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Catching the Gazelle: Antecