improve value creation in the entrepreneurial ecosystem. Second, I surveyed diverse literatures and identified their relevance to entrepreneurial ecosystem research based on the integrated definition, linking

each to social actors, factors, cooperation, and communication. Third, through the integrated definition and the survey of related literatures, I have argued for the importance of a systems approach to entrepreneurial ecosystem studies, based on the interdependence of social actors and the dynamic nature of the ecosystem social actors, factors, and outcome.

CHAPTER 3: THEORY & HYPOTHESIS DEVELOPMENT

Chapter Overview

In this chapter, I identify a gap in social evolutionary theory (SET) due to assumptions about the way communication between social entities works, and then I use signaling theory logic and mechanisms to propose a model of signaling behavior explaining patterns of firm formation and firm failure in entrepreneurial ecosystems. The model offers insights into the mechanisms through which social actors in the environment communicate and induce cooperative behaviors. The addition of signaling theory logic and mechanisms to social evolutionary theory enhances the explanatory power and applicability of SET.

In the first section of the chapter, I describe social evolutionary theory, its key assumptions and logics for action. Social evolutionary theory provides a basis and explanation for the cooperative behaviors of actors in social environments such as entrepreneurial ecosystems (EEs). Key assumptions include the presence of evolutionary processes of variation, selection, retention, and struggle for survival, all of which are present in entrepreneurial ecosystems. The logics through which organisms are induced to cooperate are further explicated. These logics, or rules for why individuals would choose to cooperate, include kin selection, direct reciprocity, indirect reciprocity, network reciprocity, and group selection. While SET does explain the logic behind these rules and the expected outcomes of their application, SET does not explain how individuals leverage the rules in order to benefit from cooperative behaviors. Thus I describe signaling theory in the second section of the chapter and explain how the two theories complement one another. Due to information asymmetry, social actors possess incomplete knowledge of potential partners, for example their openness to cooperation or their fitness as cooperative partners. To induce cooperative behaviors, they must reduce this information asymmetry through signals. Signaling theory explains how these signals are transmitted, received, and interpreted by actors in the social environment of the entrepreneurial ecosystem.

In the final section of the chapter, I synthesize insights from these two theories to propose a model of signaling behavior in entrepreneurial ecosystems. Specifically, I consider the influence of highly visible signals transmitted through the media and the influence of the signals on the formation and failure rates of firms in the entrepreneurial ecosystem. Signals transmitted by the media to induce entrepreneurial behaviors originate from diverse entrepreneurial ecosystem

stakeholders, including politicians, business leaders, non-governmental organizations supportive of entrepreneurship, and other entrepreneurs. For the most part, these signalers have vested interests in creating more entrepreneurship and through their costly signals, in terms of time, reputation, or money, they convey information about the quality of the EE for potential entrepreneurs. Building from these assumptions, I develop hypotheses based on specific mechanisms of signaling behavior, including signal frequency (volume), signal attributes (content), and signal valence (tenor) and how they influence firm formation and failure. Further, I propose the mechanisms through which environmental factors of industry diversity and resource availability might affect the interpretation and influence of these signals by receivers.

Theory

Social Evolutionary Theory

Social evolutionary theory draws on the tenets and processes of evolutionary theory to explain why organisms develop cooperative strategies and identifies the mechanisms through which cooperation is possible in social environments (Nowak, 2006). In nature, individuals compete for survival in situations where they have limited access to food, shelter, and mates, but biologists observe many examples of cooperative behaviors designed to reduce the time spent searching for food, improve protection from the elements, and ensure mate selection for reproduction and spreading genes (Margulis, 1971; Corning, 1995). The same reasoning for cooperation of other organisms applies to people as well. Indeed, research in the area of social evolutionary theory has not only identified the mechanisms through which organisms in nature induce cooperative behaviors, but has also found mechanisms that apply uniquely to humans (Nowak, 2006; West et al., 2007).

Driving the need for cooperative behaviors, competition for scarce resources underlies social evolutionary theory and evolutionary theory, from which researchers draw the processes of evolution (Darwin, 1859; Nowak, 2006). Four processes constitute evolutionary theory: variation, selection (natural selection), retention (diffusion), and the struggle for existence (Aldrich, McKelvey, & Ulrich, 1984; Aldrich & Ruef, 2006). Variation is most easily described as some form of intentional or accidental change in response to external stimuli operating on the organism. Accidental or unintentional changes are often referred to as blind variations (McKelvey & Aldrich, 1983; Aldrich & Ruef, 2006). Genetic mutations, such as albinism or polydactyly, are examples of

blind variations (Galis, 1999). Intentional variations usually involve behavior, such as an organism choosing an alternate food source or environment, for example the migration of bears into northern climates, where they eventually became polar bears.

Variation, alone, does not ensure survival or fitness, rather it is the interaction of the modified organism with the environment that determines survival, a process known as selection (Darwin, 1859; Aldrich & Ruef, 2006). By virtue of their variations, whether blind or natural, some organisms experience superior performance, being better adapted to survival (Darwin, 1859). For example, the peppered moth of Great Britain has both light and dark versions, and the dark version was more prominent and successful during the industrial revolution because that variant was able to blend in with the sooty buildings more easily, avoiding predators (Miller, 1999). It is important to clarify that selection does not necessarily result in any kind of optimum performance, only an improvement over other organisms without the variation, so better enough, but not best (Berkley, 2016). Variations that do not produce better adaptation are selected against and should become extinct in the population, while the successful variations should be reproduced through heredity in succeeding generations (Darwin, 1859; Aldrich & Ruef, 2006). The diffusion of successful variations through the population is known as retention (Darwin, 1859). In the case of the peppered moth, the lighter variants all but disappeared as they were consumed by predators, but the variant was retained in the genes (Miller, 1999). This illustrates the fourth process as well, the struggle for survival, which necessitates the evolutionary process (Darwin, 1859; Aldich & Ruef, 2006).

Evolutionary theory has been applied to organizations as well, as an explanation for how organizations change over time (Aldrich, 1976; Hannan & Freeman, 1977; Aldrich & Ruef, 2006). Just as with individual organisms, organizations change over time as organizations adapt, are selected, and traits leading to success are retained (Aldrich & Ruef, 2006). The evolutionary cycle operates continuously on the population of organizations. Organizations adapt through intentional and blind variation, the same as organisms. Intentional variation may result from changes in organizational form or strategy designed to take advantage of perceived market opportunities (Aldrich & Ruef, 2006; Barnett & Carroll, 1995). Blind variations occur as well, such as in the reproduction of existing forms or businesses, when those recreating the form do not possess a full understanding of why the form works well (or does not work well), for example (Aldrich, 1999; Breslin, 2008). Adaptations and blind variations of firms are subject to the process of selection.

If the variation enhances survival of the organization, it is selected, while a reduction results in selection of competing forms (Aldrich & Ruef, 2006). At the population level, the organizations with the best adaptations to the environment at any given time should survive and those traits that offered the benefits are then retained. Retention occurs when the new trait that proved successful in the selection phase proliferates into the next generation through reproduction (Aldrich, 1999). Reproduction of organizations may be in terms of new firm founding or the diffusion of practices or innovations (Breslin, 2008). Over time, the configurations possessing the trait become dominant as managers recognize which exploitative behaviors are most successful, exemplifying the principle of retention. As in the case of organisms, the competition over scarce resources results in a struggle for continued existence, motivating the need to adapt and change to maintain superior performance as competitors do the same (Aldrich et al., 1984; Aldrich & Ruef, 2006).

Building on evolutionary theory, from the struggle for existence to the processes of variation, selection, and retention, social evolutionary theory (SET) specifically addresses competition and cooperation of organisms, and because they are composed of organisms, organizations (Nowak, 2006; Chandler, 1962). In addition to the core evolutionary theory principles, SET also has assumptions about social behavior and fitness (Nowak, 2006; West el al., 2007). First, as defined by social evolutionary theory, social behavior is any behavior that has consequences for both an actor and a recipient (Hamilton, 1964b; West et al., 2007). Second, and related, the consequences of the behavior are measured in terms of direct fitness and indirect fitness (West et al., 2006). Direct fitness affects the production of offspring, leading to retention through successful reproduction. As an example of direct fitness among organizations, consider the case of spin-offs such as Fairchild Semiconductor, originally a division of Fairchild Camera and Instrument, as firms reproduce their structure (Laws, 2010). Indirect fitness, on the other hand, relates to the reproduction of related individuals. Fairchild Semiconductor also presents an example of indirect fitness among organizations. It had tremendous influence on the entire ecosystem through the transference of its culture and training of a generation of executives and entrepreneurs, including AMD, Intel, Netscape, and Google, among others (Saxenian, 1994; Saxenian, 1996; Laws, 2010).

Social evolutionary theory, therefore, suggests that organisms cooperate with one another rather than compete, because they gain either direct or indirect fitness through the relationship, and thus increase the chance of passing on their traits (Hamilton, 1964b; West et al., 2006). Of

note, as exemplified with Fairchild, indirect fitness does not strictly require genetic relation. Individuals can benefit indirectly through cooperating with other individuals who possess traits that result in cooperation (Hamilton & Axelrod, 1981). In addition, SET research highlights that cooperative behaviors benefit not just individuals but the entire ecosystem and these benefits accrue at the population level. Specifically, populations consisting of more individuals engaged in cooperative behaviors have higher average fitness, while populations with more individuals focused on purely competitive behaviors have lower average fitness (Nowak, 2006). To clarify this finding, populations where more firms cooperate have lower variation between the highest and lowest members of the population and the average fitness for all members of the population is higher. From an entrepreneurial ecosystem perspective, the entire ecosystem would be performing better and firms, on average, would perform better (Nowak, 2006). On the other hand, populations with more pure competitors exhibit larger variation between high and low performers - there are exceptional competitors and their performance comes at a price for the low performers. In this type of population, the average fitness of the population is lower than with cooperative populations (Nowak, 2006). From the ecosystem perspective, the ecosystem performance suffers with pure competition, rather than cooperation. This implies that entrepreneurial ecosystems with higher levels of cooperation should have higher average fitness and will exhibit less variation in terms of individual fitness.

Social evolutionary theory proposes four possible social relationships between actors: 1) mutualism, 2) altruism, 3) selfishness, and 4) spite (West et al., 2007; West et al., 2006). Mutualism exists when both the recipient and the actor receive a positive benefit from the interaction. Organizational studies literature in the domain of evolutionary theory further distinguishes between partial and full mutualism (Aldrich & Martinez, 2010). Partial mutualism corresponds to SET's altruism, in which one party benefits, while the other does not (Aldrich & Martinez, 2010; West et al., 2007). A relationship is altruistic when the actor receives no benefit or incurs a cost, while the recipient benefits. Selfishness reverses the relationship of altruism, such that the actor receives benefits while the recipient incurs negative consequences. Selfishness corresponds to the partial competition relationship identified in organizational studies (Aldrich & Martinez, 2010). Finally, spiteful relations results in negative consequences for both the actor and the recipient, similar to

the full competition condition in organizational studies (Aldrich & Martinez, 2010). These social interactions allow social evolutionary theory to be extended to the organization level of analysis.

Further, social evolutionary theory proposes the logics through which organisms, and organizations as well, induce cooperative behaviors (Nowak, 2006; West et al., 2007). These logics are kin selection, direct reciprocity, indirect reciprocity, network reciprocity, and group selection (Nowak, 2006). The first form of cooperation is kin selection, in which natural selection operates in such a way as to promote the cooperation of individuals who are genetic relatives (Hamilton, 1964a). In less cognitively sophisticated life forms, from microorganisms to cattle, kin selection functions through indirect fitness. An organism may undertake an action that would be costly to it in order to ensure the survival of its genes. In an organizational context, this can be construed in several ways. First, some organizations or their representatives may be considered genetic relatives of the firm, such as in the case of a spin-off or "child" company. Firms might also have an actual genetic, biological tie between them, such as when two firms are controlled by the same family. Shared directors or corporate officers who have moved between firms might also provide a familial tie between firms. In order for kin selection to function, all that is required is the perception of relatedness on the part of decision-makers in the organization. This perception of relatedness results in their willingness to undertake actions that will benefit a recipient, although benefits to the actor are not required, thus mutualism and altruism both apply in this case. For entrepreneurs with new ventures, a sense of kinship may arise from shared education or experiences. With the emergence of more directed efforts to encourage entrepreneurship, accelerators and incubators have become more common. Entrepreneurs who share mentors, are part of the same accelerator cohort, or received office space in the same incubator are likely to develop a sense of kinship with other entrepreneurs, thus encouraging cooperation. The shared identity as entrepreneurs may foster this as well (Yang & Aldrich, 2012).

The second form that cooperation can take in natural selection is direct reciprocity, which explains cooperation among unrelated individuals, and develops from repeated interactions between individuals or organizations (Trivers, 1971). However, a component of competition also exists in this relationship, because hyper-competitive environments can result from repeated decisions to compete (Barnett & Hansen, 1996). This type of cooperation is most easily represented by the Prisoner's Dilemma (Hamilton & Axelrod, 1981), in which, during multiple rounds of play, the

players have an opportunity to either cooperate or defect (compete), knowing that in the next round their actions will potentially affect the actions of the other player. Multiple strategies can be employed to win the game by surpassing the performance of competitors. The simplest winning strategy is known as tit-for-tat, in which the game begins with cooperation and then the previous player's move is repeated, a cooperative action for cooperation, and a defection for defection (Hamilton & Axelrod, 1981; Nowak, 2006). In the real world, however, cognition is present and so non-cooperation can be forgiven. In this strategy, termed win-stay (Nowak & Sigmund, 1993), cooperation is repeated as long as the player is doing well (Nowak & Sigmund, 1993). Game theorists suggest that in cooperative environments, win-stay surpasses tit-for-tat in performance (Nowak & Sigmund, 1993). In an organizational context, direct reciprocity is most readily represented by formal arrangements, such as strategic alliances, in which an exchange relationship has been detailed and can be enforced. As described in the Prisoner's Dilemma example, any of the four types of consequences may result from direct reciprocity. In entrepreneurial ecosystems, cultural factors can affect the perceptions of entrepreneurs about the desirability of working with other entrepreneurs. Non-market entities directing ecosystem development may encourage entrepreneurs to work together more strongly because their goals are aligned to the health or benefit of the ecosystem as a whole, rather than to the success or failure of a particular firm.

Indirect reciprocity takes into consideration the asymmetric relationships among people and organizations. It requires actors to be capable of recognizing and remembering the actions of cooperators and competitors; thus it occurs only in humans (Nowak, 2006). Indirect reciprocity involves helping others, whether individuals or organizations, where the potential for direct reciprocity does not exist. Although direct reciprocity is based on immediate exchange, indirect reciprocity operates through the intermediary of reputation. One organization helping another organization results in an increase in reputation and all decisions about whether to assist others are based on how aiding others, or not, will affect the reputation of the organization (Nowak, 2006; Rankin et al., 2007). Individuals and organizations that help others have been shown to be more likely to receive assistance in return (Nowak, 2006; Nowak & Sigmund, 1998). Indirect reciprocity requires memory and the ability to survey and understand the social situations, as well as the ability to acquire and disseminate information through language (Nowak & Sigmund, 1998). Among organizations, indirect reciprocity occurs when entities provide aid or cooperate

with no expectations of returns. For example, during the 2008 hops shortage, Samuel Adams provided 20,000 pounds of hops to craft breweries caught unprepared (BYO, 2008). The company had no expectations for remuneration. Social dilemma and public goods problems are situations in which game theorists have experimentally tested this issue, particularly with the development of common resources. All four of the social evolutionary theory responses can be observed in indirect reciprocity. In the entrepreneurial ecosystem, indirect reciprocity is enhanced through the non-market entities capable of offering support to new ventures. For example, senior entrepreneurs who take on mentoring roles to nascent entrepreneurs may receive indirect benefits from government or other non-market entities, including access to social capital or other reputational benefits.

The fourth form of cooperation in natural selection is network reciprocity, or spatial reciprocity, in which clusters of cooperating individuals or organizations form to assist each other (Nowak, 2006; Nowak & May, 1992). Among lower order organisms, network reciprocity occurs among populations that are physically co-located. In this type of cooperation, all of these organizations that cooperate pay a cost for each of their neighbors to receive some benefit, while entities that do not cooperate pay no cost and are essentially free-riders. When the cooperators cluster, they can exclude the non-cooperators and enhance their own benefit, which allows them to compete more effectively. This means that organizations can eliminate some portion of competition at one level in order to better compete as a network. Examples of this type of cooperation in organizations would be value network or supply chains, in which integrated networks of organizations compete more effectively than individual companies acting in their own best interests while participating in the buyer-seller relationships. Competing social networks are also an example of this form of reciprocity, when the entire network cooperates to compete against other networks. Entire entrepreneurial ecosystems can develop this form of cooperation, as the new ventures forming compete against other established ecosystems or large entities. If the culture of the ecosystem develops in such a way as to encourage an ‘us’ versus ‘them’ mentality toward an outside entity, this type of cooperation occurs.

Group selection is the final form of cooperation and this type of cooperation operates on two levels simultaneously: within-group and between-group. At the within-group level, cooperators are less effective than non-cooperators, because non-cooperators take resources and do not pay for them, which allows non-cooperators to benefit more (Nowak, 2006). At the between-group

level, agglomerations of cooperators have more favorable resource availability and grow faster (Nowak, 2006). This differs from network reciprocity, for example, because the individual network members are working together as a unit to compete, rather than working against each other. In an organizational context, this means that individual companies within an industry or strategic group might receive a boost when they choose not to cooperate, but they lose out to groups of companies that choose to work together to compete as an industry. Group selection is particularly interesting when considering the idea of community ecologies (Astley, 1985; Moore, 2006), which are considered to be a higher form of organization, composed of small organizations. An effective group configuration of cooperators benefits all of the participants and provides better resource access for all. An extreme example of group selection would be a cartel that competes against a second group of firms that are highly competitive among themselves. This level of cooperation develops when ecosystems compete with one another.

While extant SET has identified different forms of and rules for explaining what actions (cooperation or competition) will happen under certain conditions, little work in the area of SET has investigated or indeed hypothesized the specific mechanisms at work to explain how individuals can leverage these rules of cooperation to elicit or induce the desired cooperative relationship and corresponding behaviors. Any combination of these rules might be at work in a given relationship or population, resulting in multiple rules and reasons to cooperate or to compete, depending on the information exchanged between social actors. As explained above, SET identifies four potential relationships that can emerge between social actors. Mutualism occurs when both benefit and share the cost. Altruism occurs when one benefits at a self-imposed cost for the other. Selfishness occurs when one benefits at the cost of the other. Finally, spite occurs when one self-imposes a cost to impose a cost on the other. These relationships emerge based on the rules of cooperation: kin selection, direct reciprocity, indirect reciprocity, network reciprocity, and group selection (Nowak, 2006). The link between the rules and the behavior that emerges, however, has not been explored in SET, only implied. In this dissertation, I suggest this gap in the theory can be addressed through the application of logic and theory about how groups and individuals communicate.

Inducing a behavior through any of these mechanisms in a social context requires communication. This link has been explored to a limited extent in the context of evolutionary biology (Warrington et al., 2014). Yet, the qualities and traits which would lead individuals or organizations

to follow through on the logics and engage in the cooperative behavior are not obvious or easily identified by the potential partners. Consider the case of kin selection in nature as an example. Apostle birds cannot visually identify members sharing their genetic markers to ensure survival of their genes (Warrington et al., 2014). They have developed a cooperative breeding strategy, however, and need to be able to assist family members. They have developed a communication mechanism, such that members of the same family lineage, even from diverse geographic regions, can identify each other through song (Warrington et al., 2014). This allows the family sub-populations to have better chances of success and survival. In an organizational context, firms want to induce cooperation as well and doing so is not a direct process. Partner firms cannot know in advance the outcome of such a partnership or the qualities of the original firm that would make cooperation beneficial; only engaging in cooperative activities of some sort will prove such a claim.

The fact that firms have imperfect knowledge of one another, as with organisms, results in information asymmetry. Firms reduce the information asymmetry in the expectation that the information they communicate will lead potential partners to conclude that cooperation is desirable through one of the above logics. Cooperation then leads to one of the four relationship types: mutualism, altruism, selfishness, or spite (West et al., 2007). The nature of the relationship affects firm performance and the resulting change results in selection. Successful relationships are retained and may diffuse, while unsuccessful relationships should fail. The process begins with communication and inducement to cooperate, however. SET has little to offer in terms of how the information is transmitted, only why it matters and what effect it will have. Thus, another theoretical lens is needed to understand the specific nature and dynamics of the communications between actors.

Signaling Theory

Signaling theory addresses the mechanisms actors use to reduce the effects of information asymmetry between them (Spence, 1974; Birch & Buetler, 2007; Connelly et al., 2011). Signaling theory originated with work in economics concerning the characteristics of information as an economic good (Stiglitz, 2000; Rothschild & Stiglitz, 1976; Spence, 1974). Research in economics surrounding and utilizing signaling theory has led to the development of information economics (Birchler & Buetler, 2007), a field of research that examines the production, reproduction, and communication of information in markets, and has identified and modeled the properties of

information, which has certain similarities to public goods, while emphasizing the importance of appropriating value from information generated (Birchler & Buetler, 2007; Stiglitz, 2000). Research utilizing this perspective in management and economics has primarily considered the problem of adverse selection, when hidden information may result in the selection of undesirable outcomes over desirable outcomes (Birchler & Buetler, 2007). The problem of adverse selection has been examined in areas such as price inefficiencies in IPOs (Ragozzino & Reuer, 2007), micro-financing of entrepreneurial ventures (Moss, Neubaum, & Meyskens, 2014), and insurance markets (Puelz & Snow, 1994), among others.

An alternative perspective on signaling theory has also been used to explain and explore signaling in the context of human social behavior, particularly in anthropology (Bird & Smith, 2005) and religion (Sosis & Alcorta, 2003). Rather than focusing on markets for information and price efficiency, this research has examined the signaling behavior individuals and groups use to induce desired behaviors from other individuals and groups (Sosis & Alcorta, 2003), as well as within communities (Sosis & Bressler, 2000). Some research in this area has also considered the importance of audience effects, a parallel concept to the non-excludability of information in information economics (McGrath & Nerkar, 2004). Assumptions of this stream of literature parallel those of information economics, although the streams have developed largely without cross-over. Similar to information economics, this perspective assumes that signalers possess unobservable attributes, that the receivers stand to gain something from accurate information, that signalers and receivers have at least partially conflicting interests, and that signal cost and benefit depends on the quality of the signal (Bird & Smith, 2005). Based on these assumptions, an outcome of cooperation between individuals or groups has been identified as one goal of signaling behavior (Sosis & Alcorta, 2003). Based on this perspective, in purely competitive situations, information asymmetry would be desirable, because it would allow actors an advantage over their rivals (Nayyar, 1990; King, 2007).

A recent review of signaling theory in the organizational studies literature identified over 40 studies of signaling behavior (Connelly et al., 2011). Across the topics studied, the goal of signaling was to induce some form of cooperative behavior, whether from customers (Carter, 2006), potential investors (Arthurs et al., 2008), employees (Ryan et al., 2000), or competitors (McGrath & Nerkar, 2004). This is consistent with social evolutionary theory, which explains how

cooperation can be an appropriate choice and may even be a superior competitive option (Nowak, 2006). In social environments, cooperation may involve sharing information with specific parties with whom one wishes to cooperate to induce cooperative behavior. Consider intellectual property as an example of information asymmetry. In order to obtain a patent and receive protections, information has to be shared with a government. The government and firm cooperate and both receive benefits as well as indicating to potential investors that there is IP as a basis for market competition (McGrath & Nerkar, 2004). However the reduction in information asymmetry means that possible competitors understand what the firm has done and can then attempt to duplicate it. If a firm does not want to receive government protection for the property, they can alternately choose to maintain information asymmetry and treat the intellectual property as a trade secret. This highlights the trade-offs that exist within signaling behavior, that there are costs associated with the signal and reducing information asymmetry, as well as potential benefits.

The commonality between all of these situations is the need to communicate the existence of an underlying quality or trait to the potential cooperator, a quality or trait that is not directly observable (Connelly et al., 2011). Only the results of the quality will be observable and only after the cooperative behavior has taken place. To communicate the existence of the quality, the signaler, the actor attempting to induce cooperation, must send a signal to a receiver, a potential partner. The signal, by definition, contains information about the signaler that will induce cooperation by reducing information asymmetry, and demonstrates the benefits of cooperation to the receiver. The receiver must benefit in some way, else there is no reason for cooperation to occur.

In theory, there is a purely dyadic relationship between a single signaler and a single receiver. In practice, there are often many signalers and many receivers, constituting a communication network (McGregor & Peake, 2000; Busenitz et al., 2005). The area encompassed by the signal's coverage comprises the entirety of the communication network. In the context of entrepreneurial ecosystems, the ecosystem corresponds to the active space of the signal (McGregor & Peake, 2000). In communication networks, additional issues face the signaler and receiver of a specific signal and the size of the active space may matter to the signaler because of the presence of other signalers and unintended receivers. Research has found that the environment of the signal in organizational signals can moderate the effect of the signal, so clearly defining the active signaling space matters for signaling research (Ndofor & Levitas, 2004). Such issues can relate

to the signaler, the signal itself, the receiver, or the environment (Connelly et al., 2011). Signaler issues include honesty of the signal, which is whether or not the signaler actually possesses the desirable quality (Arthurs et al., 2008). Additionally, there can be signaler issues relating to the credibility of the source (Sanders & Boivie, 2004).

The signal itself is subject to observability parameters, whether it is clear, visible, or sufficient strength to be noticed by intended receivers (Warner et al., 2006). Further, the signal quality and value suffer when it does not correspond to the desirable quality sufficiently (Busenitz et al., 2005). Research in this area has also examined frequency of signals and the consistency between signals as areas where issues might arise in the signal being received and interpreted correctly by the receivers (Fischer & Reuber, 2007). Additionally, each signal has an associated cost, both to the signaler (Certo, 2003) as well as to the receiver (McGregor & Peake, 2000). For the signaler, this is the cost of encoding and sending the message, while the receiver incurs the cost of identifying the signal and decoding it for discriminating information (McGregor & Peake, 2000).

Other issues from the perspective of the receiver may arise in the successful transmission of the information when the receiver does not have adequate attention for the signal (Gulati & Higgins, 2003). Even when the signal is received, it is subject to interpretation by the receiver and the calibration of the signaler and receiver may be misaligned, leading to misinterpretation due to differences in shared lexicons or perceived importance of certain aspects of the signal (Perkins & Hendry, 2005).

The environment, too, can affect the signal, including the sending of feedback or countersignals that influence interpretation or perception by the receivers or signalers (Gulati & Higgins, 2003). Further, the environment can distort the signal, for example, through the presence of multiple signalers or receivers, or external forces or actors that influence the interpretation (Zahra & Filatochev, 2004). When multiple signalers are present, for example, signalers must make a determination about the extent to which they compete or cooperate with other signalers to enhance the observability of the signal they are sending, so that it does not get lost (Matos & Schlepp, 2005). Among the effects observed when multiple receivers are present, audience effects describe the change in the signal when certain kinds of audience members are present (Matos & Schlepp, 2005). There are, generally, two types of audiences, the evolutionary audience, defined as the audience that was present during the development of the signal and its contents, generally does

not change the content of the current signal, although it likely shaped the signal in past iterations. The apparent or intended audience, on the other hand, noticeably impacts the signal when the signaler is aware of their presence (Matos & Schlepp, 2005).

Because signals, by definition, convey information about an unobservable quality in the signaler, the content of the message must be encoded in a manner that allows it to demonstrate the possession of the underlying quality. The mechanism of encoding utilizes signs and symbols that co-evolve with the rise of the need for the signal to be sent. In the study of human communication networks, which include organizational studies, these signs and symbols co-evolve from the social and institutional environments of the signalers and receivers through repeated interactions and signaling (Sosis & Alcorta, 2003). The content, then, is subject to change over time, as the underlying qualities change and as the content is refined to better represent the underlying quality. Each iteration of the signaling process, from signal encoding to counter-signaling, results in changes over time.

This change can be illustrated through the example of car warranties and involves the potential for signalers to cheat (Akerlof, 1970). Cheating occurs when a signaler conveys that they possess the desired quality, when they do not (Connelly et al., 2011; Akerlof, 1970). Akerlof (1970) describes the problem as one of signaling that a car being sold is of high quality and not a lemon. In order to signal this, a manufacturer offers a warranty on the car, guaranteeing that the customer can drive it safely for so many years or miles. Because the actual quality of the car's construction is impossible to observe at the time of purchase (the owner will only know if a car will last 100,000 miles once he has driven 100,000 miles), the offer of a warranty signals that the manufacturer believes it to be high quality. If the use of a warranty provides an advantage to the first car company offering it, other manufacturers in the high quality market will also have to signal the quality of their vehicles, most likely through the use of the already established signal, a warranty. Car manufacturers who do not provide high quality vehicles, those selling lemons, might cheat, also attempting to send the signal of high quality through offering a warranty.

Signaling costs play an important role in the proliferation of cheating, and change over time of the signals. In this situation, there are essentially three possible outcomes for the change in the signal, based on signaling costs. First, if the warranty is too costly for even the high quality car manufacturers to afford, they will stop using it. Second, if the warranty costs are too low, such that even the low quality manufacturers can provide it and still sustain superior performance,

the warranty will cease to be a discriminating signal, one that allows a receiver to distinguish between a signaler who possesses the quality and one who does not. Finally, the warranty cost could be such that it only pays for the genuinely high quality manufacturers to offer a warranty. In this case, the warranty offer will be retained as a signal and a warranty will become a sign of high quality cars (Akerlof, 1970).

This example also illustrates the mechanisms of social evolutionary theory. Both the car manufacturer and the consumer are seeking a cooperative relationship. The car manufacturer offers a product for profit, while the customer benefits from the product's features and quality. The first car company to offer a warranty has demonstrated the process of variation, changing something about the way they signal. The customers then engage in a selection process. If the signal results in higher customer preference, then the selection is successful and the warranty is likely to be retained by the car manufacturer in future iterations of the social evolutionary process. The example also demonstrates the process of retention at the social level as the warranty either diffuses through the population of car manufacturers, or does not. Other car manufacturers observe the competitor and adapt to follow the example, if successful and the cost is not too great. In the example, cheating by low quality manufacturers serves to illustrate the case of selfishness in social evolutionary theory. If the signal is copied out of spite, it may lead to adverse selection, in which a less successful quality is chosen to the mutual detriment of both parties. It would be expected that those firms that choose maladaptive strategies would ultimately falter and fail to thrive. Thus, the two theories are complementary in nature, as signaling theory and social evolutionary theory jointly explain the co-evolution of important social structures and processes.

Hypothesis Development

Entrepreneurship is a process of social construction (Aldrich & Martinez, 2010), one in which a potential entrepreneur must actively engage many participants, inducing their cooperation through the act of signaling the quality of a successful venture. The quality of success is undeniably unobservable at the start of a new venture, given that even researchers are generally uncertain about new venture survival rates, with five year failure rate estimates in U.S. samples ranging from as high as eighty percent (Starbuck & Nystrom, 1981) to sixty

percent (Audretsch, 1991) to as low as thirty-three percent (Holtz-Eakin et al., 1994) depending on the measurement of failure (Yang & Aldrich, 2012).

From the perspective of the potential entrepreneur, there is no way to observe the underlying quality of the environment as it pertains to success, except to start and potentially fail. Each potential entrepreneur operates within a communication network, an entrepreneurial ecosystem, from which he receives signals from the environment as well as sending signals to potential cooperators. Understanding the mechanisms through which these signals are sent, received, and influence decisions of potential entrepreneurs to engage in entrepreneurship benefits from the application of both social evolutionary theory, which explains the importance of and motivation for cooperative social actions within an entrepreneurial ecosystem, as well as from signaling theory, which offers insight into the specific mechanisms actors use to induce cooperative behaviors.

In applying both of these theories to the entrepreneurial ecosystem, it is necessary to define the roles filled by actors in the context, in terms of signaler and receiver. There are many actors in an entrepreneurial ecosystem, including current entrepreneurs, potential entrepreneurs, government, professional organizations, support firms, customers, suppliers, and the media, among many others. Each of these actors plays the role of both signaler and receiver, which results in a multitude of signals in the entrepreneurial ecosystem at any time. As individuals, signalers and receivers are interested in establishing the most efficient and profitable relationships and outcomes possible. As members of the entrepreneurial ecosystem, the interests of theses social actors converge and diverge to a varying degree. Certain individuals are more concerned with ecosystem-level outcomes and the success or failure of individuals or firms are not as important as the performance of the whole. Politicians, business leaders, non-profit organizations devoted to entrepreneurship, and even the media itself all have reasons to support entrepreneurship in an entrepreneurial ecosystem and to be more invested in the survival and success of the entire ecosystem above the interested of individual firms. Politicians, for example, are judged by job growth in the ecosystem, not the success of a single firm (Bartik, 2011). Consistent with the previously cited findings in SET, cooperative behaviors are the behaviors most likely to result in a higher average fitness and success for the population of firms, while competitive behaviors are more likely to result in individual firms performing better in terms of fitness, rather than the population. There is verifiable information that these signalers can transmit in terms of evidence

of the entrepreneurial ecosystem's fitness, including economic conditions, new firm starts, and information about rules or regulations. More importantly, there is also non-verifiable information that would require signaling - such as the openness of the government to certain types of firms, availability of potential partners, and private investment funding.

In order for these signals to be believable, there must be a cost associated, consistent with the mechanisms of signaling theory. These costs can be financial, in terms of investment the signalers have put into the ecosystem, reputational because the signalers will suffer a reputation decline if their information is proven false, or may also be measured in terms of time devoted to a particular topic or initiative. An example of one such cost would be coverage of the efforts of politicians to fund area redevelopment of locations specifically for entrepreneurship, even though the area might not be ideal for the type of business being targeted. Potential entrepreneurs might be motivated to start a firm to take advantage of the costly investment the signalers have made, only to find that the location requirements hinder their efforts and make survival harder. The media picks up signals about these quality signals and amplifies the signal to the entire population of potential entrepreneurs in the entrepreneurial ecosystem.

Research has demonstrated the importance of the media as a central channel of information and communication, an infomediary (Pollock & Rindova, 2003). Thus, many signals will be collected and communicated through the media, which makes these signals highly observable by potential entrepreneurs and of particular importance. Other signals are also present in the environment outside of those transmitted by the media. The actions of competitors transmit information and may be interpreted as signaling future activities. Similarly those actions taken by other actors in the ecosystem may result in the transmission of information, either as signals or as distortion of more relevant signals. Any of these signals may be interpreted by the potential entrepreneur as an opportunity for cooperation thus inducing entrepreneurial action, possibly the founding of a new firm.

Signals vary from ecosystem to ecosystem, in content, tenor, and volume, due to the coevolution of the signalers, receivers, and the social structures and institutions in the ecosystem over time. For example, some ecosystems may develop strong culture and institutions around particular industries, such that signals pertaining to local industry ventures or opportunities are highly visibility or are given additional weight in the interpretation by receivers. Such weight and

visibility develop from the repeated social interactions as those firms varied, were selected, and were retained, per the mechanism and predictions of SET. The same evolutionary processes influence the positivity or negativity of the signal as well as the number of signals being sent as signalers and receivers communicate. SET offers insight into how these mechanisms operate at the level of the entrepreneurial ecosystem and how they influence potential entrepreneurs. In the following sections, I develop specific, testable hypotheses about the mechanisms of these signals on potential entrepreneurs in entrepreneurial ecosystems, grounded in these two complementary theories.

Signal Frequency

Defined as the number of times a particular signal is transmitted over time, prior research has found a positive relationship between signal frequency and effectiveness. Signal frequency has been examined in a number of contexts, including diversification (Baum & Korn, 1999), location decisions of firms (Chung & Kalnins, 2001), and entrepreneurship (Carter, 2006; Janney & Folta, 2003). The relationship between signal frequency and the effectiveness of the signal has been observed to apply to competitors (Baum & Korn, 1999) as well as stakeholders (Carter, 2006), and to potential partners (Michael, 2009). The mechanism through which this operates is the reduction of information asymmetry between the signaler and receiver, as predicted by signaling theory.

To understand the phenomenon, it is necessary to appreciate the role played by time in the repeated interactions between signaler and receiver. At any given time, T0, before a signal has been transmitted, information asymmetry exists between the signaler and the receiver. Once the signaler transmits the first encoded message, a reduction in the effect of information asymmetry occurs, albeit the level of reduction will depend on the characteristics of the signal. Between Tt and Tt+1, information asymmetry increases once again, because the signaler continues to conduct operations. At Tt+1, when a second signal is sent, information asymmetry is reduced once again. Each additional signal transmitted results in further reduction of the effects of information asymmetry between the signaler and receiver.

First, information about what has transpired in the interval between Tt and Tt+1 is transmitted, updating the receiver on actions and operations the signaler has taken, as well as changes in underlying qualities that are of interest to the receiver. Second, each additional signal transmitted allows for calibration between the signaler and receiver on the encoding factors of the

message. Recall from above that calibration is the degree to which a signaler and receiver share similar lexicons of words, signs, and symbols (Janney & Folta, 2006). In the initiating signal at Tt, signaler and receiver assume they share the lexicons, though this may not be true, leading to misunderstandings and distortions of the signal (Perkins & Hendry, 2005). Prior research has demonstrated a positive link between frequency of signals and the accuracy of interpretation (Filatotchev & Bishop, 2002).

Third, the interval between and given time Tt and Tt+1 may have an influence on the calibration of signals as well. As the interval increases, more time passes between the signals, and the amount of information that has to be transmitted about intervening operations is likely to increase by virtue of operations, assuming the signaler is a functional entity. While studies have shown that the increase in time between signals can lead receiver to be more highly attuned to the next incoming signal (Janney & Folta, 2003), receivers are also limited in the amount of attention they are able to devote to a particular signal (Gulati & Higgins, 2003). When a given signal contains more information than a signaler can comfortably attend to, this can also lead to distortion of the interpretation. Further, because receivers attend to signals from multiple signalers in communication networks (McGregor & Peake, 2000), a longer time delay between signals can lead to a decay in the calibration of the lexicons. The final mechanism of frequency relates to signaling consistency. When signals are consistent over time, they reinforce the credibility of the signaler in the perceptions of the receiver (Sanders & Boivie, 2004). As the time between signals increases, however, receivers may fail to perceive the consistency of the messages. At the extreme, the interval between Tt and Tt+1 may be so great that the receiver fails to recall the signal at Tt by the time a signal is transmitted at Tt+1. All of these factors, considered together, demonstrate the importance of sending a signal with regular frequency.

In the context of the media in an entrepreneurial ecosystem (EE), the same logic applies. When signals are transmitted about entrepreneurship in the EE, frequent signals will: 1) reduce the information asymmetry between signalers (EE stakeholders) and receivers (potential entrepreneurs), 2) allow signalers and receivers to better calibrate their lexicons as far the signal content is concerned, 3) reduce the decay of calibration between signals, and 4) increase recognition of signal consistency when it is present. Ceteris paribus, frequent signals about entrepreneurship will bring receiver attention to entrepreneurship. The increase in the attention to entrepreneurship

will lead to an increase in the pool of potential entrepreneurs as they consider it a course of action they might not otherwise have known existed or considered reasonable to pursue. Thus:

H1a: Frequent signals about entrepreneurship will lead to more new venture starts in an entrepreneurial ecosystem.

However, signaling frequency does not account for the qualities of the receiver, or for the appropriateness of entrepreneurship as a viable pursuit for a particular receiver. Indeed, a signal that has the appropriate qualities to reach appropriate receivers, that is signals that are highly observable, of adequate strength, clarity, intensity, and visibility (Lampel & Shamsie, 2000), will be visible to inappropriate receivers as well. Even when signalers are honest about the information transmitted (Arthurs et al., 2008) and are credible signalers (Busenitz et al., 2005), receipt by inappropriate receivers may result in the wrong actions by those receivers. Much of this rests with the characteristics of an inappropriate receiver. Just as the appropriate receiver will be calibrated to the message and give attention to the right messages, inappropriate receivers will pay attention to messages that do not specifically target them and due to miscalibration between their lexicons and those of the signalers, they will interpret the signals as encouraging them to engage in entrepreneurship. This is one of the downfalls of communication networks, that a message can be simply be received and misinterpreted by the wrong receiver (McGregor & Peake, 2000).

In the context of the media in an entrepreneurial ecosystem, the same logic applies. When signals are transmitted about entrepreneurship in the EE, frequent signals will: 1) reduce the perceived information asymmetry between signalers and inappropriate receivers (those who do not possess the qualities correlated to success), 2) allow signalers and inappropriate receivers to better calibrate their lexicons as far the signal content is concerned, 3) reduce the decay of calibration between signals, and 4) increase recognition of signal consistency when it is present. Because inappropriate receivers will be better able to mimic appropriate receivers, they will be more likely to found new ventures as well. Due to their lack of the underlying quality correlating to success, making them unqualified, they are more likely to fail. Ceteris paribus, frequent signals about entrepreneurship will bring receiver attention to entrepreneurship. The increase in the attention to entrepreneurship will lead to an increase in the pool of unqualified potential entrepreneurs as they consider it a course of action they might not otherwise have considered reasonable to pursue. Thus:

H1b: Frequent signals about entrepreneurship will lead to more entrepreneurial failures in an entrepreneurial ecosystem.

Signal Attributes

Consistent with signaling theory, the attributes of the message must represent an underlying, desirable quality that is unobservable at the time the signal is sent (Spence, 1974). Similarly, the sender of the signal is assumed to be in possession of more complete information than the receiver (Balboa & Marti, 2007). As identified previously, although signaling theory is frequently used to explain behaviors and interpretations at the macro-level of analysis, there are strong assumptions about the importance of the dyadic relationship between a single signaler and a single receiver (Spence, 1974). The research in this area has covered topics ranging from technology diffusion in hypercompetitive industries (Lampel & Shamsie, 2000) to individual firm signaling behavior in alliance formation (Park & Mezias, 2005) to the decisions of individuals about job-selection (Ryan et al., 2000). All of these studies have focused on the importance of the information asymmetry problem and have further delved into attributes of signals that influence decisions and actions.

Research has thus identified several mechanisms through which signals lead to action. Perceived legitimacy on the part of decision-makers, or the degree to which a decision-maker believes actions are desirable (Suchman, 1995), has been explored in some depth and research has found support for legitimacy as a mechanism through which signals convey the presence of the unobserved quality (Perkins & Hendry, 2005; Bell, Moore, & Al-Shammari, 2008). Legitimacy has been studied in entrepreneurship financing (Higgins & Gulati, 2006), board compensation decisions (Perkins & Hendry, 2005), and in the context of equity managers' reputation and performance (Balboa & Marti, 2007). When individuals perceive an option is legitimate due to signals of quality, they are more likely to pursue the option.

In the case of entrepreneurship in an entrepreneurial ecosystem, receivers (potential entrepreneurs) do not possess complete information about pursuing entrepreneurship as an alternative to their current employment and so uninformed receivers rely upon information provided by the media. As a career alternative, entrepreneurship has many characteristics in common with other jobs, as individuals self-select into becoming entrepreneurs. Research on employment self-selection using signaling theory as a lens has examined the attributes individuals use to make inferences about their various employment alternatives and to make decisions about which alternative to pursue (Highhouse et al., 2007; Hochwarter et al., 2007; Ryan et al., 2000).

Such research has identified two major categories of attributes used by individuals - instrumental attributes and symbolic attributes (Lievens & Highhouse, 2003).

This framework, originally used in marketing research on branding and product attributes (Turban et al., 1998; Keller, 1993), has found that, consistent with product decisions in which individuals have incomplete information, when making decisions about jobs and organizations, individuals prioritize symbolic attributes over instrumental attributes (Lievens &Highhouse, 2003). In the absence of information about instrumental attributes, the research has found that individuals will infer them from symbolic attributes. Instrumental attributes include the physical, tangible, and functional attributes of a job, product, or organization, while symbolic attributes include intangible and subjective attributes. In the case of entrepreneurship, instrumental attributes would include the need to identify opportunities, develop supporting relationships such as securing financing, and then implementation of the business model. Symbolic attributes, on the other hand, would be intangible and subjective, including reputation of entrepreneurship, perceived characteristics of an entrepreneur, and social desirability of being an entrepreneur.

The source of the signal also transmits some information about the legitimacy and desirability of entrepreneurship. Prior research has shown that, in the absence of primary sources, the media is a credible source for most receivers seeking information (Lampel & Shamsie, 2000). This research has found a positive relationship between information asymmetry and the perceived credibility of the media, such that where information asymmetry is high, the media may be the only credible information source. Further, as the time to make a decision decreases, individuals are more likely to perceive the media as a credible source (Lampel & Shamsie, 2000). In general, information asymmetry is higher in situations where the underlying quality has intangible, knowledge-based, or subjective attributes (Ndofor & Levitas, 2004; Lampel & Shamsie, 2000). In other cases, the attribute may be tangible or functional, in which case, examination of the attribute may be easier, leading to lower information asymmetry once a decision-maker can engage in some sort of interaction or personal investigation (Lampel & Shamsie, 2000).

Uninformed receivers (potential entrepreneurs), in the absence of further information, are likely to infer the desirability and legitimacy of pursuing entrepreneurship based on the symbolic attributes transmitted in the signal from credible sources. Once a decision has been made and action taken on the part of the receiver, the action can be interpreted by the original signaler as a counter-

signal (Connelly et al., 2011; Srivastava, 2001). Because of the repeated interactions of signalers and receivers over time, signalers are subject to adjust the content of the message to the audience. In the case of entrepreneurship in an EE, potential entrepreneurs either take steps to start a business or not.

When entrepreneurship is perceived as socially desirable, based on the signal attributes transmitted, individuals are likely to make a decision to emulate the qualities they perceive as desirable. In cases where others perceive they actually possess the qualities, they may be able to successfully start a business. If the attributes transmitted are actually representative of the underlying quality corresponding to successful entrepreneurs, then, ceteris paribus, they will have a higher likelihood of succeeding as well. In each subsequent iteration of interactions between signalers and receivers, the qualities will be reinforced by signals from the media in response to more successful entrepreneurs who exhibit the quality. In entrepreneurship, the underlying quality stakeholders seek is the ability to succeed, something that cannot be observed directly at the start of a venture.

Consistent with these prior findings about attributes and also consistent with the legitimacy argument, uninformed receivers of signals about entrepreneurship are likely to base their decisions about whether entrepreneurship is the right path for them based on the symbolic attributes presented in the signals.

H2a: Signal attributes of entrepreneurship will result in more new venture starts in an entrepreneurial ecosystem.

Even if a potential entrepreneur does not possess the quality, making them unqualified, they may still seek to start a business, based on the symbolic attributes associated with being an entrepreneur and the social desirability of entrepreneurship. In this case, these are unqualified entrepreneurs are considered to be "cheaters", those who do not possess the quality. The outcome of cheating depends on the cost of pursuing entrepreneurship, relative to cheating. If the costs of starting a firm and running it are not high, a higher percentage of entrepreneurs without the qualities will start firms and, they may continue to operate and consume ecosystem resources indefinitely. In this event, the quality, whether corresponding to successful entrepreneurship or not, will cease to serve as a mechanism for discriminating between those entrepreneurs who will succeed and those who will not. If the costs of starting and running a firm are higher than the cost of emulating the qualities that signal success, the new ventures will fail relatively soon and the signal attributes will continue to be discriminating signals.

A legitimate, socially desirable status for entrepreneurship will induce individuals to pursue entrepreneurship when they are unqualified, to "cheat", because it may result in higher reputation or status for them in the ecosystem. Research has found that the desire to belong to a particular socially desirable group can lead people to choose jobs or organizations for which they are not particularly suited, resulting in adverse self-selection (Lievens & Highhouse, 2003). In signaling terms, they do not possess the underlying quality that corresponds to successful new ventures. In cases where cheating is not costly, they will eventually fail because they do not possess the qualities to succeed. Thus:

H2b: Signal attributes of entrepreneurship will result in more failures in an entrepreneurial ecosystem.

Signal Valence

Signal valence refers to the positivity or negativity of the signal being transmitted. Signaling theory assumes that the purpose of a signal is for a signaler to induce cooperative behavior from a receiver, thus this implies that signals will generally have a positive valence. Research has identified the primary mechanism through which signal valence operates to be the formation and maintenance of reputation (Fombrun & Shanley, 1990; Deephouse, 2000; Fischer & Reuber, 2007). This is consistent with the predictions of social evolutionary theory research as well, which has found that where repeated interactions occur, individuals develop reputations which then assist them in forming new cooperative relationships (Nowak, 2006). As reputation requires cognition and awareness of past actions and indirect causal relationships, this phenomenon only occurs among humans (Nowak, 2006; Rankin et al., 2007). The development of a reputation also requires memory of actions and information dissemination capabilities (Nowak & Sigmund, 1998). Much management research has been devoted to studying this dissemination and reputation process, the social construction of reputation (Fombrun & Shanley, 1990; Rao 1994; Rindova & Fombrun, 1999; Deephouse, 2000; Fischer & Reuber, 2007), and the ways in which it affects both the behavior of the firm and the reactions of others to a firm, including competitor actions (Pfarrer et al., 2008), stakeholders (Zavyalova et al., 2012), and investors (Pollock & Rindova, 2003).

Researchers have also identified reputation as an important mechanism for decision-making under conditions of information asymmetry (Balboa & Marti, 2007). An organization's reputation,

defined as public perception about attributes of the organization, has been demonstrated to serve as a signal to audiences of the underlying performance of the firm (Basdeo et al., 2006). Research in the area of reputation has examined how reputation develops over time through repeated signals and how, in the presence of multiple signalers and receivers in the environment, reputation can form and change over time (Basdeo et al., 2006). Reputation has also been demonstrated to serve as a substitute for information about the firm, such that decision-makers infer positive attributes from a positive reputation (Balboa & Marti, 2007).

Because reputation forms through the transmission of signals, whether a signaler develops a positive or negative reputation depends on the valence of the signals being transmitted to receivers in the environment. Positive signals enhance the reputation of the signaler, while negative signals decrease reputation (Fombrun & Shanley, 1990). Thus signalers prefer to transmit positive signals to increase their reputation and induce cooperation from receivers.

Signal valence is subject to the same signal criteria as signal attributes, in that the signal cost, signal credibility, and signal consistency will influence the interpretation of a receiver (Connelly et al., 2011). In entrepreneurial ecosystems, costs of positive signals include the production of the signal, the opportunity cost to the signaler or sending a poor signal, the increase in competition generated by the signal. As long as the benefits of the positivity of the signal surpass the cost, a positive signal will be transmitted. The media, as a purveyor of information in the absence of primary sources, has been shown to be a credible source in research, thus signal credibility is likely to be high (Lampel & Shamsie, 2000). The consistency of the valence is likely to influence the interpretation of the signal as well. A consistent pattern of positive signals will reinforce the reputation of a signaler and increase the likelihood of inducing cooperation.

However, research has also demonstrated that signals can be negative. Further, because signals may be ambiguous (Fombrun & Shanley, 1990), such negative signals may be unintentional (Perkins & Hendry, 2005). Negative signals may garner more attention from receivers, intended or unintended, for a variety of reasons related to the characteristics of the signal. Signal costs of negative signals are inherently more costly to the signaler, because they are highly likely to result in lost opportunities for cooperation in the future (Nowak, 2006). In line with signaling theory logic, costly signals are more salient for receivers and considered to be more credible and reliable (Connelly et al., 2011). Negative signals may also disrupt the pattern of positive signals,

thereby decreasing consistency, in turn reducing the effectiveness of signals and further reducing the credibility of the signaler. In addition to the signal characteristics, negative signals may garner more receiver attention because of the phenomenon of loss aversion (Tversky & Kahneman, 1973). When receivers perceive the potential for loss, they avoid the source of the loss, meaning negative signals would tend to reduce cooperative behaviors benefiting the signaler.

Research has demonstrated that the pattern of signals has meaning to receivers and influences interpretation of signal attributes (Balboa & Marti, 2007). The pattern of the valence of the signals sent may provide the discriminatory factor needed to transmit messages to the appropriate receivers. Neither signal frequency nor signal attribute in the media address the mechanism through which signalers ensure the appropriate receivers act on the information. Frequency and signal attributes target all receivers equally. Signal valence may fulfill this distinguishing role for receivers as it provides a more realistic expectation of the signal. Positive valence will strengthen the relationship between frequency and new venture starts in an EE as the multitude of positive signals induce the desired behavior. Negative valence will attenuate the relationship between frequency and new venture starts, however, as only those who believe they possess some form of inside information, or are strongly motivated despite the signaled probabilities of success, will pursue the undesirable behavior. Thus:

H3a: Signal valence moderates the positive relationship between signal frequency and new venture starts, such that the more positive (negative) the signal valence, the stronger (weaker) the relationship between signal frequency and new venture starts.

Positive signals, as stated above, would not discriminate between appropriate and inappropriate audiences, painting a picture of entrepreneurship that appeals to the qualified and unqualified alike. As such, positive valence of signals would be expected to strengthen the relationship between signal frequency and firm failures as increased numbers of unqualified individuals engage in entrepreneurship as well. Because negative valence leads to fewer individuals engaging in the behavior, entrepreneurship, as the frequency of negative signals increases, fewer failures are likely to take place, attenuating the relationship between frequency and firm failures. This follows from the previous logic, that only those individuals who strongly believe they are in possession of unique information or are highly motivated, will found firms. Such individuals are also likely to pursue the venture longer, in the face of potential failure, due to the same beliefs.

H3b: Signal valence moderates the positive relationship between signal frequency and venture failures, such that the more positive (negative) valence, the stronger (weaker) the relationship between signal frequency and venture failures.

At the core of the signal attributes is the correspondence between the signal attributes and the unobservable, underlying quality of success. When the attributes correspond to success and the receivers possess them, the probability of success is much higher. Conversely, the attributes may not correspond to success or the receivers may not possess them, in which case, the probability of success decreases. As developed in the hypotheses for signal attributes, these attributes can be either instrumental or symbolic, and in the absence of instrumental information, decision-makers will base their reasoning on symbolic, inferring instrumental attributes from the available information on symbolic attributes (Highhouse et al., 2007). Symbolic attributes are those attributes that are intangible and subjective and thus, they are open to more interpretation by receivers. The valence of the signal can thus influence the interpretation of these attributes and the receiver weight used to evaluate them.

When signals about these attributes have a positive valence, individuals are likely to have higher opinions of those who possess the attributes. Just as when they make decisions about jobs or organizations, individuals would be expected to prioritize desirable behaviors associated with strong positive valence signals over those with neutral or negative valence signals (Lievens & Highhouse, 2003). More positive signals will result in possessing the attributes being even more socially desirable and thus individuals may wish to believe they possess the attributes, even when they do not. In an effort to countersignal that they do possess the attribute, they attempt to engage in the behavior signified.

In this case, to signal that they possess entrepreneurial qualities, individuals engage in entrepreneurship, whether they possess the symbolic attributes or not. The characteristics of the attribute are also related to positive reputation when the signal valence is positive. In an effort to increase their own status and reputation, therefore, individuals may engage in counter-signaling behavior indicative of the attributes. The conclusion is that there are the two primary mechanisms through which the interaction of valence and signal attributes influence behavior - 1) social desirability of possessing the attribute, 2) status and reputation of the underlying quality signaled by the attribute. As in the case of frequency, however, the presence of positive valence signals alone will not serve any sort of discrimination function among receivers of the signal.

Negative valence signals, however, may serve this discriminatory function of ensuring the appropriate receivers engage in the signal. Negative valence signals about the signal attribute or the underlying quality will be expected to lower the social desirability of both possessing the symbolic attribute and engaging in the activity correlated to the attribute. Individuals who genuinely possess the attribute may actually be discouraged from pursuing the correlated activity, except in cases where they have strong motivation or believe they have superior information that would result in success. Similarly, negative valence signals about the activity would also be expected to reduce the perceived status and reputation of the activity and accompanying status or reputation gains of pursuing it. Thus:

H3c: Signal valence moderates the positive relationship between signal attributes and new venture formation, such that the more positive (negative) the signal valence, the stronger (weaker) the relationship between signal attributes and new venture formation.

Positive signals would not discriminate between appropriate and inappropriate receivers, encouraging all individuals who seek socially desirable activities, reputation, or status to pursue entrepreneurship with equal strength. As such, positive valence of signals would be expected to strengthen the relationship between signal attributes and firm failures as increased numbers of unqualified individuals engage in entrepreneurship. In such a case, the perceived social benefits to the individual would outweigh the perceived cost, resulting in honest counter-signaling by qualified receivers and cheating by unqualified receivers, however actual costs would be higher than the social benefits, leading to the increase failures. Because negative valence increases the perception of the social costs of the activity, it leads to fewer individuals engaging entrepreneurship. As the negative signal valence increases, the perceived costs increase and thus only individuals who perceive greater benefits than signal costs will engage in entrepreneurship. Such individuals must believe they possess superior information or be more highly motivated in order to pursue a behavior that would incur greater costs. These individuals, because of their perceived superior knowledge, might also be more likely to pursue the venture longer, in the face of potential failure, to attempt to avoid the loss of reputation or status that would accompany failure and force them to incur the cost, as opposed to delaying it by continuing in operation. Thus:

H3d: Signal valence moderates the positive relationship between signal attributes and firm failure, such that the more positive (negative) the signal valence, the stronger (weaker) the relationship between signal attributes and firm failures.

Industry Diversity

Industry diversity describes the number of industries in a geographic region and the dispersion of economic activities across these industries (Dissart, 2003). Researchers have examined the impact of industry diversity on economies of scale (Henderson, 1974), knowledge spillovers (Lucas, 1988), wages (Mason & Howard, 2010), and labor market productivity (Hanson, 2001), among other outcomes of interest. This research supports the conclusion that the degree of industry diversity or industry specialization matters (Hanson, 2001; Dissart, 2003). The primary benefit of the degree of specialization has been identified as economies of scale (Henderson, 1974; Hanson, 2001; Mason & Howard, 2010), through a promotion of learning and an exchange of ideas (Marshall, 1920; Hanson, 2001), although the specific mechanism through which this occurs is not explicit (Hanson, 2001). Social evolutionary theory combined with signaling theory offer insight. SET provides the motivation for firms to communicate, to induce cooperative behaviors, and to ensure survival (Nowak, 2006). Signaling theory explains how they send signals to one another, resulting in the learning and the exchange of ideas, a particular cooperative behavior.

Industry diversity, for an individual, is a characteristic of the environment in which they operate. As such, and consistent with other research using signaling theory, industry diversity would be expected to moderate the relationship between signal and desired behavior. Industry diversity does this through altering the signal cost, visibility of a particular signal, altering the fit of a signal between the unobserved quality and outcome, through increasing demands on receiver attention, and by increasing the distortion of a given signal in the signaling environment (Connelly et al., 2011).

At one end of the continuum of diversity is the specialized ecosystem. In such an ecosystem, signaling costs to induce cooperation are relatively low for firms because of shared markets and assumptions, which reduce information asymmetry and limit the amount of information that must be transmitted between signalers and receivers. Signals in such an environment are also likely to be relatively visible and consistent between signalers, that is, they are likely to use the same type of signals and encode them similarly. Further, the fit between the signal and the unobserved quality (likelihood of success) will be higher, because the paths to success are fewer. In addition, the demands on the attention of a receiver to identify and interpret signals will be lower, because the signal attributes are all likely to be similar, with higher calibration. Finally, because of the

specialized nature of firms in the environment, and the similarity between other signalers and external referents, there is likely to be lower distortion of the signal.

At the opposite end of the continuum is a highly diversified ecosystem, where economic activity is dispersed across many industries. As the industry diversity increases, all of the previously identified characteristics influencing the signal reception and interpretation are subject to change. Signal costs change because information asymmetry between industries increases and the information that must be transmitted to reduce the asymmetry increases as well. Signal visibility may decrease as well, as different industries may not share the same repertoire of signals. Researchers have identified a wide variety of signals, from firm name (Lee, 2001) to reputation (Coff, 2002) to board structure (Certo et al., 2001) to number of patents (McGrath & Nerkar, 2004). A signal attribute that constitutes an effective signal in one industry may be meaningless and undecipherable by a receiver in another industry that is unrelated, because context matters for calibration (Connelly et al., 2011). Similarly, signal fit may not be the same across industries. That is, a particular attribute representative of success in one industry may not be indicative of success in another. The attention demand on receivers, who are limited in their information processing ability (Simon, 1955), increases with the number of industries as they must monitor, identify, and process signals and attempt to maintain calibration among multiple industries which could affect them. Finally, as diversification increases, the signaling environment grows increasingly complex with a multitude of signals and many external referents who are less likely to share signal repertoires, and this complexity will lead to increasing signal distortion, adding more noise and making signaling more difficult.

Research in the area of regional diversification has shown that some diversification is beneficial to the regional growth (Hanson, 2001). While the above argumentation addresses the two extremes, prior research thus suggests that there is some optimal level of diversification between pure specialization and pure (complete) diversification, and signaling theory can be used to explain this as well. All of the above characteristics contribute to the cost of sending a signal. Signals, however, are instrumental in reducing search costs by signalers and receivers in need of partners for opportunities (Basdeo et al., 2006). As the industry diversity grows more complex, however the number of opportunities for synergistic cooperative relationships increase, and these relationships provide some benefit to the partners, or else they would not, by definition, send

signals (Connelly et al., 2011). As long as diversity continues to create more opportunities, and the benefits of these opportunities outweigh the search and signaling costs, increasing industrial diversity will result in more entrepreneurial ventures. At some point, the benefits no longer exceed costs and industrial diversity will result in fewer ventures.

As noted above, however, industry diversity is not likely to operate on the signal-new venture relationship directly, but rather through the interaction of the industry diversity with the frequency of signals. Higher industry diversity requires signalers to provide more information in order to reduce information asymmetry and calibrate signaling attributes and repertoires with receivers, to influence their perceptions and interpretations successfully. Thus:

> *H4a: Industry diversity moderates the positive relationship between signal frequency and new venture formation such that it creates an inverted-U shape curve, as industry diversity strengthens the relationship between signal frequency and new venture formation initially, and then attenuates the relationship between signal frequency and new venture formation.*

Resources

Resources are the strategic factors of production needed to produce the goods and services actors in the environment will use to create goods or services that enable them to compete, offer the potential to develop cooperative relationships, and ultimately, to ensure their survival through competitive and cooperative actions. The conditions of the environment as to resource access are an important component of social evolutionary theory, which incorporates resource availability as one of the reasons that actors compete and therefore might choose to cooperate (Nowak, 2006). Resource scarcity, under SET logic, would indicate a greater need to induce cooperative behaviors and to reduce search costs for individuals. Signaling theory contributes to this understanding through identifying the mechanisms that actors can use to communicate the desire for cooperation and how the difficulty of inducing cooperation might differ across conditions of resource availability.

Researchers have theorized that munificence of resources in the ecosystem affects the signaling behavior of actors, both signalers and receivers (Ndofor & Levitas, 2004) and limited research has investigated this phenomenon, finding a relationship between environmental munificence and the types of signals receivers expect (Park & Mezias, 2005) and changing the perceptions of actors about the uncertainty of the environment (Janney & Folta, 2006). An uncertain environment, in signaling theory language, has higher information asymmetry between

signalers and receivers. In order to overcome the information asymmetry, signalers must alter their signaling behaviors accordingly to induce cooperation from receivers.

According to signaling theory, resource abundance would be expected to result in changes to the signal through the mechanisms of the signal attributes, receiver attention and interpretation, as well as altering the nature of feedback and signal distortion (Connelly et al., 2011). At low levels of resource abundance, that is to say, under conditions of resource scarcity which increase environmental uncertainty, the signal cost would be expected to be higher and more important for survival, because each signal reduces information asymmetry to all receivers about the resource and increases competition for the scarce resource (Connelly et al., 2011; Ndofor & Levitas, 2004). Under this condition, signal observability is also likely to be more influential, as signals will have increased strength, would be expected to require better clarity to target receivers, and would need to be more visible to reduce the information asymmetry between signalers and receivers (Connelly et al., 2011; Ndofor & Levitas, 2004). Resource scarcity would also influence receiver attention, as they would need to be more aware of signals in an uncertain environment and devote more attention to environmental conditions to overcome the uncertainty. Interpretation would be different as well, because receiver calibration with the signal determines successful transmission. Environmental distortion would also have a stronger effect in conditions of resource scarcity as the importance and cost of filtering out noise for signalers would increase (Connelly et al. 2011).

As resource abundance increases, the weighting and importance of these characteristics would be expected to decrease, because there is more room for actors to make mistakes and the need for cooperation is less pressing. Signal costs decrease because increased competition does not limit resource access as stringently. Signal observability becomes less important as reaching a potential receiver becomes less important to the signaler. Receiver attention would shift away from signal identification, likely more focused on the resources available in the environment than on signals being transmitted. Similarly, the importance of calibration decreases, because the signals are no longer the focus or the best basis for survival, rather the environment may be. Finally, the importance of environmental distortion would likely decrease, but environmental counter-signals would increase in importance.

Signaling theory research has identified the influence of environmental characteristics such as resource abundance to be one of moderation, such that the environment influences aspects

of the signal and the interpretation or effectiveness, rather than directly changing the outcome. Consistent with these findings, the two mechanisms most likely to interact with the environment are signal frequency and signal attributes and their influence on firm failure rates (Janney & Folta, 2006; Ndofor & Levitas, 2004). Resource scarcity is likely to serve a distinguishing or discriminatory role for signals, such that more actors who possess underlying qualities associated with the outcome of success will act under these conditions.

Resource availability influences the interpretation and value of signals between signalers and receivers. When resources are scarce, signalers must be efficient and each signal transmitted is important for reducing information asymmetry between signalers and receivers. Scarce resources also increase the importance of cooperation for efficient use of available resources for survival (Nowak, 2006). As resource availability increases, the importance of each individual signal, the cost of signaling, and the importance of cooperation for survival decrease. Under conditions of resource scarcity, signaling theory would predict that fewer signals would be transmitted and each would have more information and value. Under conditions of resource abundance, more frequent signals would be sent and the importance of each signal would be lower. Because signals are limited in the amount of information they can transmit and the reduction in information asymmetry each can reduce, actors make decisions under conditions of resource scarcity with less information and this leads to more failures.

H5a: Resource availability moderates the positive relationship between signal frequency and firm failure, such that more (less) resource availability strengthens (weakens) the relationship between signal frequency and failure.

Similarly, the signal attributes are more important under conditions of resource scarcity because fewer signals are able to be sent, due to cost and each signal must be better calibrated to the receivers. The cost of a signal with poor fit is higher, signal fit being the extent to which the underlying quality of success and survival is correlated to the signal (Connelly et al., 2011). As resource abundance increases, the importance of the signal attributes decreases and the actors have more room for error as environments with higher resource abundance are more forgiving of mistakes (Ndofor & Levitas, 2004) and thus signalers and receivers can afford to take more time to reach calibration as the signal attributes.

H5b: Resource availability moderates the positive relationship between signal attributes and firm failure, such that more (less) resource availability strengthens (weakens) the relationship between signal attributes and failure.

As resource availability increases, the importance of cooperation for survival becomes less important to signalers and to receivers. Under these situations, potential entrepreneurs may be better served by turning their attention to the environment directly and by directly accessing resources, rather than seeking interpreting signals. As such, when resource availability is higher, potential entrepreneurs may perceive more opportunities in the environment, directly leading to increased new venture formation. Signals may become virtually irrelevant under extreme conditions of resource abundance, such that no relationship exists between signals and new venture starts, because receivers do not spare limited attention for signals.

H5c: Resource availability moderates the positive relationship between signal frequency and new venture starts, such that resource abundance attenuates the positive relationship between signal frequency and more new venture starts.

Similarly, under conditions of resource abundance, receivers (potential entrepreneurs) do not spare attention for signal attributes, because they are better served by focusing attention directly on the resources available in the environment for starting new ventures. Further, when signals are received, because they are not sparing attention for calibration, the signals are likely to be misinterpreted or disregarded. As such, even highly visible signals may be of little importance to potential entrepreneurs in these conditions. Thus:

H5d: Resource abundance attenuates the positive relationship between signal attributes and more new venture starts.

Chapter Summary

In this chapter, I proposed a model for signaling behavior in entrepreneurial ecosystems using insights from SET and signaling theory to explain how signaling behavior impacts the formation and failure of firms. The model implies that potential entrepreneurs rely on signals from other social actors in the entrepreneurial ecosystem to reduce information asymmetry and inform their actions as far as creating a new firm or terminating operations of a going concern. The model suggests that the frequency of signals, as well as their attributes, and valence inform

the actions of potential entrepreneurs. Additionally, the model suggests the mechanisms of action through which environmental factors shape perceptions and interpretations of the signals.

I argue in the chapter that social evolutionary theory and signaling theory offer complementary approaches to explaining behavior or potential entrepreneurs in the entrepreneurial ecosystem. While SET provides processes for change and logics for cooperation, signaling theory provides the mechanisms for communication that induce cooperation. The theories jointly imply the importance of reducing information asymmetry for cooperation. This is of particular importance for potential entrepreneurs in entrepreneurial ecosystems, individuals who rely on signals to inform their activities. Table 3.1 summarizes the hypotheses, while Figure 3.1 depicts the proposed model in graphical form.

CHAPTER 4: METHODS

Chapter Overview

In this chapter, I describe the methods I used to test the model proposed in Chapter 3. I describe the sample frame and the selection of the level of aggregation and why it is appropriate for entrepreneurial ecosystems (EE) and is consistent with prior research in the area. I also explain the collection of data and the creation of all variables used in the analysis. Finally, I describe the analytical techniques, tests, and report the results of the necessary tests. The study utilized archival data matched from several sources, including the Dow-Jones Factiva Database, the U.S. Bureau of Labor and Statistics (BLS), and data collected and provided by the Kauffman Foundation.

Sample Frame and Data Collection

Sample Frame and Selection

For the purpose of this dissertation, an entrepreneurial ecosystem is defined as a Metropolitan Statistical Area (MSA). MSAs are defined by the U.S. Census Bureau as geographic entities, consisting of a core urban area with a population of at least 50,000 people and encompassing cities or counties with a high degree of social and economic integration measured by commuting to the urban core, for use in collecting, aggregating, and reporting statistical information (BLS.gov). Past research in areas related to EE have used the MSA as a unit of analysis, including work in population ecology (Yang & Aldrich, 2012), economics (Beaudry & Schiffauerova, 2009), political science (Bartik, 2015), and entrepreneurship policy (Audretsch et al., 2007). Consistent with the definition of an EE used in this study, the MSA encompasses sufficient area to include the entire population of organizations that are part of the co-evolving system of technological, normative, and regulatory regimes (Aldrich, 1999) of an EE. Aggregating at the city level would unnecessarily eliminate social and economic actors who are otherwise part of the MSA and who commute to the urban core.

For sampling, I first matched data on population with the statistical data on business formations and failures at the MSA level. Then, I identified ecosystems of high and low formation and failure rates base on quartiles. The upper quartile was composed of MSAs with populations over 1 million. I then randomly sampled 15 MSAs from the 50-75 percentile range and matched them

with MSAs in the same state from the lower percentile range, where possible, to control for state-level effects. Table 4.1 lists the MSAs that were ultimately selected from this process. Population has an important impact on the formation of firms in the ecosystem, because as population increases, human capital, investment capital, and entrepreneurial activity are likely to increase as well (Florida, 2002; Aldrich & Martinez, 2010; Motoyama & Bell-Masterson, 2014). In an effort to control for this, and consistent with sampling techniques used in prior MSA studies (Rubin, 2006), the MSAs were also selected to be as close in population as possible and distance, whenever possible. Where no matching state MSA was available, an MSA that was geographically close was identified. MSAs are identified by a the U.S. Census Bureau's Core Based Statistical Area code and with an MSA name that may include up to three major cities, depending on the dispersion of economic activity in the MSA. However, the Census Bureau does not provide an inclusive list of cities within each ecosystem, but rather provides a list of counties constituting the geographic area. Using the core cities provided by the U.S. Census Bureau on each MSA, I used Google Maps to determine the distance between the principal cities of the MSAs not in the same states.

The sampling frame covers a ten year period from 2001 to 2010. I selected this time period and range for three reasons. First, there are limitations on the availability of data, because the BLS has only made MSA-level data available through 2012 (BLS.gov). Second, other work in the area has similarly examined a ten-year span (Motoyama & Bell-Masterson, 2014). Finally, when examining patterns of economic activity at the MSA level, ten years is a logical period over which to observe changes that may result, while shorter periods may be insufficient to see these patterns.

Data Collection and Research Procedures

Using the previously identified sample, articles related to entrepreneurship were gathered from these MSAs using the Dow-Jones Factiva Database. Factiva is a database owned and maintained by Dow Jones of international news sources, covering 36000 sources worldwide (proquest.libguide.com/factiva). The database has been used in a number of business studies as a data source (Johal, 2009; Abu-Laban & Garner, 2005; Peck, 2012). Factiva provides access to a large range of media sources in each of the MSAs, sources which serve as information channels for signals from numerous social actors. Research has shown that many social actors actively

seek to control and manage media coverage (Ahern & Sosyura, 2014). Further, media sources are highly visible signals for receivers in the EE.

Once the MSAs were identified, collection of articles began by identifying the appropriate key words. The search term "entrepreneur*" was used to (1) collect information on entrepreneurs and entrepreneurship and (2) differentiate from articles mentioning only small businesses. Searches of the Factiva database were filtered by region (e.g. U.S. Southwest) and state (e.g. California). To ensure that the coverage was limited to the MSA, the three largest cities identified above were used as keywords because articles in the Factiva database have the city of publication included in the text as part of the byline. Some MSAs in the U.S. are already identified with multiple principal cities, but the Census Bureau limits the identification to three cities. Thus, to be consistent across all MSAs, identifying the three large population centers in the MSA ensured all ecosystems were treated equally. With the aid of research assistants, I identified all of the counties comprising each ecosystem. From this list, we then identified the largest population centers in each of the counties. We compared them and narrowed the list to the three largest population centers for each MSA selected to assist in the collection of data.

Articles were collected annually, thus the search criteria were limited by date ranges of January 1 to December 31 for each search. For example, searching for articles for the Riverside, California MSA for 2003 used the date restriction of January 1-December 31, 2003, the keywords: entrepreneur* AND (Riverside or San Bernardino or Ontario – the three largest cities in that MSA) and were filtered to the Southwest region and the U.S. State of California. Because Factiva draws from multiple databases, the decision was made to filter for identical articles as well, to avoid having the same article multiple times. The only source exclusion was to remove legal findings, which were easily identified because of their database (e.g., LegAlert) and generally large size (i.e., 50,000-150,000+ words), often more than the total word count of all other articles identified for an observation. All companies, industries, and subjects were included in the searches, which were limited to English language publications because English is the official language of the U.S. For the collection, the research assistants and I jointly collected 5 MSAs until we arrived at 100% agreement in the articles downloaded, and then they independently searched and downloaded the articles from the remaining MSAs.

Once downloaded, the articles were matched to the data from the BLS and from the Kauffman Foundation to create an annual panel data set covering ten years and 30 MSAs. The Kauffman data set included variables such as educational attainment, investment funding available in the MSA collected from Crunchbase, patent filings of firms in the MSA, Small Business Innovation Research (SBIRs) grants awarded to firms in the MSA, and National Institute of Health (NIH) grants awarded to firms in the MSA. The BLS data included firm formations and failure rates, number of firms by industry in the MSA, and population of the MSA.

An initial examination of the data identified an outlier in the Lancaster-York MSA in Lancaster, PA. It was removed from the dataset after the preliminary analysis of descriptive statistics identified it as an extreme outlier with up to 1500 articles per year. Lancaster was later identified as the home of QVC, and this likely contributes to explaining the extreme difference in coverage and why there are so many more articles in Lancaster, irrespective of MSA size, business formation, and firm failures.

The following section details the variables used in the analysis, their collection and calculation. The section concludes with the analytical techniques used in the dissertation and reports the results of all tests performed on the data to obtain the results.

Independent Variables

Signal Frequency

A variety of signals have been identified in the literature on signaling theory, from top management team members (Higgins & Gulati, 2006) to patents (McGrath & Nerkar, 2004). While the diversity of measures of the signal itself has varied, the measure of signal frequency has been consistent as either a count of the number of signals (Janney & Folta, 2003) or as the rate of signals per time period (Baum & Korn, 1999). Other signaling studies have used counts of media articles or press releases as a measure of signal frequency (Carter, 2006). Research into media effects has used a similar variable, volume of coverage (Pollock & Rindova, 2003).

Consistent with past research in both signaling theory and media effects, I operationalize signal frequency as the annual count of articles about entrepreneurs or entrepreneurship in a particular signal area. The signal frequency variable ranged between 1 and 203 articles per year per MSA. The signal frequency variable was not normally distributed and was log-transformed

to correct for this. All news coverage was collected, including news articles, letters to editors, editorials, and columns, as long as they were available in the Factiva database, consistent with prior research in the area of media studies (Deephouse, 2000). As previously mentioned, legal findings were excluded. Aggregation of the articles to an annual frequency is based on both the nature of the dependent variable, which is available only annually, and on past research which has found that the limited time lag between media coverage and action does not adversely influence the ability to make inferences from annual data (Brown & Deegan, 1998; Deephouse, 2000).

Signal Attributes

Signal attributes cover a wide range of possible measures and are specific to the context and phenomenon being studied. Prior signaling theory research has identified many signal attributes, such as the reputation of a Venture Capitalist (VC) in the context of securing VC funding (Gulati & Higgins, 2003), and earnings claims by franchisors for attracting franchisees (Michael, 2009). Research at the individual level of analysis has gone further to categorize these attributes into two types and to identify instrumental attributes such as job demands in hiring signals (Ryan et al., 2000) and symbolic attributes including as job and organizational reputation (Highhouse et al., 2007).

Because symbolic attributes have been demonstrated to have a stronger effect under conditions of information asymmetry, I measured these symbolic signal attributes as coverage of Entrepreneurial Orientation (EO), a general set of attributes that correspond to the underlying characteristic of success of new ventures. A well-researched and validated construct exists for assessing dimensions of entrepreneurship in the form of entrepreneurial orientation (EO) (Miller, 1983; Lumpkin & Dess, 1996). Defined as strategy-processes influencing managers and individuals in their decision-making and actions, EO has been used to explain firm level performance in over 100 studies (Rauch, Wiklund, Lumpkin, & Frese, 2009).

Early work identified three dimensions of EO: innovativeness, risk taking, and proactiveness (Miller, 1983). Later, the dimensions of autonomy and competitive aggressiveness were included (Lumpkin & Dess, 1996). Innovativeness addresses creativity and willingness to experiment. Risk taking relates to the how firms deal with uncertainty. Future-orientation, searching for new opportunities, and anticipating the future all characterize proactiveness. Competitive aggressiveness assesses strategic posture and responses to rivals. Autonomy includes the freedom of leaders and

teams to engage in independent activity. EO has been measured using a validated dictionary of entrepreneurial orientation (EO) (Short, Broberg, & Cogliser, 2009).

Using the QDA Miner software suite developed by Provalis Research, word counts of each dimension of the EO construct were created, after using the validated dictionaries to create the search terms for the software. All of the five sub-dimension dictionaries identified by previous research (Miller, 1983; Lumpkin & Dess, 1996; Short et al., 2009) were used in QDA Miner, separately, to generate word counts by dimension. Additionally, prior work has identified a subset of words that do not factor into the specific dimensions identified, but which are nonetheless part of the EO construct, and these additional words were also collected as a sub-dimension of the final scale. Afterward, these dimensional word counts were aggregated to create a continuous measure. The EO measure for the analysis using the dictionaries for all six dimensions had a Cronbach's alpha of .8667, indicating good reliability (Mallery, 2003). This measure corresponds to the coverage of EO words in an entrepreneurial ecosystem, rather than measuring the EO of a particular individual or firm. While there are articles about individuals and about firms, there are also articles that talk about policy and entrepreneurship, more generally. Thus, this particular construct actually measures the level of EO attributes in the collection of signals, the pattern of EO, or the Ecosystem Entrepreneurial Orientation (EEO). The level of aggregation and the level of analysis of the study mean that it is difficult to measure the particular signals that an individual receiver weighs, however the pattern of signals, including the EEO would be something visible to all potential receivers in the ecosystem.

Moderators

Signal Valence

Signaling theory research examining the construct of signal valence has been largely theoretical (Fischer & Reuber, 2007; Perkins & Hendry, 2005) due to assumptions that signaling theory makes as to the content of signals and the purpose, which is to induce cooperation. However, related research on media and intangible assets provides a guide and justification for measuring signal valence in media content. Media effects research has operationalized tenor, a variable theoretically consistent with signal valence, as affective content (e.g., Deephouse, 2003; Jonnson & Buhr, 2011; Pfarrer, Pollock, & Rindova, 2010; Pollock & Rindova, 2003).

Using existing measurement techniques from these studies, I measured signal valence for all articles for each MSA-year observation. While this measure does not capture the valence of each individual signal, it is consistent with theoretical and empirical work in signaling theory suggesting that the overall pattern of signals, rather than any individual signal, is important (Balboa & Marti, 2007). I use the Linguistic Inquiry and Word Count (LIWC) dictionary of affective words validated by previous research on affect in media coverage (Pennebaker et al., 2007) in QDA Miner to generate a word count of the total positive affective words and the total negative affective words for each MSA-year observation in the data set.

To create a continuous variable from these two word counts, I calculated the Janis-Fadner Coefficient of Imbalance, consistent with prior research on media tenor (Janis & Fadner, 1943; Pollock & Rindova, 2003; Deephouse, 1996). The Janis-Fadner was calculated using the following formula, which generates an index variable between 0 and 1, with higher values indicating more positive coverage, while a value of 0 would be a neutral pattern, with equal positive and negative valence (Janis & Fadner, 1943; Deephouse, 1996). In the final data set of ten years and 30 MSAs, the J-F ranges from 0.051 to .796 with a mean value of .396 (std. dev. of .123). Because the count of positive valence words was higher than the negative valence across the sample, this indicates that an increase in the variable corresponds to more imbalance between positive valence words and negative valence words in each observation.

The Janis-Fadner valence variable was calculated using the following formula, consistent with prior research: $\frac{(f^2-f(u))}{(f+u)^2}\ if\ f > u\ OR \frac{(f(u)-f^2)}{(f+u)^2}\ if\ u > f$; where f is the positive coverage and u is the negative coverage.

Industry Diversity

Prior research in social evolutionary theory and signaling theory have not examined ecosystem level phenomena, however regional studies literature and economics literature have studied the relationship between industry diversity and unemployment rates (Siegel, Johnson, & Alwang, 1995), regional stability (Bahl, Farstine, & Phares, 1971), and income (Wagner & Deller, 1998). This literature provides insight into the appropriate measure of diversity and has found that certain measures of diversity strongly influence the analysis of data (Kort, 1981), thus choosing the appropriate measure is particularly important for regional studies (Dissart, 2003).

Consistent with findings and recommendations in the regional studies literature, this study used the Shannon-Weaver Diversity Index (Shannon & Weaver, 1948). The S-W Index ranges between 0 and 1, where 0 is an ecosystem with only a single industry and 1 is perfect diversity (Shannon & Weaver, 1948; Nissan & Carter, 2010). To calculate the index, the relative frequency of the economic activity of each industry was calculated, then multiplied by the log of the frequency and then the negative sum of these numbers was used to calculate the index. Data were available at the MSA level through the BLS and U.S. Census Bureau about the number of firms active in an MSA by 2-digit North American Industry Classification System (NAICS) codes. Thus, to calculate the index, I needed the total number of firms in the ecosystem, the total number of industries, and the total number of firms in each industry in the ecosystem. The formula for the Shannon-Weaver Index is shown here: $H = -\sum_{i=1}^{n} p_i \ln p_i$, where pi is the number of firms in an industry and n is the number of industries.

Resource Availability

Resource availability, as a construct, has been measured in several different ways, depending on the area of research. Studies of individual entrepreneurs, for example, used subjective, perceptual measures (Tang, 2008; Chandler & Hanks, 1994; Krueger & Carsrud, 2000), while other studies measure the construct objectively, as the availability of strategic factors of production, including financial capital (Keuschnigg & Nilesen, 2003) and human capital (Martin et al., 2013).

In this dissertation, I measured both financial and human capital. The measure of financial capital available for entrepreneurship was gathered from the Crunchbase, a free website of venture capital activity and start-up activity, on an annual basis over a ten year period. Crunchbase has been used in previous research into venture capital funding (Block & Sandner 2011; Waldner et al., 2012; Motoyama & Bell-Masterson, 2014). Crunchbase contains self-report data from firms and venture capitalists, which includes angel investment and crowdfunding investment only when the reporting firms include them. For human capital, consistent with past research, data from the BLS on educational attainment about high school completion, college attendance, and college completion for each MSA were collected and an aggregate measure computed (Barro & Lee, 2013; Motoyama & Bell-Masterson, 2014). This approach is also consistent with other MSA level research in the areas of regional studies (Beine et al., 2008) and economic development (Benhabib & Spiegel, 1994).

Dependent Variables

New Venture Formation

New venture formation has been studied as an outcome in many entrepreneurial studies and across a number of levels of analysis, including the decisions of individuals to become entrepreneurs (Townsend et al., 2010; Delmar & Shane, 2003), entrepreneurial networks (De Carolis et al., 2009), as an outcome for regions (Davidsson & Wiklund, 1997; Fritsch & Mueller, 2004), as well as for countries (Malecki, 1997; Reynolds et al., 1994; Aldrich & Ruef, 2006). Consistent with other research in this area, new venture formation is collected from the BLS at the MSA level about new firm births (Stangler & Kedrosky, 2010).

Firm Failures

Prior studies have operationalized firm failure in a number of ways, either at the individual level when a venture goes defunct and self-reports the failure (Lohr, 2009), at the population level using publicly available data to create a variable such as a count of failures (Nystrom and Starbuck, 1981), or even hazard rates to represent the probability of failure over time (Bruederl et al., 1992). Unlike the new venture formation variable, the firm failure data in the BLS is not limited solely to new ventures. The BLS does not make the data about new firm failure rates publicly available in the aggregated statistics. This measure is consistent with research in the population ecology literature and should not present any unusual issues in analysis (Yang & Aldrich, 2012). Additionally, the measure of failures, overall, is consistent with the definition of productive entrepreneurship used to define the entrepreneurial ecosystem, in that firm failures, whether new or old, may contribute to the economic growth of the ecosystem because of the net increase in value, such as through releasing resources previously tied to failing ventures (Baumol, 1993; Stam, 2015; Aldrich & Martinez, 2010).

Analytical Methodology

The nature of the research question dictates the methodology used for testing the hypotheses proposed in Chapter 3. The research question of this study seeks to answer is what effect signals about entrepreneurship have on the behavior of potential entrepreneurs. This requires

the comparison of signaling and entrepreneurial activity between entrepreneurial ecosystems over time, indicating a cross-sectional time-series dataset, also known as panel data (Torres-Reyna, 2013). Panel data allows for researchers to control for unobserved and unmeasured variables, such as differences in policies between ecosystems or historical path dependencies unique to each ecosystem, that is, any variable that might change over time, but would not vary across entities, accounting for individual heterogeneity (Baltagi, 2008). Disadvantages of panel data include difficulties in sampling and correlation between entities, cross-sectional dependence, and temporal dependence, however there are tests to identify whether issues exist in the data (Baltagi, 2008; Torres-Reyna, 2007; Hoechle, 2007).

In the analysis of panel data, an important decision was to determine whether to use fixed-effects or random-effects (Green, 2008). Fixed-effects (FE) analysis is appropriate when the variables of interest vary over time, but not between entities. FE assumes that some unmeasured or unobserved variable exists within each entity that affects or biases the outcome variable and then controls for this variable (Torres-Reyna, 2013). In the FE assumption, the time-invariant factor is unique to each individual and must not be correlated with the factor across individuals, or else FE is not the appropriate method and estimates will be incorrect (Baltagi, 2008). In such a case, random-effects (RE) would be appropriate. RE assumes that the variance across entities is random and uncorrelated with the independent variables (Torres-Reyna, 2007). When variations across entities should influence the outcome, RE is more appropriate, although problems can arise because of omitted variables which cannot be specified as RE requires (Baltagi, 2008; Torres-Reyna, 2013). To empirically determine whether FE or RE is appropriate, the Hausman test was used, testing for whether the errors were correlated with the regressor variables (Torres-Reyna, 2013). To calculate the statistic for the Hausman test, a fixed-effects model was estimated with the data, along with a random-effects model. Then the estimates were compared using the Hausman test under the null hypothesis that the difference in the coefficients was not systematic, resulting in a test statistic of .9848, indicating that there was no evidence to reject the null hypothesis and that random effects would be the more appropriate model. Thus, there are likely unobserved variables that differ between the ecosystems.

In addition to testing for FE or RE as the appropriate model, tests for cross-sectional dependence, heteroskedasticity, and serial correlation are recommended best practices for panel

data (Baltagi, 2008). Cross-sectional dependence, mutual dependencies between cross-sectional units (i.e. ecosystems), is usually only present in macro-level panels over long time periods of 20-30 years (Hoechle, 2007). The logic espoused to explain why cross-sectional dependence is observed, especially in social sciences research, is that unobserved common factors of spatial or temporal nature arise, examples of which may include social norms and psychological behaviors (Hoechle, 2007). These types of factors may exist in the panel for the current study, even though the panel covers fewer years and MSAs than those in which these effects are usually observed. Regional dependencies related to social norms about entrepreneurship, or psychological behaviors related to the signal attributes might exist, indicating that testing for cross-sectional dependence is particularly important to ensure reliable, unbiased estimates (Hoechle, 2007). The Pesaran Cross-sectional Dependence test was used to determine whether the residuals are correlated across entities in the panel (Hoechle, 2007; Torres-Reyna, 2013). Cross-sectional independence was indicated by the test and cross-sectional dependence was addressed when the regression was estimated (Hoechle, 2007; Driscoll & Kraay, 1998).

Heteroskedasticity exists when the variance of a variable across the values of a second variable changes (Newey & West, 1986). Because an assumption of linear regression is that the distribution of variables and errors is homoskedastic, invariant across values, the presence of heteroskedastic error terms violates the assumptions and biases the estimates, which are based on standard errors that do not account for the variance (Wooldridge, 2010; Baltagi, 2008). A likelihood ratio test was used to test for heteroskedasticity, and the resulting test-statistic between the estimates was significant, indicating heteroskedasticity. Huber-White standard errors can be used to provide a robust estimate (Huber, 1967; Torres-Reyna, 2013). Serial correlation typically occurs in panels with long time series and results in artificial inflation of R-square values (Wooldridge, 2010; Torres-Reyna, 2013). Using the Wooldridge test for autocorrelation in panel data (Wooldridge, 2010), there was evidence to suggest first-order autocorrelation for both dependent variables. When the model was estimated, this autocorrelation was taken into account.

An additional test for the presence of a unit root was run on the data as well (Torres-Reyna, 2007; Dickey & Fuller, 1979). A unit root indicates that a series has more than one trend (Dickey & Fuller, 1979) and this violates the assumption of stationarity, that the mean and variance do not change over time or follow any trends (Wooldridge, 2010). In economic modeling, time series data

often violate the assumption, for example because of seasonal or cyclic trends that explain changes in the data in addition to the independent variables of interest, and so transformations of the data are required to deal with this non-stationarity (Torres-Reyna, 2013; Baltagi, 2008; Enders, 2010). The Dickey-Fuller test for stationarity can be used to identify the presence of a unit root (Dickey & Fuller, 1979; Torres-Reyna, 2013). All tests indicated that there were no unit roots present, although a transformation of the data using first-differencing has been demonstrated as a viable method of adjusting for the stationarity (Dickey & Fuller, 1979; Baltagi, 2008).

Once the analyses were run, a final test to determine causality was used. Testing Granger causality begins with a regression of past values of the dependent variable and controls on the dependent variable (Granger, 1969; Seth, 2007). Then, the independent variables that are being tested as causes of the dependent variable are also regressed on the dependent variable and if the explanatory power of the independent variables on the past values of the dependent variable contain more information, then the independent variables are said to Granger-cause the dependent variable (Granger, 1969; Seth, 2007). The data must have certain characteristics for the test to be run effectively, including linearity and stationarity of the covariances (Seth, 2007). In practice, Stata provides a post-estimation test to determine whether specific variables Granger-cause the dependent variable (Stock & Watson, 2007; Green, 2008; Torres-Reyna, 2013). There are difficulties in using the test with panel data, however, because causality may differ between panels. One method of testing for Granger causality in panel data is to test each of the panels, individually, to determine whether further testing is needed (Sadraoui, Ali, & Deguachi, 2014). This testing indicated that Granger causality did not exist within the present study and that causation could not be verified through this testing method.

The panel data were collected over a 10-year period, during which a recession occurred and publicly available information suggests that the levels of both firm formation and firm failures changed dramatically, possibly as a result of general economic conditions related to the annual observations (BLS.gov; Stangler & Kedrosky, 2010). While including a time-fixed effect dummy variable would be appropriate if a FE model is indicated, another test is available to determine whether a break occurs in the regression coefficients (Torres-Reyna, 2013; Chow, 1960). In order to test whether the regression coefficients are the same pre-2008 and post-2008, a dummy variable was created for both groups and then the Chow test was used to determine whether the coefficients

of the variables are the same for both groups (Chow, 1960). The Chow test indicated a structural break in the data at the start of 2008.

Finally, with time series data, identifying whether a lag effect exists and what the appropriate lag should be for analysis is an important question. In the context of entrepreneurship, there is considerable evidence suggesting that the time it takes for individuals to realize their entrepreneurial intentions is non-negligible. Prior empirical studies in the area have suggested that the time delay between deciding to engage and realizing the intention can take upwards of ten years, although in one study, 90% had a gestation period of three years or fewer (Reynolds & Miller, 1992). Past research has estimated that only about ten percent of nascent entrepreneurs are able to realize a venture within 14 to 18 months (Reynolds, 1994), although activity on the part of nascent entrepreneurs appears, at least in some studies, to steady between two and three years from the original decision point (Carter, Gartner, & Reynolds, 1996). Studies that have examined characteristics of nascent entrepreneurs suggest that in some cases, waiting, rather than beginning immediately, has benefits for the entrepreneur (Parker & Belghitar, 2006). Other studies have found that in a given year, the population of young, small firms might involve those making decisions to enter up to four years prior to the date of the analysis (Mueller, 2006). Other research examining the difference in start-up gestation periods has empirically identified a mean of 67 months, with a median of 30 (Liao & Welsch, 2008).

Applying the findings of these studies suggests that the appropriate lag between signals and firm starts should be three years. Given that the dependent variable has been aggregated at the end of the calendar year, this should capture the majority of nascent entrepreneurs motivated by signals in a particular year, consistent with the median age of 30 months (Liao & Welsch, 2008), stability of entrepreneurial pursuit activities between 2 and 3 years (Carter et al., 1996), as well as the findings that 90% of gestations windows are three years and under (Reynolds & Miller, 1992). Most entrepreneurial firms fail within the first year of operation (Shane, 2009). Because I used a three-year lag between the signal and the new firm starts, adding an additional year to the lag should be the best estimate for the effect of the signal on firm failures, given that it takes three years to get the firm started and the majority of firms will fail within the first year. Thus a four-year lag between the signal and firm failure variable was used. In addition to the three-year lag for firm starts and the four-year lag for firm failures, I also examined the effect of the signals on same year firm starts. I

justified this because signalers may base their behaviors on immediate returns, and because 10% of entrepreneurs are able to begin in the first year.

To summarize, a number of tests were run to determine characteristics of the data to improve analysis. The Hausman test indicated that a random effects model should be estimated. The Dickey-Fuller test for stationarity indicated that no unit root was present in the data and thus, no first-difference transformations were needed. The Chow test for structural breaks suggested that there was a structural difference in the estimates before and after 2008. The LR test indicated that heteroskedasticity was a concern. The Pesaran test for cross-sectional dependence additionally indicated that cross-sectional dependence does exist between panels. The Wooldridge test for autocorrelation indicated first order autocorrelation in the data. In addition, the nature of the sample being from a single country and the sampling method of collecting geographically neighboring ecosystems suggests the possibility of spatial cross-correlations between the panels might be an issue. Finally, time-series cross-sectional data with small number of panels, N, relative to time periods, T, have been demonstrated in past research to have poor fit and estimates when using certain estimation techniques, notably Feasible General Least Squares (FGLS) due to the manner of estimation. When the number of panels is greater than the number of periods, the estimation results are based on a generalized inverse of a singular matrix, thus the results are not valid (Beck & Katz, 1995). However, an alternative estimation method exists that is robust to all of the potential problems identified in the tests of the data, specifically that the data are serially correlated, heteroskedastic, and have cross-sectional dependence between the panels. Using Pooled Ordinary Least Squares (POLS) and the Driscoll-Kraay standard errors allows for estimates that are robust to all of these problems and also generally robust to both temporal and spatial cross-correlations (Hoechle, 2007). This estimation method, using the Driscoll-Kraay standard errors is included in the Stata package xtscc (Hoechle, 2007). The results of the analyses using POLS and Driscoll-Kraay standard errors are presented in Chapter 5.

Chapter Summary

In this chapter, I explained how I tested the hypotheses presented in Chapter 3 using a single study design. I described the sample frame and selection, the collection of data and how I matched data from multiple sources. I also explained how I created each of the variables using

the data sources and how this is consistent with prior research in streams of research related to entrepreneurial ecosystems and signaling theory. I identified potential problems with the data and tested for them, presenting my test results and the corrections applied where appropriate. Table 4.2 summarizes the variables, measures, and data sources used for the study.

CHAPTER 5: RESULTS

Chapter Overview

In this chapter, I describe, discuss, and summarize the results of the analyses. First, I briefly describe the data and provide descriptive statistics and correlations. Then, I review the results of the analyses organized by dependent variable, the entry of new firms (DV1), then the exit of firms (DV2), and finally the robustness checks using an alternate measure of new firms (DV3). The results generally support the role of signals and signal attributes in the entrepreneurial ecosystem context as predicted in Chapter 3. The results remain consistent with SET and Signaling Theory, confirming that signals transmit information to receivers and then the receivers act on the information using their individual interpretations. The actions of the receivers, at least insofar as founding new establishments in entrepreneurial ecosystems, are consistent with SET logic which suggests individuals will choose cooperative or competitive behaviors based on their perceptions of the environment and how best to compete in it. In what follows in this chapter, I summarize the results and compare them to the hypotheses. In Chapter 6, I examine the reasons why some relationships were opposite of those predicted.

Descriptive Statistics

The study used a sample of thirty MSAs from which data were collected from 2001-2010, resulting in 330 MSA-year observations. Table 5.1 shows the descriptive statistics for the dependent, independent, moderator, control, and interaction variables used to test the hypotheses presented in Chapter 3. The data presented in Table 5.1 reflects non-standardized variables. Per the selection criteria, none of the MSAs had populations over one million, with the largest MSA in the sample having a population of 842,813, while the smallest was 160,576.

New Firms

The hypotheses can generally be separated into two groups, based on the dependent variable of interest. The first set of hypotheses is related to the establishment of new firms in an entrepreneurial ecosystem. Table 5.3 summarizes the effects related to new firms. These hypotheses can be further categorized by independent variable and associated moderators. The

first independent variable is signal frequency. Hypothesis 1a predicted a direct and positive effect of signal frequency on new firm creation. Hypothesis 1a, signal frequency, was supported (β=.623, p=.000). In practical terms, a one percent increase in the number of articles about entrepreneurship results in 2.6 new firms, on average. In addition to the direct effect, several moderators were proposed, including signal valence, industry diversity, and resources. Hypothesis 3a, predicting a positive interaction between signal frequency and signal valence was not supported. The relationship was significant, but opposite the predicted direction (β=-1.084, p=.012). Because the valence variable range was positive across the sample, the interpretation of the interaction involves positive valence and increasingly unbalanced valence in the positive direction. Figure 5.1 depicts the positive relationship between signal frequency and new firms. As coverage becomes increasingly positive, the sign of the relationship flips and higher signal frequency results in fewer new firms. Thus, this result is opposite the prediction and signal valence attenuates the positive relationship between signal frequency and new firm formation. I discuss this result further in Chapter 6. Hypothesis 4a predicted an interaction between industry diversity and signal frequency. It was not supported (β=-.118, p=.430). Hypothesis 5c predicted that resources would attenuate the relationship between signal frequency and new firms. Hypothesis 5c was not supported. The interaction was significant but opposite the direction predicted (β=3.32E-09, p=.000). Figure 5.2 depicts the positive relationship between signal frequency and new firms. As resources increase, the positive relationship between signal frequency and new firms is strengthened. Although the interaction is significant, the practical effect is small across the range of the sample.

A second set of hypotheses examines the relationship between content attributes of the signals and new firm formation. Hypothesis 2a predicted a direct and positive effect of signal content on the creation of new firms. The hypothesis was not supported. The relationship was significant in the model of independent variables, but was not supported in the full model (Table 5.3, Model 2: β=-.320, p=.000; Model 3: β=-.388, p=.472). In both models, the direction of the effect was opposite predictions. Hypothesis 3c predicted that signal valence would strengthen the positive relationship between signal content and new firms. This hypothesis was not supported (β=.007, p=.659). Hypothesis 5a predicted that that resources would strengthen the positive relationship between signal content and new firms. Hypothesis 5a was not supported (β=-1.47E-09, p=.184). In addition to the hypothesized relationships, valence, industry diversity, and resource availability

were found to have significant direct effects. Valence was marginally significant, exhibiting a positive direct effect on new firm establishments (β=.164, p=.065). The effect of industry diversity was negative and significant (β=-.458, p=.004). Finally resource availability exhibited a direct, negative effect (β=-.309, p=.003).

Firm Failures

The second broad set of hypotheses examines the failure of firms in entrepreneurial ecosystems. Table 5.4 summarizes the relationships related to firm failures. These hypotheses can be broken into two subsets around the independent variables predicting direct effects. The first subset of hypotheses predicts the effect of signal frequency on firm failures. Hypothesis 1b predicted a positive relationship between the frequency of signals and the number of firm failures. This hypothesis was supported (β=.429, p=.001). In practical terms, this means that a one percent increase in the number of articles about entrepreneurship increases the number of firm failures by 1.5 firms, on average. Hypothesis 3b predicted that signal valence would strengthen the relationship between signal frequency and firm failures. The hypothesis was not supported. The relationship was marginally significant and negative (β=-.591, p=.067), but opposite the predicted direction. Figure 5.3 depicts the moderating effect of signal valence on the positive relationship between signal frequency and firm failures. As coverage becomes increasingly positive, the sign of the relationship flips and higher signal frequency results in fewer firm failures. This result is opposite the prediction and signal valence attenuates the positive relationship between signal frequency and firm failures. This finding is consistent with the result of hypothesis 3a, above. Hypothesis 5d predicted that resources would attenuate the relationship between signal frequency and firm failures. Hypothesis 5d was not supported. The relationship was positive and significant (β=2.44E-08, p=.000), which is opposite the predicted direction. Figure 5.4 depicts the moderating effect of resources on the positive relationship between signal frequency and firm failures. As resources increase, this strengthens the positive relationship between signal frequency and firm failures. The effect of the interaction is significant, however the practical effect is small across the range of the sample.

The second subset of hypotheses about firm failure predicts the effect of signal attributes on firm failures. Hypothesis 2b predicted that signal attributes of entrepreneurial orientation would lead to more firm failures. This hypothesis was not supported. The relationship was significant in

the model of independent variables, however it was not significant in the full model (Table 5.4 Model 2: β=-.141, p=.046; Model 3: β=-.157, p=.637). In both models, the effect was opposite the direction predicted and consistent with the results for hypothesis 2a. Hypothesis 3d predicted that signal valence would strengthen the positive relationship between signal attributes and firm failures. This hypothesis was not supported (β=.002, p=.866). Hypothesis 5b predicted that resources would strengthen the positive relationship between signal attributes and firm failures. Hypothesis 5b was not supported. The relationship was significant and negative, which is opposite the prediction (β=-2.93E-08, p=.000). Figure 5.5 graphically depicts the moderating effect of resources on the negative relationship between signal attributes and firm failures graphically. As resources increase, the negative relationship between signal attributes and firm failures becomes stronger. As with the interaction effects between resources and other variables found in the results, hypothesis 5b, while significant, appears to have a small practical effect across the range of the sample. Finally, the model also revealed that valence and resources had direct and significant effects on firm failures. Valence exhibited a positive direct effect (β=.179, p=.039), along with resources, which also had a positive direct effect on firm failures (β=.315, p=.001).

Robustness Checks

As a test of the robustness of the analysis and results, I also ran the analyses for firm starts using a different data source from the Business Dynamics Statistics to calculate an alternative measure for new firms. The measure is the count of all establishments in the MSA considered to have an age of zero, meaning that these firms had no employees during the previous year. This measure should represent the same population as new establishment entries. In addition, the BLS has corrected the measure for left-truncation of the data. Left truncation occurs because the aggregated annual reports do not account for firms that start and fail within the same reporting period in most databases (Yang & Aldrich, 2012). Ordinarily, a firm that was founded in 2000 and failed in 2000 would not be included in the dataset, thus resulting in a bias in the results because the data are left-censored. The results for the alternate measure of new firms are summarized in Table 5.5. The results of the analyses were consistent with those of the primary analysis. The effect magnitudes differed, however they were all in the same directions as the primary analyses, suggesting that across the DVs, they are consistent.

In addition to this DV, I was also able to identify a subset of firms that were new and small sized (1-4 employees). I performed two analyses on this subset of firms, one using a three year lag as in the primary analyses and a second one using the same year predictors (no lag). The logic behind this test is that new, small firms may be able to move faster and organize resources quicker, because they have fewer needs. They would also correspond to the 10% of firms able to start in the same year (Reynolds & Miller, 1992) and could represent a different audience of firms for the same signal. The new, small firms may represent a subset population with higher entrepreneurial intentions and also a population consistently targeted by signalers attempting to encourage entrepreneurship. The results of the analyses for new, small firms are presented in Table 5.6. The analyses indicate consistency across the subset and with the primary analyses. A notable difference is that hypothesis 2a, predicting a direct and positive effect between signal attributes and new firm creation, while still not supported, becomes marginally significant in the same year in the analysis of new, small firms (Table 5.6, Model 3: β=-.449, p=.093). Hypothesis 5a is not supported in the robustness checks, either. However, the interaction between signal attributes and resources becomes significant for new, small firms (Table 5.6, Model 3: β= -3.30E-09, p=.003). This is opposite the direction of the prediction, however the signal attributes relationship is also opposite predictions. Thus, the interaction makes the negative relationship between signal attributes and new, small firm formations even more negative in the presence of resources. I discuss this in Chapter 6.

Chapter Summary

Chapter 5 described and explained the findings of the analyses. Table 5.7 summarizes the support, partial support, or lack of support for each hypothesis tested. Consistent with expectations, signal frequency appears to be a significant predictor of both new firms and firm failures. There was evidence to suggest signal frequency remains important with the interactions for both valence and resources, although the interaction with valence was opposite predictions. Signal attributes were found to have significant direct effects on both new firms and firm failures, although the direction was opposite predictions. In addition, the signal attribute direct effect became non-significant in the presence of interactions. The interaction between signal attributes and resources was significant for firm failures in the primary analysis and for new, small firms in the same-year analysis. All of the signal attribute coefficients were in the opposite direction as

predicted, which warrants some discussion and explanation in Chapter 6. The effects observed were consistent across DVs, with direct effects in the same direction and interaction effects exhibiting the same general shape.

CHAPTER 6: DISCUSSION AND CONCLUSION

Chapter Overview

In this chapter, I discuss the contributions and implications of the dissertation. I begin with a brief review of the results of the dissertation, organized by main effects and interactions, then discuss the findings using the lenses of SET and signaling theory. Next, I identify the boundary conditions of the present study and explore paths for future research. Then, I highlight implications for research, practice, and policy. Finally, I conclude with evidence of how I met each of the research objectives in Chapter 1.

General Discussion

Signal Frequency and New Firms

Signal Frequency and New Firms. The first set of hypotheses links signal frequency to new firm starts and include hypotheses 1a, 3a, 4a, and 5c. Hypothesis 1a predicted a direct and positive relationship between signal frequency and new firm formations. Support was found for a direct effect of signal frequency in the analysis, suggesting that signal frequencies are important for the formation of new firms. As argued, an increase in signal frequency should reduce information asymmetry and then the reduction in information asymmetry provides potential entrepreneurs in the ecosystem a more accurate picture of the environment, in turn motivating potential entrepreneurs to engage in entrepreneurial activities. This is consistent with the SET perspective, in that signals about the competitive environment should motivate cooperative or competitive behaviors among and between individuals in an ecosystem (Nowak, 2006).

Hypothesis 3a predicted that signal valence would strengthen the positive relationship between signal frequency and firm formations. Hypothesis 3a was partially supported, although the finding suggests that the relationship is more complex that predicted. Higher signal frequency in the presence of moderately positive signal valence corresponded to an increase in new firms. The range of the valence variable was positive in the sample, and thus the positivity increased across the sample as it became increasingly unbalanced in the direction of positive valence. Increasingly positive valence interacted with increasing signal frequency in such a way as to correspond to fewer new firms, suggesting that signal valence plays a critical role in the signal interpretation by potential entrepreneurs. Individuals with higher entrepreneurial intentions may be more willing to

act on only a few very positive signals, for example. When there are many positive signals, even individuals with high entrepreneurial intentions may re-evaluate the signals being sent. The shape of the interaction, combined with signaling theory concepts, suggests that an increasing frequency of increasingly positive valence articles may begin to lose credibility with the receivers, perhaps because they perceive bias from the signalers (Connelly et al., 2011).

In such a case, the receivers may not believe that the signals are reducing information asymmetry as well, consistent with research in the area of communication that has found that negative words convey more information than positive words (Garcia, Garas, & Schweitzer, 2012). A moderately positive valence of signals, on the other hand, suggests that there are also more negative valence articles and that the signals being sent are less biased and more credible. The combination may be perceived as reducing information asymmetry better. This is consistent with research in signaling theory identifying the importance of both signaler honesty (Arthurs et al., 2008) and signaler credibility (Busenitz et al., 2005) as important dimensions for the signal, as discussed in Chapter 3. Thus, a better reduction in information asymmetry, represented by the interaction of balanced valence and higher signal frequency results in more individuals choosing to pursue entrepreneurship, consistent with the SET argument that they can more accurately choose between cooperative and competitive behaviors. Potential entrepreneurs may believe that too much positive coverage of entrepreneurship in an ecosystem is an indication of a situation that is simply too good to be true.

Hypothesis 4a predicted that industry diversity would moderate the relationship between signal frequency and firm starts, such that under conditions with fewer signals and many signals, there would be fewer starts, while a moderate number of signals would result in more starts. This hypothesis was not supported in the primary analysis. The subset analysis found only a marginal relationship here. Thus, it appears that industry diversity does not have a significant moderating effect on the relationship between frequency and firm formations.

Hypothesis 5c predicted that resource availability would weaken the effect between signal frequency and firm starts. This effect was not supported in the primary analysis. Instead, it was found to be opposite, such that greater resource availability strengthened the effect between signal frequency and new firm starts. This suggests that signal frequency is more important under conditions where resources are available.

Considered together, the results of these hypotheses suggest that signal frequency is a necessary condition to encourage new venture formation in entrepreneurial ecosystems. For the signal, itself, the valence matters, such that more balanced signals are more important than many positive signals, which indeed, appear to have a negative effect on the perception of the signal. Resource availability appears to moderate the relationship such that higher resource availability in the presence of more signals has a stronger effect than either alone. A likely explanation for this is that under conditions of resource abundance, more potential entrepreneurs are receptive to signals about entrepreneurship. By SET logic, this interaction makes sense, because a resource abundant environment would mean that individuals would be less motivated to work together to acquire resources and more motivated to compete for the resources amongst themselves (West et al., 2007). As a result, fewer individuals would remain with their existing firms, they would not be as motivated to seek out partnerships, and would seek to start new firms instead.

These results present an interesting extension of SET. Specifically, the definition and meaning of cooperative and competitive behaviors may differ between levels of analysis. As an example, consider the case of mutualism, which SET identifies as one possible relationship between social actors. In mutualism, both actors incur a cost to cooperate and both benefit from the relationship. At the ecosystem level of analysis, new firm creation is an example of mutualism because several social actors (suppliers, financiers, politicians, entrepreneurs) engage in cooperative behaviors that incur costs and result in mutually beneficial relationships among the actors. At the individual level, mutualism could, alternatively, also be working for another firm. This cooperative behavior at the individual level would not be directly observable, although it would impact the results of this study. Also at the individual level, starting a firm might be viewed as a more competitive behavior whereas starting a firm would be viewed as a cooperative behavior (joining the ecosystem) at the ecosystem level. When individuals choose to strike out on their own, especially when forgoing partnerships with other individuals or firms, this action would likely be viewed, at the individual-level, as more competitive than cooperative. This may also be the case because potential entrepreneurs do not appreciate the full range of relationships that must be developed and maintained as a new firm. This would be consistent with work suggesting that media coverage might provide the motivation to start new firms, but does not provide the necessary know-how or details on how to make them successful (Aldrich & Yang, 2012). Thus, starting a

new firm with partners would be a cooperative behavior from the individual perspective which would reduce the overall number of starts in an ecosystem when compared to each individual starting on his or her own. Although the current study data are not nuanced enough to measure this outcome in finer detail, the logic here is consistent with an extension of SET to the individual level of analysis and warrants examination in future research.

Signal Frequency and Firm Failures

The second set of hypotheses links signal frequency to firm failure and includes hypotheses 1b, 3b, and 5d. Hypothesis 1b predicted a direct and positive relationship between signal frequency and firm failures and was supported. The logic of the hypotheses was that firm failures are likely to increase because additional unqualified individuals start firms. Signaling theory logic predicts that the signal frequency will reduce the information asymmetry in the ecosystem, while SET logic predicts that individuals will then choose the appropriate cooperative or competitive behavior based on this information. The support for hypothesis 1b suggests that signal frequency motivates potential entrepreneurs to start firms, although consistent with the logic in the hypothesis development, it also indicates that more of the new firms may have been founded by those without the necessary qualifications.

Hypothesis 3b predicted that signal valence would strengthen the positive relationship between signal frequency and firm failures. Hypothesis 3b was partially supported in the primary analysis. However, opposite the logic of the hypothesis, and consistent with the finding in hypothesis 3a, the direction of the effect was opposite predictions. This means that increasingly unbalanced, positive valence of signals corresponds interacts with the increasing frequency to result in fewer firm failures. The second proposed moderation for the relationship between signal frequency and firm failures was hypothesis 5d, which predicted that resource availability would weaken the positive effect between signal frequency and firm failures. The logic behind the hypothesis was that increasing resource availability would prolong the life of nascent ventures that might otherwise fail. Contrary to the prediction, increasing resource availability strengthened the relationship between signal frequency and firm failures. Across the range of the sample, the effect was statistically significant, though practically small.

Considered together, these hypotheses suggest that signal frequency influences the failure of firms as predicted in Chapter 3. Potential entrepreneurs are motivated to start firms by the frequency of signals; however the signals do not discriminate between those with higher potential for success. The pattern of results between the new firm starts and firm failure DVs are largely consistent, in terms of shape of the effects, though the magnitudes differed. This may provide evidence of an alternative model linking signal frequency, firm starts, and firm failures. The lag of three years selected to analyze the effect of the signaling behavior on firm formation was consistent with past empirical work. Similarly, because a firm has to have started in order to fail, a four year lag was selected for the firm failure analysis. The logic behind these lag selections may suggest an alternative model of signaling behavior on firm failures, one in which the signals are mediated by firm starts. There are direct effects between signaling frequency and firm failures, which may indicate a partial mediation. As a result, an avenue for future research may be to test this alternate model.

Signal Content and New Firms

The third set of hypotheses links signal content, specifically E.O. content, to new firm starts and includes hypotheses 2a, 3c, and 5a. Hypothesis 2a predicted a positive relationship between E.O. content and firm starts with more E.O. content leading to more firms in the ecosystem. The logic behind this hypothesis was that E.O. content would be representative of the entrepreneurial orientation of the entrepreneurial ecosystem and the coverage of the content would encourage potential entrepreneurs to pursue entrepreneurial ventures. In the analyses, the effect of E.O. content varied in terms of statistical significance, but the effect always reflected a negative relationship between E.O. content and new firm starts, contrary to the prediction of hypothesis 2a. This suggests that entrepreneurs may be interpreting E.O. content differently than the logic articulated for hypothesis 2a. Specifically, some entrepreneurs may view E.O. content as an undesirable, rather than desirable, signal for new starts. Instead of promoting individual-level competitive behaviors (starting new ventures), E.O. content may stimulate individual-level cooperative behaviors (continuing with existing firms or jobs; partnering with others rather than starting an independent venture). One possible reason for this is that many of the words associated with the E.O. construct are oriented towards competition and how to compete, including competitive aggressiveness, proactiveness, and innovation. When covered in the media,

signals about these topics may be indicative of the competitive environment or dynamics in the ecosystem, rather than the mindset of the ecosystem as a whole. According to SET, signals about increasing competitiveness should lead to more cooperative, rather than competitive behaviors, because cooperation offers an evolutionary advantage over competition in these cases.

Hypothesis 3c predicted that signal valence would strengthen the positive relationship between E.O. content and new firm starts based on the logic that E.O. content represented the mindset of the ecosystem pertaining to entrepreneurship and that positive signals about it would encourage potential entrepreneurs to believe it was a valued pursuit and thus they should start their own firms. This hypothesis was not supported in the analysis. Hypothesis 5a, predicted that resource availability would strengthen the positive relationship between E.O. content and new firm starts based on the logic that additional resources would incentivize potential entrepreneurs to pursue new ventures. This relationship was not significant. However using the subset analysis of new, small firms, there was evidence to suggest the interaction was significant, although as with other resource interactions, the effect was practically small. The finding in the subsample still suggests that under certain circumstances, such as in the presence of resource availability, content signals may are important for the formation of new firms, particularly for new, small firms, those most likely to be in need of resources. These same firms may also be particularly attentive to the E.O. content of signals as well.

In considering the logic behind why the E.O. content relationship with new firm starts is opposite what was predicted, I have identified two possible explanations. First, the construct of entrepreneurial orientation at the ecosystem level and applied to media coverage of entrepreneurship may be interpreted differently than when used in the context of letters to shareholders in which the dictionary used was developed. Specifically, the dimensions of E.O., when used by companies, suggest a certain competitive mindset characterized by autonomy, innovativeness, proactiveness, risk-taking, and competitive aggressiveness (Lumpkin & Dess, 1996). When used as signaling attributes in letters to shareholders, these words and their unobservable associated characteristics are selling points.

However, when used as signaling attributes about the entrepreneurial ecosystem, different elements may be highlighted and are subject to a different interpretation by receivers. Risk-taking and competitive aggressiveness, for example, may be viewed by individuals as negative attributes

of an ecosystem - it might be too risky to start a firm there or the competition could be perceived as too fierce. Indeed, prior research demonstrates that when density levels are high (a large number of firms are competing in an industry), entrepreneurs rate all potential opportunities as less attractive (Wood, McKelvie, & Haynie, 2014). Additionally, individuals with lower entrepreneurial intentions might be equally deterred by signals about the need for innovation or proactiveness, leading them to choose the pursuit of other career opportunities, instead. Thus, the meaning of the construct in context changes, and the relationship proves to be opposite expectations. Table 6.1 provides a selection of exemplar quotations taken from the text of articles used in this study. These quotes are suggestive of how the E.O. content of the articles might have a different meaning than if they were used in the context of letters to shareholders. For example, "If you're more productive, you're better able to compete and survive and expand and grow." Note the emphasis on competition and challenges, even survival, that could drive potential entrepreneurs with lower entrepreneurial intentions to seek other options than self-employment. The nature of the construct suggests that it may serve to eliminate those who are less dedicated to the idea from those that are more passionate.

Second, using the lens of SET, this finding remains consistent with the logic of the theory, when the construct at the ecosystem level signals higher levels of competition. SET predicts that under such conditions, individuals will seek cooperative relationships in order to improve their competitive positions. Even among the individuals with higher levels of entrepreneurial intentions, a highly competitive environment would be more likely to lead them to seek out partnerships. Instead of starting an entrepreneurial venture alone, two or more potential entrepreneurs would be subsumed into a single firm, and this would create a negative relationship between the E.O. content coverage and actual firm formations as well. The same logic holds true for firm failures as well (see next section), predicting why the findings suggest that higher E.O. leads to fewer failures - potential entrepreneurs either choose not to start a business or they hedge their risk by finding cooperative relationships that allow them to survive longer. This is consistent with literature in the area of opportunity evaluation at the individual level which has found that higher risk perceptions by potential entrepreneurs lead them to evaluate opportunities less favorably (Forlani & Mullins, 2000; Keh, Foo, & Lim, 2002).

These findings suggest that the signal content, in this case E.O. content, is an important signal attribute linking the signaling pattern to new firm formations. The E.O. content does not

appear to be representative of the entrepreneurial mindset of the ecosystem, as conceptualized in Chapter 3, but rather it would seem the E.O. content may be representative of underlying, unverifiable dimensions of the competitive environment that influence potential entrepreneurs' perceptions. In the presence of highly positive valence signals, entrepreneurs seem to view E.O. content as a signal that existing firms are performing well, that the environment is competitive, and that there is no place for the new firms they might have an interest in creating. On the other hand, in the presence of balanced signals, E.O. content may be indicative of the existing firms performing poorly, which creates the perception for potential entrepreneurs that opportunities may exist for the venture ideas they would pursue. In the case of new, small firms, the availability of resources also influences perceptions of the signal content, insofar as the interaction is significant, although the practical effects are limited.

Signal Content and Firm Failure

The fourth and final set of hypotheses links signal content, again as E.O. content, to firm failures and includes hypotheses 2b, 3d, and 5b. Hypothesis 2b predicted a positive relationship between E.O. content and firm failures with more E.O. content leading to more failures in the ecosystem. The results suggest that a relationship exists, but the direction is opposite what was predicted in the hypotheses, consistent with the findings and discussion presented above about hypothesis 2a.

Hypothesis 3d predicted that signal valence would strengthen the positive relationship between E.O. content and firm failures based on the logic that E.O. represented the ecosystem mindset about entrepreneurship and that positive signals would indicate to potential entrepreneurs that entrepreneurship was a desirable pursuit in the ecosystem. As discussed in the previous section, the findings indicate E.O. content may not represent this at all, but rather describes to potential entrepreneurs the competitive environment of the ecosystem. The interaction was not found to be significant, and the hypothesis was not supported.

Hypothesis 5b predicted that resource availability would strengthen the positive relationship between E.O. content and firm failures following the logic that E.O. content, as a mindset, combined with the presence of resources with which to begin their endeavors, would encourage potential entrepreneurs to found firms and that more of them would not be qualified as well, thus resulting in more failures. The results suggest that resource availability weakens the negative relationship

between E.O. content and firm failure. As with all of the resource availability moderations, the practical effects of the interaction are limited, with a significant, but negligible difference between low and high resource availability.

These findings are consistent with the signal frequency hypotheses concerning signal frequency and firm failure and the E.O. content concerning new firm starts. As with the hypotheses about signal frequency and firm failure, these findings suggest that while there are some direct effects, there may also be evidence for new firm formation as a mediator, an alternate model to test in future research. Consistent with the E.O. content to new firm relationships, E.O. content would seem to represent the competitive environment, rather than the mindset of the ecosystem as conceptualized in the hypothesis development. SET logic suggests that signals to potential entrepreneurs indicating a more competitive environment should lead to fewer firm failures. This follows from the logic that a more competitive environment should influence individuals to engage in cooperative behaviors, the most likely of which are to remain employed by another, operating firm, or to find partners with whom to pursue a new venture. Both of these cooperative outcomes result in fewer new firms in the entrepreneurial ecosystem, leading to fewer failures. In addition, starting firms with partners may allow nascent entrepreneurs to hedge their risk and to survive longer than an individual entrepreneur because of the support from multiple personal resource networks. This would then lead to even fewer firm failures. Thus, these findings are consistent with and support SET as applied to entrepreneurial ecosystems.

Boundary Conditions & Future Directions

The present study is not without limitations that may have influenced the results and might restrict the generalizability of the findings. These limitations include the choice of signal type, article selection, the population-level nature of the data used in the analysis, and the limited time period of the study. Fortunately, each of the limitations also suggests future research and opportunities to extend the present model. Finally, the findings of the dissertation opposite the directions predicted also suggest avenues of study for future studies.

The choice to use printed news media articles to operationalize the signaling activity in the ecosystem was justified by the highly visible nature of the media channel and by a vibrant literature in communications (Bandura, 2001) and management on media studies (Pfarrer et

al., 2008). Media articles, as signals, are likely to reach all audiences in the ecosystem and be recognized and accorded some degree of credibility, thus leading to their influence on behaviors. In addition, the time period of the study, from 2001-2010, necessitates printed news media, because social media did not begin to develop fully until after 2006. In a study exploring a new application of theory, such as this one, a highly visible signal and strong expectations of a relationship are ideal. However, as I have argued, there are many signalers in an entrepreneurial ecosystem, and they send signals through many channels using a variety of means to reach the intended receivers. Alternative channels to consider for signals could include television news, social media, or word of mouth. In addition, other actions that pertinent signalers in an entrepreneurial ecosystem take are signals to receivers, such as advertising, promotions, donations, and participation in trade groups or entrepreneurship-oriented organizations. The broad coverage aspects of news print means that a selection of these actions are already incorporated into the data, but less visible actions may be missing. Indeed, the possibility exists that taking the action, rather than the news coverage of it, might prove to be the more important signal. Future research could incorporate additional channels to determine whether certain forms of communication alter the perception or importance of the signals being sent. An alternative research idea would be to identify the signals being sent directly by firms, independent of media and then to identify the differing impact of the direct signals and media signals. Future researchers could also consider an inductive approach to this question, in order to investigate which channels and signal attributes are more pertinent to potential entrepreneurs when making the decision to undertake entrepreneurial endeavors.

Another limitation of the present study may be the selection criteria for articles used in the analysis. While the selection of articles related to entrepreneurship is a logical decision for this study, the narrower range of topics may limit the generalizability of the findings. It is possible that an expansion in the scope of selection could provide additional insight into the way signal frequency impacts firm formation and failure in entrepreneurial ecosystems. Future research could randomly sample from all articles in the entrepreneurial ecosystem to determine whether the broad coverage has a different effect. The present study did not examine the relative frequency of entrepreneurship articles as compared to all articles in the ecosystem, which may, in future research, provide insight into how important entrepreneurship is for an ecosystem as well as how difficult it is for potential entrepreneurs to receive the signals about entrepreneurship from the

array of signals being sent. This might allow future research to make inferences about the attention potential entrepreneurs give to signals about entrepreneurship. Alternatively, all business-related articles could be collected, although the article selection in the present study suggests that such an undertaking might be prohibitive in terms of time for data collection, space for storage requirements, and even processing power because of the volume of articles.

The use of ecosystem-level data for the analysis allows the present study to identify patterns of activity among potential entrepreneurs who decide to engage in some form of entrepreneurial activity, however a limitation of this approach is that it is not possible to determine the effect of signals on the entire population of potential entrepreneurs. Thus, there are nuances missing from our understanding, and some of the inferences made from the analysis may be more tenuous and might not apply to the population of potential entrepreneurs who do not engage in firm creation. The population-level of analysis and the available data do not account for the movement of individuals between ecosystems, for example, such that an entrepreneur may found a firm in Ecosystem B, while the signals most pertinent for the decision and motivation were received in Ecosystem A. The presence of a time-lag effect found in the analysis only complicates this relationship further, such that the signal could have been received in Ecosystem A in time 0, while the firm was founded in Ecosystem B at time 4. Future research in this area exploring these relationships would probably benefit from access to the U.S. Census Bureau Research Data Centers, which would allow them to follow specific cohorts of individuals and their spatial movement in addition to their entrepreneurial activity. It would not be unreasonable to expect, for example, that positive signals about entrepreneurship received by individuals in larger MSAs motivate those potential entrepreneurs who receive them to actually found firms in smaller MSAs with less coverage suggesting they would not be as highly competitive as a larger MSA might be. Such data access would allow future research to make more fine-grained inferences and recommendations, especially for practice and policy.

The ecosystem level of analysis also highlights the importance of the stock of existing population and resources, consistent with past studies in population ecology (Aldrich, 1990) and industry agglomeration (Krugman, 1991). The population of the entrepreneurial ecosystem appears to be an important factor for entrepreneurial activity and is a significant predictor of future firm formations. A limitation of the present study is that it did not consider the antecedents of increasing

population or the possible influence of population and agglomeration on the type of firm formed. Future research could link the firm formations to industry or examine antecedents of population in media signals as well, advancing similar research that has been done in economic development policy literature (Florida et al., 2002) and linking it more specifically to entrepreneurship and entrepreneurial ecosystem outcomes.

The time period of the study, from 2001-2010, because of the availability of data, may be a limitation. There may be cultural variables at work linked to the characteristics of the population and population turnover that have effects measurable only in a longer time series. Work in entrepreneurial culture, for example, suggests that fifteen, twenty, or longer periods of time may be necessary to observe the influence of entrepreneurial culture changes and their influence on patterns of entrepreneurial activity (Beugelsdjik, 2007). The dissertation proposed that media had a more direct effect on the decisions of potential entrepreneurs to engage in entrepreneurial activity, however future research could look at the pattern of media and determine whether an additional influence may exist in shifting entrepreneurial culture and attitudes or beliefs about entrepreneurship in entrepreneurial ecosystems.

The findings concerning the signal attributes measurement in terms of the E.O. content may suggest a direction for future research as well. While the effect of signal attributes was significant, it was opposite the direction predicted. This suggests that the E.O. content at the level of the entrepreneurial ecosystem, in terms of coverage in the media and pattern of coverage, may not have the same meaning as at the firm level. However, future research could seek to identify the content of signals that are indicative of the actual entrepreneurial orientation of the entrepreneurial ecosystem. Past work in content analysis suggests that future researchers would begin with the population of articles in the ecosystem and then develop a new dictionary from the content of the articles, consistent with the way the E.O. dictionary was developed for letters to shareholders (Short et al., 2009).

In concert with the limitations on the level of analysis, the findings also suggest that there may be individual-level effects and that individual differences may play a role in the interpretation of the signals sent. Again, prior research demonstrates as characteristics of the ecosystem change, entrepreneurs rate potential opportunities differently (Wood et al., 2014). Prior research has examined decisions about exploiting opportunities through intrapreneurship (working for an

employer) or entrepreneurship and has found that individual differences are important for the outcome (Parker, 2011). Future research in this area could link individuals to specific decisions to start or terminate and thus examine the role of individual differences for interpreting signals. Linking the individual level of analysis to media coverage, prior work in social psychology has utilized behavioral contagion theory (Wheeler, 1966) to explain the influence of media on individual behaviors, including aggression (Phillips, 1986) and suicide (Gould, Jamieson, & Romer, 2003). These studies have found that individuals with predispositions toward certain behaviors who have never acted upon those predisposition may be triggered to act by media coverage of similar acts (Gould et al., 2003). The same logic could be applied to the phenomenon of media coverage in entrepreneurial ecosystems in future research to test whether behavioral contagion theory might be a viable explanation. A study of competing hypotheses contrasting the predictions of behavioral contagion theory and signaling theory might be an interesting direction for a future study in this area.

Implications

Implications for Research

The research in this dissertation has several implications for researchers. First, I integrated various definitions of EE across literatures to derive a single definition that encompasses the prior definitions, acknowledges the dynamic nature of the actors and the outcomes, and emphasizes the role of all members of the EE as social actors who engage in some form of communication to coordinate activities (Stam, 2015; Aldrich & Martinez, 2010). Second, I contribute to our understanding of how entrepreneurial ecosystems can develop differently over time, based on new theory and explanations utilizing communication as a mechanism for change in EE and I answered calls in previous theoretical work to empirically examine the role of media for entrepreneurial ecosystems (Aldrich & Yang, 2012). Third, I brought SET into the management and entrepreneurship literature to explain logics behind cooperative and competitive social behaviors among individuals and organizations. Finally, I addressed a gap in SET to explain how social actors engage others social actors to benefit from social relationships.

This dissertation integrated previous definitions of entrepreneurial ecosystems in such a way as to motivate the use of social evolutionary theory (Margulis, 1971) in entrepreneurship

research and specifically applied it to the concept of the entrepreneurial ecosystem as an explanation motivating cooperation and the logics behind cooperation. This builds on prior work using evolutionary theory and the evolutionary approach in entrepreneurship research (Aldrich & Ruef, 2006; Breslin, 2008). While past research has identified the types of relationships that emerge, specifically cooperative and competitive (Aldrich & Martinez, 2010), social evolutionary theory has specific logics for cooperation that enhance our understanding of the phenomenon.

The findings of the dissertation emphasize the role of media for explaining differences in the development of entrepreneurial ecosystems over time, specifically in the patterns of firm formations and firm failures in ecosystems. Empirically, the findings of this study support the importance of the role of signals in entrepreneurial ecosystems and provide a clearer understanding of the ways in which signals impact the pattern of new firm formations and failures in ecosystems. Specifically, the frequency of signals, alone, may affect changes. Yet, consistent with SET and signaling theory, the information conveyed in terms of signal content and valence, also influence the outcomes of formation and failure. While the direction of the effects of content was not as expected, it nonetheless supports the SET and signaling theory integration, because signals are interpreted by the receivers, and the evidence suggests that the receivers choose cooperative or competitive behaviors based on their interpretations - a potential entrepreneur choosing to remain employed by another firm is selecting a cooperative behavior over a competitive one.

This finding also suggests an implication for researchers interested in the study of entrepreneurial orientation, a construct which I have applied to media signals at the ecosystem level. While E.O. held together as a single construct when applied at this alternate level of analysis, the meaning and interpretation of the construct appears to be different in the context. Rather than signaling the entrepreneurial mindset of a firm to organizational stakeholders, as it does when used in the analysis of letters to shareholders, the same construct appears to signal meaningful information about the competitive environment in the entrepreneurial ecosystem. This competitive information influences potential entrepreneurs' decisions to found new firms or choosing to give up and fail. The empirical support for the implication is found in the result that entrepreneurial orientation content, contrary to predictions that it would motivate individuals in the ecosystem to found more firms because individuals would believe they possess associated characteristics, instead appears to deter these individuals from pursuing entrepreneurial endeavors. As other

constructs are applied to this level of analysis, it is important for researchers to keep these findings in mind and consider how the construct might have an alternate meaning when interpreted or used in the specific new context.

An implication of the findings is that the effects of these logics, when applied at different levels of analysis, may produce different cooperative or competitive relationships. From the ecosystem perspective, cooperative behaviors involve forming relationships between other businesses in a way that results in higher overall fitness for the population of firms in the ecosystem. More firm starts at the ecosystem can also be viewed as cooperation by "joining" the entrepreneurial ecosystem. At the individual level, cooperation involves behaviors that improve the individual's chance for survival. For example, SET identifies mutualism as one possible relationship between social actors. At the ecosystem level of analysis, a new firm is a measurable form of mutualism, where individuals form relationships among other members of the organization and also between firms. At the individual level, mutualism could also be working for another firm, and in the present study, would not be directly observable. However, this individual-level cooperative behavior contributes to the results of the study. Thus, at the individual level, starting a firm might be a more competitive behavior, as evidenced by the effect of the E.O. content variables. However, starting a new firm with partners would be a cooperative behavior.

Integrating social evolutionary theory with signaling theory contributes to a clearer theoretical understanding not just of the motivation for cooperation, but of the specific mechanisms social actors can utilize, in the form of signals and communication, to induce cooperation (or competition). Further, integrating elements of social evolutionary theory from evolutionary anthropology highlights an underlying assumption of signaling theory that has not been as clearly specified in management literature. Specifically, that the purpose of a signaler reducing information asymmetry is to induce some desired cooperative behavior on the part of an intended receiver (Sosis & Alcorta, 2003). In purely competitive environments, there would be no purpose to reducing information asymmetry, because it would reduce competitive advantages of the signaler. With this key assumption specified, the role of communication between social actors in entrepreneurial ecosystems becomes clearer – coordinating activities (Stam, 2015). An important implication of the use of SET is for researchers to remember, when making predictions about behaviors among social actors in the environment, that SET operates at multiple levels of analysis simultaneously.

This implication finds support through some of the results in the dissertation which might seem surprising at the ecosystem level, but which can be explained by behaviors at the individual level. One such result is the finding that the interaction of many signals under conditions of resource scarcity would lead to fewer firm failures. At the population level, logically, many signals about the environment would suggest that the firms would be aware of how few resources are available and thus, how bleak the situation might appear, which should lead to more failures, rather than fewer. SET logic, however, suggests individuals in the firms would be motivated to seek out cooperative relationships under these conditions, in order to ensure their survival, and solves issues caused by pluralistic ignorance at the individual level.

Implications for Practice

The present study highlights the role and importance of communication for social actors as signalers within entrepreneurial ecosystem. The findings of the present study suggest that those social actors who have an interest in encouraging more entrepreneurial activity in the form of firm creation and who also want to see more successful firms can influence this activity through the appropriate use of signaling behavior. Social actors who ignore communication place themselves at risk of both losing potential partners and missing important signals about the EE itself. The results of this dissertation suggest that signalers should consider: 1) What they say (content), 2) How they say it (valence), and 3) How often they say it (frequency), at least in respect to how they say it.

Addressing the first point for signalers, proper calibration matters. The question signalers need to ask of themselves is whether what they are saying accurately conveys the appropriate information to the receivers, in this case potential entrepreneurs. As the results show, talking about autonomy, proactiveness, innovativeness, competitive aggressiveness, and risk-taking in media coverage of entrepreneurship may have the opposite effect on the potential entrepreneurs in the ecosystem than expected. While the ecosystem-level social actors may want to get as many new ventures founded as possible, and are willing to see new entrepreneurs taking risks, being innovative, and being aggressive competitors, the individuals who are receiving those messages may not feel the same way when they are the ones expected to exhibit those characteristics and behaviors. From a practical standpoint, then, signalers should be careful to be accurate about

the environment in terms of entrepreneurial orientation, but should not over-emphasize it, or the results suggest they will see a decline in new firm formation.

The second point addresses how they should talk about the content, in terms of valence, positive or negative. It is not surprising to find that positive signals about entrepreneurship result in more new firms being founded in entrepreneurial ecosystems. It is important to consider, however, because coverage that is too unbalanced toward the positive can be harmful and signalers must be cognizant of the valence of the signals they are sending to potential entrepreneurs. When considering the importance of balanced valence signals, research has found that negative valence articles are weighted approximately five times that of a positive article (Porter, Taylor, & Brinke, 2008) and that negative words actually convey more information than positive (Garcia et al., 2012).

Finally, the study suggests that how often signals are sent, especially when combined with valence, makes a difference. When signalers send many positive signals, firm formations decrease, and the effect of the frequency and valence interacts to make the effect stronger than either alone. A few positive signals, and a balanced pattern of valence, produce more firm formations than many positive signals do. This suggests that an important practical implication would be to take the time to ensure that the signals sent are carefully calibrated, accurate, and balanced. In addition, controlling the frequency of signals wherever possible is important for ensuring ecosystem development. In summary, content, valence, and frequency of the signals being sent are important for signalers interested in fostering entrepreneurship in their ecosystems.

Implications for Policy

Communication matters, and this is especially true for those engaged in the formulation of policy. The same aspects of the signal apply to policymakers engaged in developing entrepreneurship as they do to other signalers in the environment - content matters, positivity of the signal matters, and the frequency of the signal matters in conjunction with positivity. The study demonstrates that sending the signal has an impact, however there are significant interactions that affect the impact of signal frequency. Signals must be consistent, calibrated in terms of signal attributes and valence, and frequent enough to successfully reach the receivers with the message intact. Policymakers, additionally, need to consider the broader population-level aspects of the signals being sent, especially the aspects related to time and how long it might take for

potential entrepreneurs to engage in activities. This is particularly important when one considers how policymaker might gauge the effectiveness of interventions they have put in place. The study suggests that while some signals may be immediately effective, it could take up to three years to see the results. Policymakers dealing with pressing concerns, such as re-election, and the desire to see and report immediate results might be frustrated when results fail to materialize within the same year the signal has been sent. Policymakers need to be aware of this lag effect and to build it into their interventions in advance so that a lack of immediate results does not lead them to terminate an otherwise successful intervention because they failed to wait long enough to see it to fruition. Policymakers should also be aware of the potential impact across ecosystems, such that signals sent in one may have an impact on their neighbors.

Conclusion

Objectives of this Research

- Objective 1: To develop a comprehensive and inclusive definition of entrepreneurial ecosystems incorporating past research, one that emphasizes a multi-theoretical approach to the phenomenon;

In Chapter 2, I identified a number of definitions that researchers have used to define the nebulous construct of the entrepreneurial ecosystem. I integrated the most appropriate definitions to emphasize the social nature of the entrepreneurial ecosystem, along with changing nature, and the need for communication among social actors. Thus, incorporating the work of Aldrich & Ruef (2006), Baumol (1993), and Stam (2015), I defined an entrepreneurial ecosystem as a co-evolving population of interdependent social actors and factors coordinated (cooperating) through communication in such a way that they enable productive entrepreneurship (Baumol, 1993; Aldrich & Ruef, 2006; Stam, 2015).

- Objective 2: To integrate social evolutionary and signaling theory in the context of entrepreneurial ecosystems to explain not just why cooperation occurs, but also the mechanisms used to induce cooperation;

Using social evolutionary theory as my primary lens of analysis and interpretation, I was able to integrate aspects of signaling theory into SET to explain the mechanisms that induce cooperative behaviors between and among individuals. In Chapter 3, the hypothesis development strongly relied upon the ecosystem level of analysis to define and explain cooperative and competitive behaviors. In the ecosystem context, entrepreneurial activities, such as starting new firms, involve cooperation, such as finding resources, seeking out information, and finally engaging in business operations that involve dealing with suppliers, partners, customers, and other stakeholders. The results of the study suggest that the individual level of analysis should not be overlooked or under-emphasized, because cooperation and competition may be perceived differently by individuals. Individuals confronted with signals about the highly competitive nature of an ecosystem, for example, appear to choose cooperative behaviors that are consistent with SET, such as remaining employed with other firms. Looked at from the ecosystem level, such behaviors result in resources, human capital in this case, remaining locked within firms, and slow down the speed of change, according to SET.

- Objective 3: To explore and understand the role of signals and communication in entrepreneurial ecosystems;

Signals convey information to individuals within the entrepreneurial ecosystem and the findings of the present study suggest that the frequency of the signals, their valence, and content are important for inducing individual behavior. Aspects of the environment separate from the signals appear to matter for their interpretation and importance as well, particularly the resource availability in the ecosystem. Of particular interest, however, is the behavior of valence as it interacts with the signal frequency. Rather than increasing numbers of positive signals resulting in even more firms being formed, it appears that the communication pattern in the ecosystem associated with a more balanced valence, containing both positive and negative signals, actually encourages the formation of new firms. This is consistent with recent findings that negative words actually provide more information (Garcia, Garas, & Schweitzer, 2012). Thus, the information asymmetry between signalers and potential entrepreneurs may not be reduced in the presence of universally positive signal valence.

- Objective 4: To provide support for the entrepreneurial ecosystem as an appropriate level of analysis for entrepreneurship research;

For stakeholders in ecosystems interested in fostering more entrepreneurship and better targeting their efforts at communication, the ecosystem level of analysis provides insights. A takeaway from the present study regarding the aggregated level of analysis, however, is that individual interpretation and behavior is still important to consider when making predictions about the influence and reception of signals and their contents in communication. Methodologically, the ecosystem level of analysis, especially in the U.S., but also globally, suffers from spatial and temporal cross-correlation. There are psychological, cultural, and demographic variables, such as culture or population movement, that alter the way the ecosystems influence one another. Generally, the benefits of using the entrepreneurial ecosystem as a level of analysis provides information about patterns of behavior in the ecosystem, as opposed to the behavior of individuals, as evidenced by the present study and thus, under the right conditions, supports using the ecosystem as a level of analysis.

Chapter Summary

In this chapter, I reviewed the results of the hypothesis testing, discussed the contributions and implications of the findings for SET and signaling theory, and identified the boundary conditions of the research, as well as a selection of directions for future research. I highlighted implications for research, practice, and policy. Finally, I concluded the chapter and the dissertation with a review of the research objectives set forth in Chapter 1 and identified how the dissertation addressed each of these objectives.

LIST OF REFERENCES

Acs, Z., & Szerb, L. 2007. Entrepreneurship, Economic Growth and Public Policy. ***Small Business Economics***, 28(2-3): 109-122.

Acs, Z. J., & Armington, C. 2006. ***Entrepreneurship, geography, and American economic growth***: Cambridge University Press.

Ács, Z. J., Autio, E., & Szerb, L. 2014. National systems of entrepreneurship: Measurement issues and policy implications. ***Research Policy***, 43(3): 476-494.

Acs, Z. J., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. 2009. The knowledge spillover theory of entrepreneurship. ***Small Business Economics***, 32(1): 15-30.

Acs, Z. J., Estrin, S., Mickiewicz, T., & Szerb, L. 2014. The Continued Search for the Solow Residual: The Role of National Entrepreneurial Ecosystem.

Ahern, K. R., & Sosyura, D. 2014. Who writes the news? Corporate press releases during merger negotiations. ***The Journal of Finance***, 69(1): 241-291.

Akerlof, G. 1970. The Market for Lemons: Quality Uncertainty and the Market Mechanism. ***Quarterly Journal of Economics***, 89.

Aldrich, H. 1999. ***Organizations evolving***: Sage.

Aldrich, H., McKelvey, B., & Ulrich, D. 1984. Design strategy from the population perspective. ***Journal of Management***, 10(1): 67-86.

Aldrich, H. E. 1990. Using an ecological perspective to study organizational founding rates. ***Entrepreneurship Theory and practice***, 14(3): 7-24.

Aldrich, H. E., & Martinez, M. A. 2001. Many are Called, but Few are Chosen: An Evolutionary Perspective for the Study of Entrepreneurship. ***Entrepreneurship: Theory & Practice***, 25(4): 41.

Aldrich, H. E., & Martinez, M. A. 2010. Entrepreneurship as social construction: a multilevel evolutionary approach, ***Handbook of entrepreneurship research***: 387-427: Springer.

Aldrich, H. E., & Yang, T. 2012. Lost in translation: Cultural codes are not blueprints. ***Strategic Entrepreneurship Journal***, 6(1): 1-17.

Aldrich Howard, E., & Ruef, M. 2006. Organizations evolving: TJ International Ltd.–Padstow, Cornwell.

Alvarez, S. A., & Barney, J. B. 2007. Discovery and creation: Alternative theories of entrepreneurial action. ***Strategic entrepreneurship journal***, 1(1-2): 11-26.

Alvarez, S. A., & Busenitz, L. W. 2001. The entrepreneurship of resource-based theory. ***Journal of management***, 27(6): 755-775.

Ardichvili, A., Cardozo, R., & Ray, S. 2003. A theory of entrepreneurial opportunity identification and development. ***Journal of Business venturing***, 18(1): 105-123.

Arruda, C., Nogueira, V. S., Cozzi, A., & Costa, V. 2015. The Brazilian Entrepreneurial Ecosystem of Startups: An Analysis of Entrepreneurship Determinants in Brazil and the Perceptions Around the Brazilian Regulatory Framework, ***Entrepreneurship in BRICS***: 9-26: Springer.

Arthur, W. B. 1989. Competing technologies, increasing returns, and lock-in by historical events. ***The economic journal***, 99(394): 116-131.

Arthur, W. B. 1990. 'Silicon Valley'locational clusters: when do increasing returns imply monopoly? ***Mathematical social sciences***, 19(3): 235-251.

Audretsch, B. 1998. Agglomeration and the location of innovative activity. ***Oxford review of economic policy***, 14(2): 18-29.

Audretsch, D., Dohse, D., & Niebuhr, A. 2009. Cultural diversity and entrepreneurship: a regional analysis for Germany. ***The Annals of Regional Science***, 45(1): 55-85.

Audretsch, D., & Keilbach, M. 2004. Entrepreneurship capital and economic performance. ***Regional studies***, 38(8): 949-959.

Audretsch, D. B. 1991. New-firm survival and the technological regime. ***The Review of Economics and Statistics***: 441-450.

Audretsch, D. B., Bönte, W., & Keilbach, M. 2008. Entrepreneurship capital and its impact on knowledge diffusion and economic performance. ***Journal of Business Venturing***, 23(6): 687-698.

Audretsch, D. B., & Feldman, M. P. 1996. R&D spillovers and the geography of innovation and production. ***The American economic review***, 86(3): 630-640.

Audretsch, D. B., Grilo, I., & Thurik, A. R. 2007. Explaining entrepreneurship and the role of policy: a framework. ***The handbook of research on entrepreneurship policy***: 1-17.

Audretsch, D. B., & Keilbach, M. 2005. Entrepreneurship capital and regional growth. ***The Annals of Regional Science***, 39(3): 457-469.

Audretsch, D. B., & Keilbach, M. 2007. The Theory of Knowledge Spillover Entrepreneurship*. ***Journal of Management Studies***, 44(7): 1242-1254.

Ausubel, J. H., & Langford, H. D. 1997. ***Technological trajectories and the human environment***: National Academies Press.

Bahl, R. W., Firestine, R., & Phares, D. 1971. Industrial diversity in urban areas: Alternative measures and intermetropolitan comparisons. ***Economic Geography***, 47(3): 414-425.

Bahrami, H., & Evans, S. 1995. Flexible re-cycling and high-technology entrepreneurship. ***California Management Review***, 37(3): 62-89.

Balboa, M., & Martí, J. 2007. Factors that determine the reputation of private equity managers in developing markets. ***Journal of Business Venturing***, 22(4): 453-480.

Baltagi, B. 2008. ***Econometric analysis of panel data***: John Wiley & Sons.

Bandura, A. 2001. Social cognitive theory of mass communication. ***Media psychology***, 3(3): 265-299.

Baptista, R. 2000. Do innovations diffuse faster within geographical clusters? ***International Journal of industrial organization***, 18(3): 515-535.

Barnett, W. P., & Carroll, G. R. 1987. Competition and mutualism among early telephone companies. ***Administrative Science Quarterly***: 400-421.

Barney, J. 1991. Firm resources and sustained competitive advantage. ***Journal of management***, 17(1): 99-120.

Barro, R. J., & Lee, J. W. 2013. A new data set of educational attainment in the world, 1950–2010. ***Journal of development economics***, 104: 184-198.

Bartik, T. J. 1991. Boon or Boondoggle? The debate over state and local economic development policies.

Bartik, T. J. 2011. Including jobs in benefit-cost analysis. ***Annual Review of Resource Economics, Forthcoming***.

Bartik, T. J. 2015. The social value of job loss and its effect on the costs of US environmental regulations. ***Review of Environmental Economics and Policy***, 9(2): 179-197.

Basdeo, D. K., Smith, K. G., Grimm, C. M., Rindova, V. P., & Derfus, P. J. 2006. The impact of market actions on firm reputation. ***Strategic Management Journal***, 27(12): 1205-1219.

Baum, J. A., & Korn, H. J. 1999. Dynamics of dyadic competitive interaction. ***Strategic Management Journal***, 20(3): 251-278.

Baumol, W. J. 1990. Entrepreneurship: Productive, Unproductive, and Destructive. ***Journal of Political Economy***, 98(5): 893-921.

Baumol, W. J. 1993. Formal entrepreneurship theory in economics: Existence and bounds. ***Journal of business venturing***, 8(3): 197-210.

Baumol, W. J. 1996. Entrepreneurship: Productive, unproductive, and destructive. ***Journal of Business Venturing***, 11(1): 3-22.

Beaudry, C., & Schiffauerova, A. 2009. Who's right, Marshall or Jacobs? The localization versus urbanization debate. ***Research policy***, 38(2): 318-337.

Beine, M., Docquier, F., & Rapoport, H. 2008. Brain drain and human capital formation in developing countries: Winners and losers*. ***The Economic Journal***, 118(528): 631-652.

Bell, R. G., Moore, C. B., & Al-Shammari, H. A. 2008. Country of origin and foreign IPO legitimacy: Understanding the role of geographic scope and insider ownership. ***Entrepreneurship Theory and Practice***, 32(1): 185-202.

Belleflamme, P., Picard, P., & Thisse, J.-F. 2000. An economic theory of regional clusters. ***Journal of Urban Economics***, 48(1): 158-184.

Benhabib, J., & Spiegel, M. M. 1994. The role of human capital in economic development evidence from aggregate cross-country data. ***Journal of Monetary economics***, 34(2): 143-173.

Beugelsdijk, S. 2007. The regional environment and a firm's innovative performance: a plea for a multilevel interactionist approach. ***Economic Geography***, 83(2): 181-199.

Beugelsdijk, S., Maseland, R., & Van Hoorn, A. 2013. Are Hofstede's Culture Dimensions Stable Over Time? A Generational Cohort Analysis. ***A Generational Cohort Analysis (October 7, 2013)***.

Bhappu, A. D. 2000. The Japanese family: An institutional logic for Japanese corporate networks and Japanese management. ***Academy of Management Review***, 25(2): 409-415.

Birchler, U., & Bütler, M. 2007. ***Information economics***: Routledge.

Bird, R. B., Smith, E., Alvard, M., Chibnik, M., Cronk, L., Giordani, L., Hagen, E., Hammerstein, P., Neiman, F., & Bird, R. 2005. Signaling theory, strategic interaction, and symbolic capital 1. ***Current anthropology***, 46(2): 221-248.

Block, J. H., & Sandner, P. 2011. Venture capital funding in the middle of the year 2011: are we back to pre-crisis boom levels? ***Strategic Change***, 20(5-6): 161-169.

Bosma, N., & Holvoet, T. 2015. ***The Role of Culture in Entrepreneurial Ecosystems: An Investigation for European Regions***. Paper presented at the 6th Annual George Washington University (GWU)-International Council for Small Business (ICSB) Global Entrepreneurship Research and Policy Conference.

Braunerhjelm, P., & Carlsson, B. 1999. Industry Clusters in Ohio and Sweden, 1975--1995. ***Small Business Economics***, 12(4): 279-293.

Breslin, D. 2008. A review of the evolutionary approach to the study of entrepreneurship. ***International Journal of Management Reviews***, 10(4): 399-423.

Brown, N., & Deegan, C. 1998. The public disclosure of environmental performance information—a dual test of media agenda setting theory and legitimacy theory. ***Accounting and business research***, 29(1): 21-41.

Bruederl, J., Preisend, Peter, & Ziegler, R. 1992. Survival Chances of Newly Founded Business Organizations. ***American Sociological Review***, 57(2): 227-242.

Bruton, G. D., Ahlstrom, D., & Li, H. L. 2010. Institutional theory and entrepreneurship: where are we now and where do we need to move in the future? ***Entrepreneurship Theory and Practice***, 34(3): 421-440.

Busenitz, L. W., Fiet, J. O., & Moesel, D. D. 2005. Signaling in Venture Capitalist—New Venture Team Funding Decisions: Does It Indicate Long-Term Venture Outcomes? ***Entrepreneurship Theory and Practice***, 29(1): 1-12.

Buss, D. M. 2009. How can evolutionary psychology successfully explain personality and individual differences? ***Perspectives on Psychological Science***, 4(4): 359-366.

Carree, M., Van Stel, A., Thurik, R., & Wennekers, S. 2007. The relationship between economic development and business ownership revisited. ***Entrepreneurship & regional development***, 19(3): 281-291.

Carree, M. A., & Thurik, A. R. 2003. The impact of entrepreneurship on economic growth, ***Handbook of entrepreneurship research***: 437-471: Springer.

Carroll, G. R., & Hannan, M. T. 1989. Density delay in the evolution of organizational populations: A model and five empirical tests. ***Administrative Science Quarterly***: 411-430.

Carroll, G. R., & Wade, J. 1991. Density dependence in the organizational evolution of the American brewing industry across different levels of analysis. ***Social Science Research***, 20(3): 271-302.

Carsrud, A. L., & Johnson, R. W. 1989. Entrepreneurship: a social psychological perspective. ***Entrepreneurship & Regional Development***, 1(1): 21-31.

Carter, S. M. 2006. The Interaction of Top Management Group, Stakeholder, and Situational Factors on Certain Corporate Reputation Management Activities*. ***Journal of Management Studies***, 43(5): 1145-1176.

Certo, S. T. 2003. Influencing initial public offering investors with prestige: Signaling with board structures. ***Academy of management review***, 28(3): 432-446.

Certo, S. T., Covin, J. G., Daily, C. M., & Dalton, D. R. 2001. Wealth and the effects of founder management among IPO-stage new ventures. ***Strategic management journal***, 22(6-7): 641-658.

Chandler, G. N., & Hanks, S. H. 1994. Founder competence, the environment, and venture performance. ***Entrepreneurship: Theory and Practice***, 18(3): 77-90.

Chow, G. C. 1960. Tests of equality between sets of coefficients in two linear regressions. ***Econometrica: Journal of the Econometric Society***: 591-605.

Chung, W., & Kalnins, A. 2001. Agglomeration effects and performance: A test of the Texas lodging industry. ***Strategic Management Journal***, 22(10): 969-988.

Cochrane, D., & Orcutt, G. H. 1949. Application of least squares regression to relationships containing auto-correlated error terms. ***Journal of the American Statistical Association***, 44(245): 32-61.

Coff, R. W. 2002. Human capital, shared expertise, and the likelihood of impasse in corporate acquisitions. ***Journal of Management***, 28(1): 107-128.

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. 2011. Signaling theory: A review and assessment. ***Journal of Management***, 37(1): 39-67.

Crook, T. R., Ketchen, D. J., Combs, J. G., & Todd, S. Y. 2008. Strategic resources and performance: a meta-analysis. ***Strategic management journal***, 29(11): 1141-1154.

Daneke, G. A. 1985. Small business policy amid state level economic development planning. ***Policy Studies Journal***, 13(4): 722-728.

Darwin, C. 1859. On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life. ***New York, NY: D. Appleton and Company***.

Davidsson, P. 1995. Determinants of entrepreneurial intentions.

Davidsson, P. 2005. What is Entrepreneurship? ***Researching Entrepreneurship***: 1-16.

Davidsson, P., & Honig, B. 2003. The role of social and human capital among nascent entrepreneurs. ***Journal of business venturing***, 18(3): 301-331.

Davidsson, P., & Wiklund, J. 1997. Values, beliefs and regional variations in new firm formation rates. ***Journal of Economic psychology***, 18(2): 179-199.

Davis, G. F. 2010. Do theories of organizations progress? ***Organizational Research Methods***.

De Carolis, D. M., Litzky, B. E., & Eddleston, K. A. 2009. Why networks enhance the progress of new venture creation: The influence of social capital and cognition. ***Entrepreneurship theory and practice***, 33(2): 527-545.

DeCarolis, D. M., & Deeds, D. L. 1999. The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry. ***Strategic management journal***, 20(10): 953-968.

Deephouse, D. L. 1996. Does isomorphism legitimate? ***Academy of management journal***, 39(4): 1024-1039.

Deephouse, D. L. 2000. Media reputation as a strategic resource: An integration of mass communication and resource-based theories. ***Journal of management***, 26(6): 1091-1112.

Deephouse, D. L., & Heugens, P. P. 2009. Linking social issues to organizational impact: The role of infomediaries and the infomediary process. ***Journal of Business Ethics***, 86(4): 541-553.

Delgado, M., Ketels, C., Porter, M. E., & Stern, S. 2012. The determinants of national competitiveness: National Bureau of Economic Research.

Delgado, M., Porter, M. E., & Stern, S. 2010. Clusters and entrepreneurship. ***Journal of Economic Geography***: lbq010.

Delgado, M., Porter, M. E., & Stern, S. 2014. Clusters, convergence, and economic performance. ***Research Policy***, 43(10): 1785-1799.

Delmar, F., & Shane, S. 2003. Does business planning facilitate the development of new ventures? ***Strategic management journal***, 24(12): 1165-1185.

Dickey, D. A., & Fuller, W. A. 1979. Distribution of the estimators for autoregressive time series with a unit root. ***Journal of the American statistical association***, 74(366a): 427-431.

DiMaggio, P. J., & Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. ***American sociological review***: 147-160.

Dissart, J. C. 2003. Regional economic diversity and regional economic stability: research results and agenda. ***International Regional Science Review***, 26(4): 423-446.

Djankov, S., Qian, Y., Roland, G., & Zhuravskaya, E. 2006. Entrepreneurship in China and Russia compared. ***Journal of the European Economic Association***, 4(2-3): 352-365.

Driscoll, J. C., & Kraay, A. C. 1998. Consistent covariance matrix estimation with spatially dependent panel data. ***Review of economics and statistics***, 80(4): 549-560.

Duval-Couetil, N., & Hutcheson, S. 2015. Nurturing an entrepreneurial ecosystem in the Midwest of the United States. ***Entrepreneurship and Knowledge Exchange***, 7: 217.

Ehrenfeld, J., & Gertler, N. 1997. Industrial ecology in practice: the evolution of interdependence at Kalundborg. ***Journal of industrial Ecology***, 1(1): 67-79.

Ehrenfeld, J. R. 2000. Industrial Ecology Paradigm Shift or Normal Science? ***American Behavioral Scientist***, 44(2): 229-244.

Ehrhart, K. H., & Ziegert, J. C. 2005. Why are individuals attracted to organizations? ***Journal of management***, 31(6): 901-919.

Enders, W. 2008. ***Applied econometric time series***: John Wiley & Sons.

Esty, D. C., & Porter, M. E. 1998. Industrial ecology and competitiveness. ***Journal of Industrial Ecology***, 2(1): 35-43.

Feld, B. 2012. ***Startup communities: Building an entrepreneurial ecosystem in your city***: John Wiley & Sons.

Feldman, M. P. 1999. The new economics of innovation, spillovers and agglomeration: Areview of empirical studies. ***Economics of innovation and new technology***, 8(1-2): 5-25.

Feldman, M. P. 2000. Location and innovation: the new economic geography of innovation, spillovers, and agglomeration. ***The Oxford handbook of economic geography***: 373-394.

Filatotchev, I., & Bishop, K. 2002. Board composition, share ownership, and 'underpricing'of UK IPO firms. ***Strategic Management Journal***, 23(10): 941-955.

Fischer, E., & Reuber, R. 2007. The good, the bad, and the unfamiliar: The challenges of reputation formation facing new firms. ***Entrepreneurship Theory and Practice***, 31(1): 53-75.

Fishman, E. A., O'SHEA, R. P., & ALLEN, T. 2014. Creating the MIT entrepreneurial ecosystem. ***Building Technology Transfer within Research Universities: An Entrepreneurial Approach***: 60.

Flora, C. B., & Flora, J. L. 1993. Entrepreneurial social infrastructure: A necessary ingredient. ***The Annals of the American Academy of Political and Social Science***, 529(1): 48-58.

Flora, J. L., Sharp, J., Flora, C., & Newlon, B. 1997. Entrepreneurial social infrastructure and locally initiated economic development in the nonmetropolitan United States. ***The Sociological Quarterly***, 38(4): 623-645.

Florida, R. 1994. Agglomeration and industrial location: An econometric analysis of Japanese-affiliated manufacturing establishments in automotive-related industries. ***Journal of Urban Economics***, 36(1): 23-41.

Florida, R. 2002. The rise of the creative class. And how it's transforming work, leisure and everyday life: New York: Basic Books.

Fombrun, C., & Shanley, M. 1990. What's in a name? Reputation building and corporate strategy. ***Academy of management Journal***, 33(2): 233-258.

Fombrun, C. J. 1996. ***Reputation: Realizing value from the corporate image***: Harvard Business Press.

Friedland, R., & Alford, R. R. 1991. Bringing society back in: Symbols, practices and institutional contradictions.

Fritsch, M., & Mueller, P. 2004. Effects of new business formation on regional development over time. ***Regional Studies***, 38(8): 961-975.

Frosch, R. A., & Gallopoulos, N. E. 1989. Strategies for manufacturing. ***Scientific American***, 261(3): 144-152.

Gallopoulos, N. E. 2006. Industrial ecology: an overview. ***Progress in Industrial Ecology, an International Journal***, 3(1-2): 10-27.

Gartner, W. B. 2001. Is there an elephant in entrepreneurship? Blind assumptions in theory development. ***Entrepreneurship: Theory and practice***, 25(4): 27-40.

Gilbert, B. A., Audretsch, D. B., & McDougall, P. P. 2004. The emergence of entrepreneurship policy. ***Small Business Economics***, 22(3-4): 313-323.

Gilbert, B. A., McDougall, P. P., & Audretsch, D. B. 2006. New venture growth: A review and extension. ***Journal of management***, 32(6): 926-950.

Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., & Shleifer, A. 1992. Growth in cities: National Bureau of Economic Research.

Gould, M., Jamieson, P., & Romer, D. 2003. Media contagion and suicide among the young. ***American Behavioral Scientist***, 46(9): 1269-1284.

Granger, C. W. 1969. Investigating causal relations by econometric models and cross-spectral methods. ***Econometrica: Journal of the Econometric Society***: 424-438.

Granger, C. W. 1988. Some recent development in a concept of causality. ***Journal of econometrics***, 39(1): 199-211.

Granger, C. W., & Huang, L.-L. 1997. Evaluation of Panel Data Models: Some suggestions from time series.

Granovetter, M. S. 1973. The strength of weak ties. ***American journal of sociology***: 1360-1380.

Green, W. H. 2008. Discrete choice modelling. ***Handbook of Econometrics***, 2.

Gulati, R., & Higgins, M. C. 2003. Which ties matter when? The contingent effects of interorganizational partnerships on IPO success. ***Strategic Management Journal***, 24(2): 127-144.

Gunther McGrath, R., & Nerkar, A. 2004. Real options reasoning and a new look at the R&D investment strategies of pharmaceutical firms. ***Strategic Management Journal***, 25(1): 1-21.

Hannan, M. T., & Freeman, J. 1977. The population ecology of organizations. ***American journal of sociology***: 929-964.

Hanson, G. H. 2001. Scale economies and the geographic concentration of industry. ***Journal of Economic Geography***, 1(3): 255-276.

Haveman, H. A., & Rao, H. 1997. Structuring a theory of moral sentiments: institutional and organizational coevolution in the early thrift industry 1. ***American Journal of Sociology***, 102(6): 1606-1651.

Hawley, A. H. 1986. ***Human ecology: A theoretical essay***: University of Chicago Press.

Hayek, F. A. 1945. The use of knowledge in society. ***The American economic review***: 519-530.

Haynie, M., & Shepherd, D. A. 2009. A measure of adaptive cognition for entrepreneurship research. ***Entrepreneurship Theory and Practice***, 33(3): 695-714.

Hayward, M. L., Rindova, V. P., & Pollock, T. G. 2004. Believing one's own press: The causes and consequences of CEO celebrity. ***Strategic Management Journal***, 25(7): 637-653.

Hayward, M. L., Shepherd, D. A., & Griffin, D. 2006. A hubris theory of entrepreneurship. ***Management Science***, 52(2): 160-172.

Hechavarria, D. M., & Ingram, A. 2014. A Review of the Entrepreneurial Ecosystem and the Entrepreneurial Society in the United States: An Exploration with the Global Entrepreneurship Monitor Dataset. ***Journal of Business and Entrepreneurship***, 26(1): 1.

Henderson, J. V. 1974. The sizes and types of cities. ***The American Economic Review***, 64(4):640-656.

Henderson, J. V. 2003. Marshall's scale economies. ***Journal of urban economics***, 53(1): 1-28.

Henrekson, M., & Stenkula, M. 2010. Entrepreneurship and public policy, ***Handbook of entrepreneurship research***: 595-637: Springer.

Higgins, M. C., & Gulati, R. 2006. Stacking the deck: The effects of top management backgrounds on investor decisions. ***Strategic Management Journal***, 27(1): 1-25.

Highhouse, S., Thornbury, E. E., & Little, I. S. 2007. Social-identity functions of attraction to organizations. ***Organizational Behavior and Human Decision Processes***, 103(1): 134-146.

Hindle, K., & Klyver, K. 2007. Exploring the relationship between media coverage and participation in entrepreneurship: Initial global evidence and research implications. ***International entrepreneurship and management journal***, 3(2): 217-242.

Hochwarter, W. A., Ferris, G. R., Zinko, R., Arnell, B., & James, M. 2007. Reputation as a moderator of political behavior-work outcomes relationships: A two-study investigation with convergent results. ***Journal of Applied Psychology***, 92(2): 567-576.

Hoechle, D. 2007. Robust standard errors for panel regressions with cross-sectional dependence. ***Stata Journal***, 7(3): 281.

Hofstede, G. H., & Hofstede, G. 2001. ***Culture's consequences: Comparing values, behaviors, institutions and organizations across nations***: Sage.

Holtz-Eakin, D. 2000. Public Policy Toward Entrepreneurship. ***Small Business Economics***, 15(4): 283-291.

Huber, P. J. 1967. ***The behavior of maximum likelihood estimates under nonstandard conditions***. Paper presented at the Proceedings of the fifth Berkeley symposium on mathematical statistics and probability.

Isaksen, A., & Onsager, K. 2010. Regions, networks and innovative performance: The case of knowledge-intensive industries in Norway. ***European Urban and Regional Studies***, 17(3): 227-243.

Isenberg, D. J. 2010. How to start an entrepreneurial revolution. ***Harvard Business Review***, 88(6): 40-50.

Jackall, R. 1988. Moral mazes: The world of corporate managers. ***International Journal of Politics, Culture, and Society***, 1(4): 598-614.

Jacobs, J. 1969. The economy of cities. ***Vintage, New York***.

Jain, B. A., Jayaraman, N., & Kini, O. 2008. The path-to-profitability of Internet IPO firms. ***Journal of Business Venturing***, 23(2): 165-194.

Janis, I. L., & Fadner, R. H. 1943. A coefficient of imbalance for content analysis. ***Psychometrika***, 8(2): 105-119.

Janney, J. J., & Folta, T. B. 2003. Signaling through private equity placements and its impact on the valuation of biotechnology firms. ***Journal of Business Venturing***, 18(3): 361-380.

Janney, J. J., & Folta, T. B. 2006. Moderating effects of investor experience on the signaling value of private equity placements. ***Journal of Business Venturing***, 21(1): 27-44.

Jenkins, H. 2006. ***Convergence culture: Where old and new media collide***: NYU press.

Keller, K. L. 1993. Conceptualizing, measuring, and managing customer-based brand equity. ***the Journal of Marketing***: 1-22.

Ketels, C., Lindqvist, G., & Sölvell, Ö. 2012. Strengthening clusters and competitiveness in Europe. The role of cluster organisations. ***Stockholm: Center for Strategy and Competitiveness***.

Keuschnigg, C., & Nielsen, S. B. 2003. Tax policy, venture capital, and entrepreneurship. ***Journal of Public Economics***, 87(1): 175-203.

Kim, L., & Nugent, J. 1999. Korean SMEs and their support mechanisms, ***Fulfilling the Export potential of small and medium Firms***: 115-167: Springer.

King, A. W. 2007. Disentangling interfirm and intrafirm causal ambiguity: A conceptual model of causal ambiguity and sustainable competitive advantage. ***Academy of Management Review***, 32(1): 156-178.

Kirzner, I. M. 1997. Entrepreneurial discovery and the competitive market process: An Austrian approach. ***Journal of economic Literature***, 35(1): 60-85.

Knight, F. H. 1921. Risk, uncertainty and profit. ***New York: Hart, Schaffner and Marx***.

Kogut, B., & Zander, U. 1993. Knowledge of the firm and the evolutionary theory of the multinational corporation. ***Journal of international business studies***: 625-645.

Konczal, J. 2013. The Most Entrepreneurial Metropolitan Area? ***Available at SSRN 2357701***.

Korhonen, J. 2001. Four ecosystem principles for an industrial ecosystem. ***Journal of Cleaner Production***, 9(3): 253-259.

Korhonen, J. 2004. Industrial ecology in the strategic sustainable development model: strategic applications of industrial ecology. ***Journal of Cleaner Production***, 12(8): 809-823.

Kort, J. R. 1981. Regional economic instability and industrial diversification in the US. ***Land Economics***, 57(4): 596-608.

Krueger, N., Reilly, M., & Carsrud, A. 2000. Entrepreneurial intentions: A competing models approach. ***Journal of Business Venturing***, 15(5/6): 411-432.

Krueger, N. F. 2012. Markers of a Healthy Entrepreneurial Ecosystem. ***Available at SSRN 2056182***.

Krugman, P. R. 1991. ***Geography and trade***: MIT press.

Kukalis, S. 2009. Agglomeration economies and firm performance: the case of industry clusters. ***Journal of Management***.

Lam, C. F., Liang, J., Ashford, S. J., & Lee, C. 2015. Job insecurity and organizational citizenship behavior: Exploring curvilinear and moderated relationships. ***Journal of Applied Psychology***, 100(2): 499.

Lampel, J., & Shamsie, J. 2000. Critical push: Strategies for creating momentum in the motion picture industry. ***Journal of Management***, 26(2): 233-257.

Laws, D. 2010. A Company of Legend;: The Legacy of Fairchild Semiconductor.

Lerner, J. 1999. The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program*. ***The Journal of Business***, 72(3): 285-318.

Lichtenstein, G. A., & Lyons, T. S. 2001. The entrepreneurial development system: Transforming business talent and community economies. ***Economic Development Quarterly***, 15(1): 3-20.

Lievens, F., & Highhouse, S. 2003. The relation of instrumental and symbolic attributes to a company's attractiveness as an employer. ***Personnel Psychology***, 56(1): 75-102.

Lifset, R., & Graedel, T. E. 2002. Industrial ecology: goals and definitions. ***A handbook of industrial ecology***: 3-15.

Lindqvist, G. 2009. Disentangling clusters: agglomeration and proximity effects.

Lomi, A. 1995. The population ecology of organizational founding: Location dependence and unobserved heterogeneity. ***Administrative Science Quarterly***: 111-144.

Lounsbury, M. 2002. Institutional transformation and status mobility: The professionalization of the field of finance. ***Academy of Management Journal***, 45(1): 255-266.

Lounsbury, M., & Glynn, M. A. 2001. Cultural entrepreneurship: Stories, legitimacy, and the acquisition of resources. ***Strategic management journal***, 22(6-7): 545-564.

Low, M. B., & MacMillan, I. C. 1988. Entrepreneurship: Past research and future challenges. ***Journal of management***, 14(2): 139-161.

Lowe, E. A., & Evans, L. K. 1995. Industrial ecology and industrial ecosystems. ***Journal of cleaner production***, 3(1): 47-53.

Lucas, R. E. 1988. On the mechanics of economic development. ***Journal of monetary economics***, 22(1): 3-42.

Lumpkin, G. T., & Dess, G. G. 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. ***Academy of management Review***, 21(1): 135-172.

Malecki, E. J. 1997. Technology and economic development: the dynamics of local, regional, and national change. ***University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship***.

Manimala, M. J., & Wasdani, K. P. 2015. Emerging Economies: Muddling Through to Development, ***Entrepreneurial Ecosystem***: 3-53: Springer.

Margulis, L. 1971. The Origin of Plant and Animal Cells: The serial symbiosis view of the origin of higher cells suggests that the customary division of living things into two kingdoms should be reconsidered. ***American scientist***: 230-235.

Markusen, A. 2013. How cities can nurture cultural entrepreneurs. *Available at SSRN 2357724*.

Marshall, A. 1920. Principles of economics: an introductory volume.

Martin, B. C., McNally, J. J., & Kay, M. J. 2013. Examining the formation of human capital in entrepreneurship: A meta-analysis of entrepreneurship education outcomes. ***Journal of Business Venturing***, 28(2): 211-224.

Martin, R., & Sunley, P. 2003. Deconstructing clusters: chaotic concept or policy panacea? ***Journal of economic geography***, 3(1): 5-35.

Martinez, M. A., & Aldrich, H. E. 2011. Networking strategies for entrepreneurs: balancing cohesion and diversity. ***International Journal of Entrepreneurial Behavior & Research***, 17(1): 7-38.

Mason, S., & Howard, D. 2010. Regional industry diversity and its impact on regional unemployment.

McCann, B. T., & Folta, T. B. 2008. Location matters: where we have been and where we might go in agglomeration research. ***Journal of Management***, 34(3): 532-565.

McCombs, M. 1978. Agenda setting function of mass media. ***Public Relations Review***, 3(4): 89-95.

McCombs, M. E., & Shaw, D. L. 1972. The agenda-setting function of mass media. ***Public opinion quarterly***, 36(2): 176-187.

McGregor, P. K., & Peake, T. M. 2000. Communication networks: social environments for receiving and signalling behaviour. ***Acta ethologica***, 2(2): 71-81.

McKelvey, B., & Aldrich, H. 1983. Populations, natural selection, and applied organizational science. ***Administrative Science Quarterly***: 101-128.

McKeon, T. K. 2013. A College's Role in Developing and Supporting an Entrepreneurship Ecosystem. ***Journal of Higher Education Outreach and Engagement***, 17(3): 85-90.

McMullen, J. S., & Shepherd, D. A. 2006. Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. ***Academy of Management review***, 31(1): 132-152.

Meyer, J. W., Rowan, B., Powell, W., & DiMaggio, P. 1991. The new institutionalism in organizational analysis. ***The new institutionalism in organizational analysis***.

Michael, S. C. 2009. Entrepreneurial signaling to attract resources: the case of franchising. ***Managerial and Decision Economics***, 30(6): 405-422.

Miller, D. 1983. The correlates of entrepreneurship in three types of firms. ***Management science***, 29(7): 770-791.

Miller, D. 2011. Miller (1983) revisited: A reflection on EO research and some suggestions for the future. ***Entrepreneurship Theory and Practice***, 35(5): 873-894.

Miller, D., Breton-Miller, L., & Lester, R. H. 2011. Family and lone founder ownership and strategic behaviour: Social context, identity, and institutional logics. ***Journal of Management Studies***, 48(1): 1-25.

Minniti, M., & Lévesque, M. 2008. Recent developments in the economics of entrepreneurship. ***Journal of Business venturing***, 23(6): 603-612.

Moss, T. W., Neubaum, D. O., & Meyskens, M. 2015. The effect of virtuous and entrepreneurial orientations on microfinance lending and repayment: A signaling theory perspective. ***Entrepreneurship Theory and Practice***, 39(1): 27-52.

Motoyama, Y., & Bell-Masterson, J. 2014. Beyond metropolitan startup rates: Regional factors associated with startup growth. ***Ewing Marion Kauffman Foundation***.

Motoyama, Y., Konczal, J., Bell-Masterson, J., & Morelix, A. 2014. Think locally, act locally: Building a robust entrepreneurial ecosystem. ***Act Locally: Building a Robust Entrepreneurial Ecosystem (April 2014)***.

Navis, C., & Glynn, M. A. 2010. How new market categories emerge: Temporal dynamics of legitimacy, identity, and entrepreneurship in satellite radio, 1990–2005. ***Administrative Science Quarterly***, 55(3): 439-471.

Nayyar, P. R. 1990. Information asymmetries: A source of competitive advantage for diversified service firms. ***Strategic Management Journal***, 11(7): 513-519.

Ndofor, H. A., & Levitas, E. 2004. Signaling the strategic value of knowledge. ***Journal of Management***, 30(5): 685-702.

Newey, W. K., & West, K. D. 1986. A simple, positive semi-definite, heteroskedasticity and autocorrelationconsistent covariance matrix: National Bureau of Economic Research Cambridge, Mass., USA.

Nicholls, A. 2010. The Legitimacy of Social Entrepreneurship: Reflexive Isomorphism in a Pre-Paradigmatic Field. ***Entrepreneurship Theory and Practice***, 34(4): 611-633.

Nissan, E., & Carter, G. 2010. Shannon Measure of Industrial Specialization at the State Level. ***Southwestern Economic Review***, 37(1): 29-45.

Nowak, M., & Sigmund, K. 1993. A strategy of win-stay, lose-shift that outperforms tit-for-tat in the Prisoner's Dilemma game. ***Nature***, 364(6432): 56-58.

Nowak, M. A. 2006. Five rules for the evolution of cooperation. ***science***, 314(5805): 1560-1563.

Nowak, M. A., & May, R. M. 1992. Evolutionary games and spatial chaos. ***Nature***, 359(6398): 826-829.

Nowak, M. A., & Sigmund, K. 1998. Evolution of indirect reciprocity by image scoring. ***Nature***, 393(6685): 573-577.

Ocasio, W., & Thornton, P. H. 1999. Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958-1990. ***Amer. J. Sociology***, 105(3): 801-843.

Park, N. K., & Mezias, J. M. 2005. Before and after the technology sector crash: The effect of environmental munificence on stock market response to alliances of e-commerce firms. ***Strategic Management Journal***, 26(11): 987-1007.

Parker, S. C. 2004. ***The economics of self-employment and entrepreneurship***: Cambridge University Press.

Parker, S. C. 2008. The economics of formal business networks. ***Journal of Business Venturing***, 23(6): 627-640.

Pennebaker, J. W., Booth, R. J., & Francis, M. E. 2007. LIWC2007: Linguistic inquiry and word count. ***Austin, Texas: liwc. net***.

Perkins, S. J., & Hendry, C. 2005. Ordering Top Pay: Interpreting the Signals*. ***Journal of Management Studies***, 42(7): 1443-1468.

Pfarrer, M. D., Smith, K. G., Bartol, K. M., Khanin, D. M., & Zhang, X. 2008. Coming forward: The effects of social and regulatory forces on the voluntary restatement of earnings subsequent to wrongdoing. ***Organization Science***, 19(3): 386-403.

Phillips, D. P. 1986. Natural experiments on the effects of mass media violence on fatal aggression: Strengths and weaknesses of a new approach. ***Advances in experimental social psychology***, 19: 207-250.

Pitelis, C. 2012. Clusters, entrepreneurial ecosystem co-creation, and appropriability: a conceptual framework. ***Industrial and Corporate Change***: dts008.

Pollock, T. G., & Rindova, V. P. 2003. Media legitimation effects in the market for initial public offerings. ***Academy of Management Journal***, 46(5): 631-642.

Porter, M. E. 1981. The Contributions of Industrial Organization to Strategic Management. ***The Academy of Management Review***, 6(4): 609-620.

Porter, M. E. 1990. The competitive advantage of notions. ***Harvard business review***, 68(2): 73-93.

Porter, M. E. 1996. Competitive advantage, agglomeration economies, and regional policy. ***International regional science review***, 19(1-2): 85-90.

Porter, M. E. 2000. Location, competition, and economic development: Local clusters in a global economy. ***Economic development quarterly***, 14(1): 15-34.

Porter, M. E. 2003. The Economic Performance of Regions. ***Regional Studies***, 37(6/7): 545.

Porter, M. E., & Porter, M. P. 1998. Location, Clusters, and the" New" Microeconomics of Competition. ***Business Economics***: 7-13.

Powell, W. W. 1995. Cultivating an institutional ecology of organizations: Comment on Hannan, Carroll, Dundon, and Torres. ***American sociological review***, 60(4): 529-538.

Priem, R. L., & Butler, J. E. 2001. Is the resource-based "view" a useful perspective for strategic management research? ***Academy of management review***, 26(1): 22-40.

Puelz, R., & Snow, A. 1994. Evidence on adverse selection: Equilibrium signaling and cross-subsidization in the insurance market. ***Journal of Political Economy***: 236-257.

Ragozzino, R., & Reuer, J. J. 2007a. Initial public offerings and the acquisition of entrepreneurial firms. ***Strategic Organization***, 5(2): 155-176.

Ragozzino, R., & Reuer, J. J. 2007b. Mind the information gap: Putting new selection criteria and deal structures to work in M&A. ***Journal of Applied Corporate Finance***, 19(3): 82.

Rao, H. 1994. The social construction of reputation: Certification contests, legitimation, and the survival of organizations in the American automobile industry: 1895–1912. ***Strategic management journal***, 15(S1): 29-44.

Reed, R., & DeFillippi, R. J. 1990. Causal ambiguity, barriers to imitation, and sustainable competitive advantage. ***Academy of management review***, 15(1): 88-102.

Reigeluth, G., Wolman, H., & Reinhard, R. 1980. Fiscal consequences of changes in a community's economic base. ***Washington DC: The Urban Institute***.

Reynolds, P., Storey, D. J., & Westhead, P. 1994. Cross-national comparisons of the variation in new firm formation rates. ***Regional Studies***, 28(4): 443-456.

Rindova, V. P., Pollock, T. G., & Hayward, M. L. 2006. Celebrity firms: The social construction of market popularity. ***Academy of Management Review***, 31(1): 50-71.

Rosenthal, S. S., & Strange, W. C. 2003. Geography, industrial organization, and agglomeration. ***review of Economics and Statistics***, 85(2): 377-393.

Rothschild, M., & Stiglitz, J. 1976. Equilibrium in competitive insurance markets: An essay on the economics of imperfect information, ***Foundations of Insurance Economics***: 355-375: Springer.

Ryan, A. M., Sacco, J. M., McFarland, L. A., & Kriska, S. D. 2000. Applicant self-selection: Correlates of withdrawal from a multiple hurdle process. ***Journal of applied psychology***, 85(2): 163.

Sanders, W., & Boivie, S. 2004. Sorting things out: Valuation of new firms in uncertain markets. ***Strategic Management Journal***, 25(2): 167-186.

Saxenian, A. 1994. Regional networks: industrial adaptation in Silicon Valley and route 128.

Saxenian, A. 1996. ***Regional advantage***: Harvard University Press.

Schumpeter, J. A. 1934. ***The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle***: Transaction publishers.

Scott, S. G., & Lane, V. R. 2000. A Stakeholder Approach to Organizational Identity. ***The Academy of Management Review***, 25(1): 43-62.

Scott, W. R. 1987. The adolescence of institutional theory. ***Administrative science quarterly***: 493-511.

Scott, W. R. 1990. Symbols and organizations: from Barnard to the institutionalists. ***Organization theory: from Chester Barnard to the present and beyond***: 38-55.

Scott, W. R. 2007. ***Institutions and organizations: Ideas and interests***: Sage Publications, Incorporated.

Shane, S., & Venkataraman, S. 2000. The promise of entrepreneurship as a field of research. ***Academy of management review***, 25(1): 217-226.

Shannon, C., & Weaver, W. 1948. Biodiversity measurements. ***Mathematical Theory of Communication***: 117-127.

Shaver, J. M., & Flyer, F. 2000. Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States. ***Strategic Management Journal***, 21(12): 1175-1194.

Shepherd, D. A., & Zacharakis, A. 2001. The venture capitalist-entrepreneur relationship: control, trust and confidence in co-operative behaviour. ***Venture Capital: an international journal of entrepreneurial finance***, 3(2): 129-149.

Short, J. C., Broberg, J. C., Cogliser, C. C., & Brigham, K. C. 2009. Construct validation using computer-aided text analysis (CATA): An illustration using entrepreneurial orientation. ***Organizational Research Methods***.

Siegel, P. B., Johnson, T. G., & Alwang, J. 1995. Regional economic diversity and diversification. ***Growth and Change***, 26(2): 261-284.

Simon, H. A. 1955. A behavioral model of rational choice. ***The quarterly journal of economics***: 99-118.

Sine, W. D., Haveman, H. A., & Tolbert, P. S. 2005. Risky business? Entrepreneurship in the new independent-power sector. ***Administrative Science Quarterly***, 50(2): 200-232.

Sirmon, D. G., Hitt, M. A., & Ireland, R. D. 2007. Managing firm resources in dynamic environments to create value: Looking inside the black box. ***Academy of management review***, 32(1): 273-292.

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. 2011. Resource orchestration to create competitive advantage breadth, depth, and life cycle effects. ***Journal of Management***, 37(5): 1390-1412.

Socolow, R. 1994. Six perspectives from industrial ecology. ***Industrial ecology and global change***: 3-16.

Sorenson, O., & Audia, P. G. 2000. The social structure of entrepreneurial activity: Geographic concentration of footwear production in the United States, 1940–19891. ***american Journal of Sociology***, 106(2): 424-462.

Sosis, R., & Alcorta, C. 2003. Signaling, solidarity, and the sacred: The evolution of religious behavior. ***Evolutionary anthropology: issues, news, and reviews***, 12(6): 264-274.

Sosis, R., & Bressler, E. R. 2003. Cooperation and commune longevity: A test of the costly signaling theory of religion. ***Cross-cultural research***, 37(2): 211-239.

Spence, A. M. 1974. ***Market signaling: Informational transfer in hiring and related screening processes***: Harvard Univ Pr.

Spence, M. 1973. Job market signaling. ***The quarterly journal of Economics***: 355-374.

Spence, M. 2002. Signaling in retrospect and the informational structure of markets. ***The American Economic Review***, 92(3): 434-459.

Srivastava, J. 2001. The role of inferences in sequential bargaining with one-sided incomplete information: Some experimental evidence. ***Organizational behavior and human decision processes***, 85(1): 166-187.

St-Jean, E., LeBel, L., & Audet, J. 2010. Entrepreneurial orientation in the forestry industry: a population ecology perspective. ***Journal of Small Business and Enterprise Development***, 17(2): 204-217.

Stam, E. 2015. Entrepreneurial ecosystems and regional policy: a sympathetic critique. ***European Planning Studies***, 23(9): 1759-1769.

Stangler, D., & Bell-Masterson, J. 2015. Measuring an Entrepreneurial Ecosystem. ***Kauffman Foundation. March***.

Stangler, D., & Kedrosky, P. 2010. Exploring firm formation: Why is the number of new firms constant? ***Available at SSRN 1585380***.

Starbuck, W. H., & Nystrom, P. C. 1981. Designing and understanding organizations. ***Handbook of organizational design***, 1: 9-22.

Stiglitz, J. E. 2000. The contributions of the economics of information to twentieth century economics. ***Quarterly Journal of economics***: 1441-1478.

Stock, J. H., Watson, M. W., & Addison-Wesley, P. 2007. Introduction to econometrics.

Suchman, M. C. 1995. Managing legitimacy: Strategic and institutional approaches. ***Academy of management review***, 20(3): 571-610.

Szerb, L., Acs, Z. J., Ortega-Argilés, R., & Komlosi, E. 2015. The Entrepreneurial Ecosystem: The Regional Entrepreneurship and Development Index. ***Available at SSRN 2642514***.

Tallman, S., Jenkins, M., Henry, N., & Pinch, S. 2004. Knowledge, clusters, and competitive advantage. ***Academy of management review***, 29(2): 258-271.

Tang, J. 2008. Environmental munificence for entrepreneurs: entrepreneurial alertness and commitment. ***International Journal of Entrepreneurial Behavior & Research***, 14(3): 128-151.

Tervo, H. 2006. Regional unemployment, self-employment and family background. ***Applied Economics***, 38(9): 1055-1062.

Thornton, & Ocasio, W. 1999. Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958-1990 1. ***American Journal of Sociology***, 105(3): 801-843.

Thornton, Ocasio, W., & Lounsbury, M. 2012. ***The institutional logics perspective: A new approach to culture, structure, and process***: Oxford University Press.

Thornton, P. H. 2002. The rise of the corporation in a craft industry: Conflict and conformity in institutional logics. ***Academy of Management Journal***, 45(1): 81-101.

Thornton, P. H., & Ocasio, W. 2008. Institutional logics. ***The Sage handbook of organizational institutionalism***, 840.

Thurik, A. 2009. Entreprenomics: entrepreneurship, economic growth and policy. ***Entrepreneurship, growth and public policy***: 219-249.

Tolbert, P. S., David, R. J., & Sine, W. D. 2011. Studying choice and change: The intersection of institutional theory and entrepreneurship research. ***Organization Science***, 22(5): 1332-1344.

Torres-Reyna, O. 2007. Panel data analysis fixed and random effects using Stata (v. 4.2). ***Data & Statistical Services, Priceton University***.

Torres-Reyna, O. 2013. Time series. ***Data and statistical services. Princeton University. http:// www. princeton. edu/~ otorres/ TS101. pdf. Accessed***, 14.

Townley, B. 2002. The role of competing rationalities in institutional change. ***Academy of Management Journal***, 45(1): 163-179.

Turban, D. B., Forret, M. L., & Hendrickson, C. L. 1998. Applicant attraction to firms: Influences of organization reputation, job and organizational attributes, and recruiter behaviors. ***Journal of Vocational Behavior***, 52(1): 24-44.

Tversky, A., & Kahneman, D. 1973. Availability: A heuristic for judging frequency and probability. ***Cognitive psychology***, 5(2): 207-232.

Van Stel, A., Storey, D. J., & Thurik, A. R. 2007. The effect of business regulations on nascent and young business entrepreneurship. ***Small Business Economics***, 28(2-3): 171-186.

Vaughn, R., Pollard, R., & Dyer, B. 1985. Confusing job creation with economic development. ***Entrepreneurial Economy***, 11: 2-6.

Venkataraman, S. 1997. The distinctive domain of entrepreneurship research. ***Advances in entrepreneurship, firm emergence and growth***, 3(1): 119-138.

Venkataraman, S., Sarasvathy, S. D., Dew, N., & Forster, W. R. 2012. Reflections on the 2010 AMR decade award: Whither the promise? Moving forward with entrepreneurship as a science of the artificial. ***Academy of Management Review***, 37(1): 21-33.

Wagner, J. E., & Deller, S. C. 1998. Measuring the effects of economic diversity on growth and stability. ***Land Economics***: 541-556.

Warrington, M. H., McDonald, P. G., Rollins, L. A., & Griffith, S. C. 2014. All signals are not equal: acoustic signalling of individuality, sex and breeding status in a cooperative breeder. ***Animal Behaviour***, 93: 249-260.

West, S. A., Griffin, A. S., & Gardner, A. 2007. Social semantics: altruism, cooperation, mutualism, strong reciprocity and group selection. ***Journal of evolutionary biology***, 20(2): 415-432.

West, S. A., Griffin, A. S., Gardner, A., & Diggle, S. P. 2006. Social evolution theory for microorganisms. ***Nature Reviews Microbiology***, 4(8): 597-607.

Wiggins, R. R., & Ruefli, T. W. 2002. Sustained competitive advantage: Temporal dynamics and the incidence and persistence of superior economic performance. ***Organization Science***, 13(1): 81-105.

Wood, M. S., McKelvie, A., & Haynie, J. M. 2014. Making it personal: Opportunity individuation and the shaping of opportunity beliefs. ***Journal of Business Venturing***, 29(2): 252-272.

Wooldridge, J. M. 2010. ***Econometric analysis of cross section and panel data***: MIT press.

Yang, T., & Aldrich, H. E. 2012. Out of sight but not out of mind: Why failure to account for left truncation biases research on failure rates. ***Journal of Business Venturing***, 27(4): 477-492.

Zahavi, A. 1975. Mate selection—a selection for a handicap. ***Journal of theoretical Biology***, 53(1): 205-214.

Zahavi, A. 1987. ***The theory of signal selection and some of its implications***. Paper presented at the International symposium of biological evolution.

Zahra, S. A., & Wright, M. 2011. Entrepreneurship's next act. ***The Academy of Management Perspectives***, 25(4): 67-83.

Zavyalova, A., Pfarrer, M., Reger, R., & Shapiro, D. 2012. Managing the message: the effects of firm actions and industry spillovers on media coverage following wrongdoing. ***Academy of Management Journal***, 55(5): 1079-1101.

Zucker, L. G. 1989. Combining institutional theory and population ecology: No legitimacy, no history. ***American Sociological Review***, 54(4): 542-545.

APPENDIX

Table 3.1 Summary of Hypotheses: Signaling in Entrepreneurial Ecosystems

Hypothesis	*Direct Effects of Signaling*
H1a	*Frequent signals about entrepreneurship will lead to more new venture starts in an entrepreneurial ecosystem*
H1b	*Frequent signals about entrepreneurship will lead to more entrepreneurial failures in an entrepreneurial ecosystem.*
H2a	*Signal attributes of entrepreneurship will result in more new venture starts in an entrepreneurial ecosystem.*
H2b	*Signal attributes of entrepreneurship will result in more failures in an entrepreneurial ecosystem.*
--------	***Moderating Effects of Signaling***
H3a	*Signal valence moderates the positive relationship between signal frequency and new venture starts, such that the more positive (negative) the signal valence, the stronger (weaker) the relationship between signal frequency and new venture starts.*
H3b	*Signal valence moderates the positive relationship between signal frequency and venture failures, such that the more positive (negative) valence, the stronger (weaker) the relationship between signal frequency and venture failures.*
H3c	*Signal valence moderates the positive relationship between signal attributes and new venture formation, such that the more positive (negative) the signal valence, the stronger (weaker) the relationship between signal attributes and new venture formation.*
H3d	*Signal valence moderates the positive relationship between signal attributes and firm failure, such that the more positive (negative) the signal valence, the stronger (weaker) the relationship between signal attributes and firm failures.*
--------	***Moderating Effects of Environmental Factors***
H4a	*Industry diversity moderates the positive relationship between signal frequency and new venture formation such that it creates an inverted-U shape curve, as industry diversity strengthens the relationship between signal frequency and new venture formation initially, and then attenuates the relationship between signal frequency and new venture formation.*
H5a	*Resource availability moderates the positive relationship between signal frequency and firm failure, such that more (less) resource availability strengthens (weakens) the relationship between signal frequency and failure.*
H5b	*Resource availability moderates the positive relationship between signal attributes and firm failure, such that more (less) resource availability strengthens (weakens) the relationship between signal attributes and failure.*
H5c	*Resource availability moderates the positive relationship between signal frequency and new venture starts, such that resource abundance attenuates the positive relationship between signal frequency and more new venture starts.*
H5d	*H5d: Resource abundance attenuates the positive relationship between signal attributes and more new venture starts.*

Table 4.1 Selected MSAs

MSA	State	Population (2000)	Nearby MSA(s)
Fayetteville	AR	463204	Springfield
Prescott	AZ	211033	Yuma
Yuma	AZ	195751	Prescott
Bakersfield	CA	839631	Modesto, Visalia
Modesto	CA	514453	Bakersfield, Santa Rosa
Oxnard	CA	823318	Bakersfield, Visalia
Santa Rosa	CA	483878	Modesto
Visalia	CA	368627	Bakersfield, Modesto
Boulder	CO	294567	Greeley
Greeley	CO	252825	Boulder
Naples	FL	321520	Ocala
Ocala	FL	331298	Naples, Pensacola
Pensacola	FL	413086	Lafayette, Ocala
Houma	LA	208178	Lafayette
Lafayette	LA	273738	Houma, Pensacola
Portland	ME	514098	Manchester
Flint	MI	425790	Lansing
Lansing	MI	464036	Flint
Springfield	MO	436712	Fayetteville
Wilmington	NC	362315	Myrtle Beach
Manchester	NH	400721	Portland
Reno	NV	425417	Provo
Canton	OH	404422	Toledo, York
Toledo	OH	651429	Canton
York	PA	434972	Canton
Charleston	SC	550916	Myrtle Beach
Hickory	SC	365497	Spartanburg
Myrtle Beach	SC	269291	Charleston, Wilmington
Spartanburg	SC	284307	Hickory
Provo	UT	526810	Reno

Table 4.2 Summary of Variables and Measures

Dependent Variables	***Measure***	***Data Source***
Firm Formations	Count of firm starts	Business Employment Dynamics-BLS.gov
Firm Failures	Count of firm failures	Business Employment Dynamics-BLS.gov
Age 0 Firms	Count of Age 0 firms	Business Dynamics Statistics - Longitudinal Business Database, census.gov
Independent Variables		
Signal Frequency	Count of Media Articles	Factiva Database
Signal Attributes	Word Count of Entrepreneurial Orientation Words	Factiva Database for articles - QDA Miner for word count using Short et al., 2009 E.O. dictionary
Signal Valence	Janis-Fadner Coefficient	Factiva Database for articles -
Industry Diversity	Shannon-Weaver Index	Business Dynamics Statistics - BLS.gov
Resource Availability	Investment in MSA	Kauffman Foundation Crunchbase.com
Control Variables		
Population	Continuous variable	Metropolitan Statistical Area Population Estimates - Census.gov
Education	Standardized variable combining all levels of education	Kauffman Foundation from Census.gov
Patents	Number of patents issued	Kauffman Foundation
SBIRs	Number of SBIRs awarded	Kauffman Foundation
NIH Grants	Number of NIH grants awarded	Kauffman Foundation

Table 5.1 Descriptive Statistics

	N	Mean	Std. Dev	Min	Max
Dependent Variables					
New Firms	330	1014.273	417.264	263	2386
Firm Failures	330	890.473	349.747	217	2018
Control Variables					
Population	330	399665.9	154132.2	160576	842813
Education	330	295.886	25.00945	251.72	374.24
Patents	330	102.330	115.638	1	599
SBIR Grants	330	2521674	7325776	0	5.00E+07
NIH Grants	330	8858928	2.23E+07	0	1.63E+08
Independent Variables					
Frequency (Number of Articles)	330	41.267	39.817	1	203
Content Attributes (Entrepreneurial Orientation)	330	80.461	77.885	0.333	370.333
Moderator Variables					
Valence (Janis Fadner Coefficient of Imbalance)	330	0.396	0.123	0.050924	0.796
Industry Diversity (Shannon-Weaver Index)	330	0.816	0.159	0	0.887
Resources (Venture Capital)	330	1.18E+07	5.07E+07	0	5.93E+08
Interaction Terms					
Frequency * Valence	330	1.284	0.610	0	2.738
Frequency * Resources	330	1.95E+07	1.17E+08	-2.52E+07	1.17E+09
Frequency * Diversity	330	0.003	0.831	-0.887	3.497
EO * Valence	330	33.423	35.134	0.115	166.594
EO * Resources	330	1.53E+07	8.90E+07	-2.53E+07	9.05E+08

Table 5.2 Correlations

	New Firms	Firm Failure	Frequency	EOContent	Valence	Diversity Ind	Resources	Population
----------	---------	---------	---------	---------	---------	---------	---------	---------
New Firms	1							
Firm Failures	0.977***	1						
Frequency	0.705***	0.748***	1					
EO Content	0.610***	0.674***	0.888***	1				
Valence	-0.066	-0.051	0.185	0.291	1			
Diversity Index	-0.163	-0.176	0.040	0.016	-0.127	1		
Resources	0.322*	0.291	0.470***	0.544***	0.140	-0.129	1	
Population	0.716***	0.761***	0.577***	0.489***	-0.065	-0.039	0.036	1
Education	0.312*	0.330*	0.511***	0.594***	0.242	-0.097	0.656***	0.023
Patents	0.495***	0.520***	0.587***	0.646***	0.016	-0.230	0.681***	0.299
SBIR	0.278	0.282	0.392***	0.552***	-0.002	-0.011	0.694***	0.005
NIH	0.376**	0.384**	0.439**	0.485***	0.102	0.150	0.215	0.226
Freq*Resources	0.266	0.231	0.425**	0.554***	0.199	-0.041	0.955	-0.023
Freq*Valence	0.607***	0.646***	0.958***	0.889***	0.433	0.017	0.463**	0.516
EO*Resources	0.276	0.247	0.433**	0.567***	0.185	-0.057	0.954***	-0.014
EO*Valence	.570***	0.629***	0.870***	0.991***	0.384	0.019	0.528	0.465*
Freq*Diversity	0.166	0.193	0.459**	0.717***	0.358*	0.081	0.674***	0.003**

	Education	Patents	SBIR	NIH	Freq*Res	Freq*Val	EO*Res	EO*Val	Freq*Div
----------	---------	---------	---------	---------	---------	---------	---------	---------	---------
New Firms									
Firm Failures									
Frequency									
EO Content									
Valence									
Diversity Index									
Resources									
Population									
Education	1								
Patents	0.666***	1							
SBIR	0.659***	0.748***	1						
NIH	0.296	0.214	0.422**	1					
Freq*Resources	0.649***	0.641***	0.790***	0.281	1				
Freq*Valence	0.525*	0.528	0.346	0.416	.442**	1			
EO*Resources	0.659***	0.660***	0.812***	0.297	0.999***	0.444**	1		
EO*Valence	0.592	0.603	0.508	0.470	.545	0.905***	0.553	1	
Freq*Diversity	0.695***	0.519***	0.733***	0.494***	0.776***	0.525***	0.780***	0.733***	1

Table 5.3 Summary of Effects of IVs and Moderators on New Firms

	Model 1: Controls				Model 2: Independent Variables				Model 3: Full Model		
	B	**p-value**	**SE**		**B**	**p-value**	**SE**		**B**	**p-value**	**SE**
Population	0.596	0.000	0.025		0.536	0.000	0.031		0.527	0.000	0.037
Education	0.156	0.000	0.016		0.147	0.001	0.040		0.161	0.000	0.037
Patents	0.166	0.000	0.033		0.133	0.001	0.034		0.132	0.000	0.023
SBIRs	-0.009	0.833	0.041		0.068	0.034	0.031		0.091	0.000	0.015
NIH Grants	0.087	0.247	0.073		0.084	0.114	0.052		0.098	0.056	0.049
Frequency					0.266	0.008	0.092		0.623	0.000	0.136
E.O. Content					-0.320	0.000	0.071		-0.388	0.472	0.532
Valence					-0.112	0.011	0.041		0.164	0.065	0.085
Industry Diversity					-0.600	0.000	0.132		-0.458	0.004	0.147
Resources					-0.093	0.071	0.049		-0.309	0.003	0.097
Frequency*Valence									-1.084	0.012	0.407
Frequency*Resources									3.32E-09	0.000	0.000
Frequency*Diversity									-0.118	0.430	0.056
EO*Valence									0.007	0.659	0.016
EO*Resources									-1.47E-09	0.184	0.000
R2	.541				.567				.591		
Δ R2					.026				.024		

Table 5.4 Summary of Effects of IVs and Moderators on Firm Failures

	Model 1: Controls				Model 2: Independent Variables				Model 3: Full Model		
	B	**p-value**	**SE**		**B**	**p-value**	**SE**		**B**	**p-value**	**SE**
Population	0.643	0.000	0.017		0.582	0.000	0.026		0.579	0.000	0.026
Education	0.160	0.000	0.016		0.099	0.000	0.006		0.087	0.000	0.018
Patents	0.209	0.000	0.012		0.151	0.000	0.015		0.133	0.000	0.019
SBIRs	-0.052	0.057	0.026		-0.002	0.836	0.009		0.022	0.474	0.031
NIH Grants	0.138	0.001	0.038		0.088	0.000	0.020		0.096	0.000	0.021
Frequency					0.225	0.000	0.043		0.429	0.001	0.112
E.O. Content					-0.141	0.046	0.068		-0.157	0.637	0.329
Valence					0.022	0.475	0.031		0.179	0.039	0.083
Resources					0.115	0.002	0.034		0.315	0.001	0.081
Frequency*Valence									-0.591	0.067	0.310
Frequency*Resources									2.44E-08	0.000	0.000
EO*Valence									0.002	0.866	0.011
EO*Resources									-2.93E-08	0.000	0.000
R2	.659				.666				.676		
Δ R2					.007				.010		

Table 5.5 Summary of Robustness Test Using Age 0 Firms

	Model 1: Controls				Model 2: Independent Variables				Model 3: Full Model		
	B	**p-value**	**SE**		**B**	**p-value**	**SE**		**B**	**p-value**	**SE**
Population	0.528	0.000	0.029		0.473	0.000	0.036		0.467	0.000	0.039
Education	0.148	0.000	0.018		0.139	0.006	0.047		0.150	0.002	0.043
Patents	0.163	0.000	0.032		0.133	0.010	0.048		0.133	0.000	0.034
SBIRs	0.001	0.977	0.037		0.067	0.148	0.045		0.094	0.000	0.021
NIH Grants	0.072	0.301	0.068		0.067	0.141	0.044		0.079	0.077	0.043
Frequency					0.274	0.020	0.112		0.685	0.000	0.113
E.O. Content					-0.328	0.001	0.085		-0.508	0.341	0.524
Valence					-0.114	0.039	0.053		0.180	0.035	0.081
Industry Diversity					-0.613	0.000	0.133		-0.497	0.002	0.149
Resources					-0.076	0.166	0.053		-0.321	0.022	0.132
Frequency*Valence									-1.175	0.002	0.354
Frequency*Resources									3.42E-09	0.000	0.000
Frequency*Diversity									-0.086	0.194	0.064
EO*Valence									0.009	0.549	0.015
EO*Resources									-1.44E-09	0.307	0.000
R2	.445				.467				.491		
Δ R2					.022				.024		

Table 5.6 Summary of Robustness Test Using Age 0 Firms, Size 1-4

	Model 1: Controls				Model 2: Full Model, 3-Year Lag				Model 3: Full Model, Same Year		
	B	**p-value**	**SE**		**B**	**p-value**	**SE**		**B**	**p-value**	**SE**
Population	0.504	0.000	0.027		0.438	0.000	0.040		0.427	0.000	0.035
Education	0.142	0.000	0.017		0.140	0.002	0.041		0.113	0.010	0.041
Patents	0.164	0.000	0.032		0.131	0.003	0.041		0.083	0.000	0.020
SBIRs	0.025	0.479	0.036		0.112	0.000	0.024		0.084	0.001	0.022
NIH Grants	0.062	0.363	0.067		0.065	0.133	0.042		0.081	0.007	0.028
Frequency					0.652	0.000	0.114		0.525	0.000	0.086
E.O. Content					-0.410	0.454	0.539		-0.449	0.093	0.259
Valence					0.156	0.066	0.081		0.112	0.077	0.061
Industry Diversity					-0.523	0.002	0.155		-0.467	0.003	0.145
Resources					-0.291	0.042	0.137		0.028	0.365	0.030
Frequency*Valence					-1.038	0.007	0.357		-0.684	0.005	0.223
Frequency*Resources					3.12E-09	0.000	0.000		3.29E-09	0.000	0.000
Frequency*Diversity					-0.076	0.261	0.066		-0.113	0.100	0.031
EO*Valence					0.006	0.713	0.016		0.011	0.221	0.009
EO*Resources					-1.34E-09	0.357	0.000		-3.3E-09	0.003	0.000
R2	.422				.469				.481		
Δ R2					.047				.012		

Table 5.7 Summary of Results of Primary Analysis

Direct Effects				
Hypothesis	IV	Prediction	DV	Result
1 a	Signal Frequency	(+)	New Firms	Supported
1 b	Signal Frequency	(+)	Firm Failures	Supported
2 a	Content Attributes	(+)	New Firms	Partial Support
2 b	Content Attributes	(+)	Firm Failures	Partial Support
Interactions				
Hypothesis	IV	Prediction	DV	Result
3 a	Frequency * Valence	(+)	New Firms	Partial Support
3 b	Frequency * Valence	(+)	Firm Failures	Partial Support
3 c	Content Attributes * Valence	(+)	New Firms	Not Supported
3 d	Content Attributes * Valence	(+)	Firm Failures	Not Supported
4 a	Frequency * Industry Diversity	U	New Firms	Not Supported
5 a	Content Attributes * Resources	(+)	Firm Starts	Not Supported
5 b	Content Attributes * Resources	(+)	Firm Failures	Partial Support
5 c	Frequency * Resources	(-)	Firm Starts	Partial Support
5 d	Frequency * Resources	(-)	Firm Failures	Partial Support

Table 6.1 Exemplar Quotations from Articles for E.O. Content

"We want to identify markets where competition exists, where entry is likely in the near future, and where competition once existed but failed."	Aspen Publishers, 2006
"There probably is enough business for everyone, but she expects tougher competition ahead."	Coleman, 2007
"There's nothing more depressing than spending $2 million on the streets and seeing empty stores."	Umlauf-Garneau, 2001
"Don't feel threatened by competition."	Bair, 2006
"Such real-world lessons, painful as they may be, are a driving force behind the downtown center's efforts."	Zwahlen, 2002
"I loved the challenge of running my own company."	Toledo Business Journal, 2004
"If you're more productive, you're better able to compete and survive and expand and grow."	Bell & Howard Information & Learning Company, 2004
"We want entrepreneurs who inspire others through intense vision, who have built and maintained a growing business, who have created jobs."	Hindustan Times, 2006
"That competitive price explains why the industry is so attractive for so many."	Energy Weekly News, 2010
"We need to consider this idea in relation to today's business climate: a highly competitive one."	Associated Press Newswire, 2010

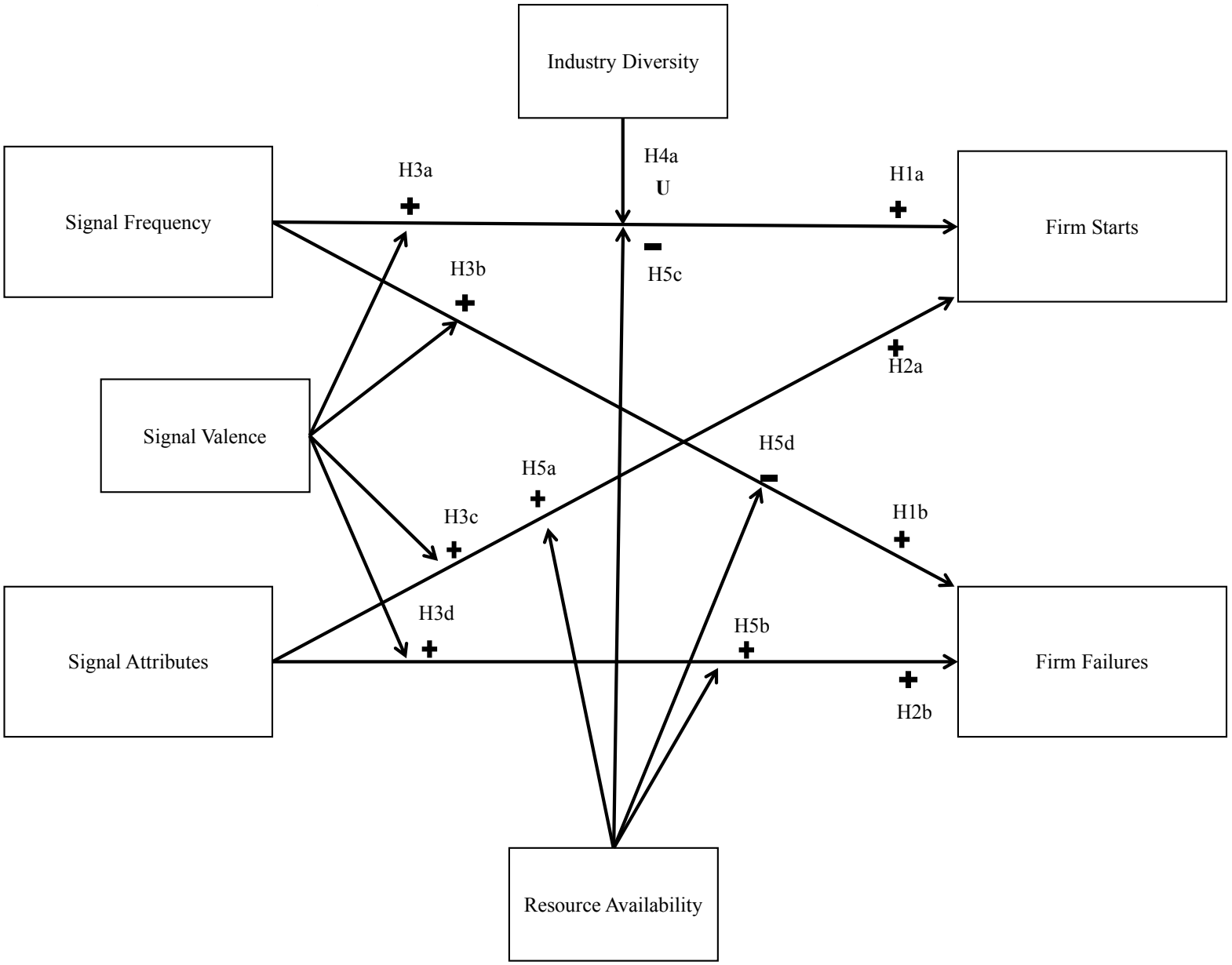

Figure 3.1 Model of Relationships

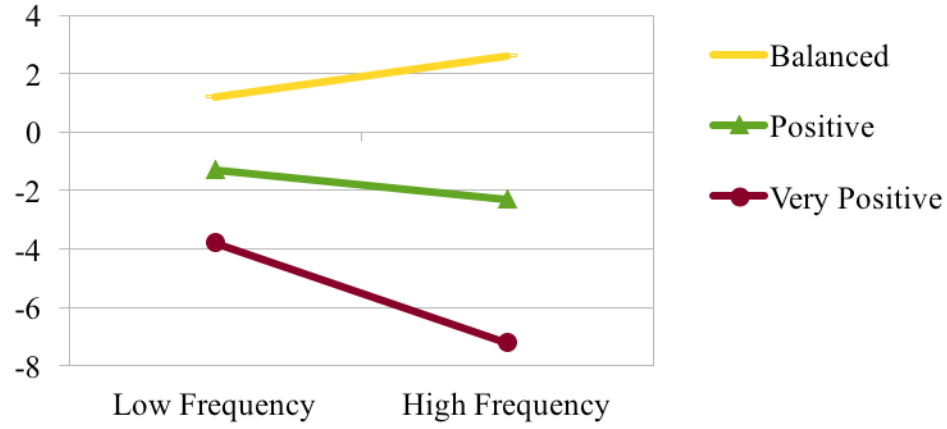

Figure 5.1 Interaction of Signal Frequency and Valence on New Firms

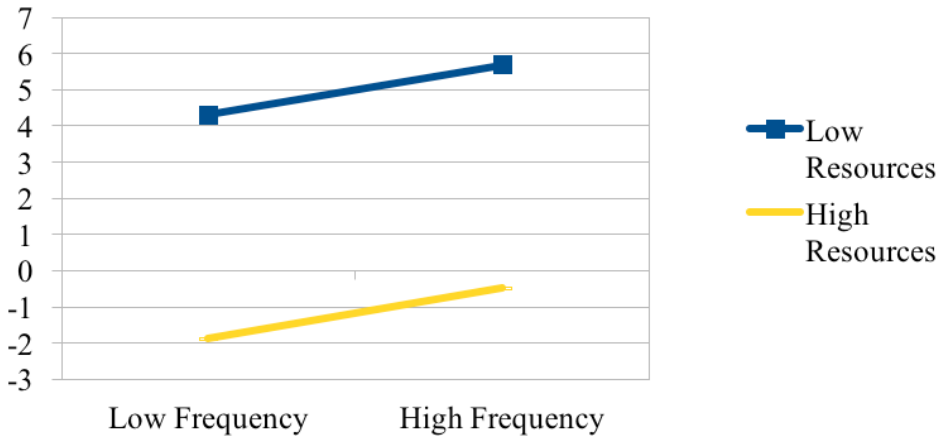

Figure 5.2 Interaction of Signal Frequency and Resources on New Firms

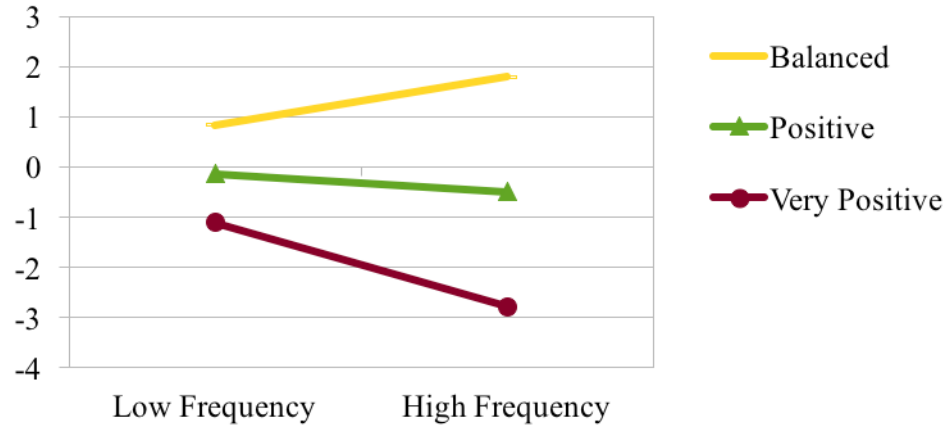

Figure 5.3 Interaction of Signal Frequency and Valence on Firm Failures

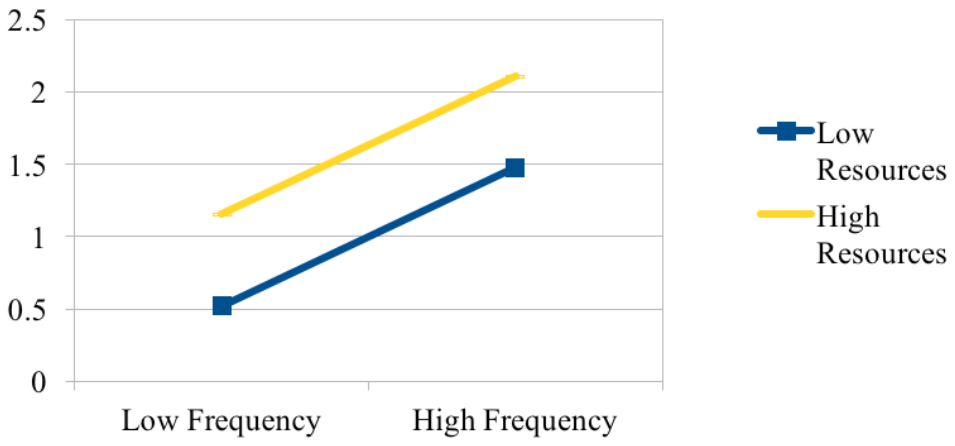

Figure 5.4 Interaction of Signal Frequency and Resources on Firm Failures

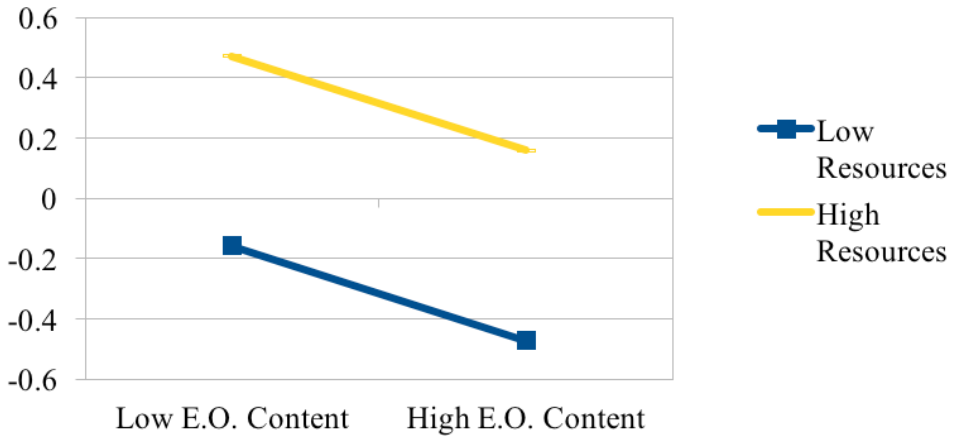

Figure 5.5 Interaction of E.O. Content and Resources on Firm Failures

VITA

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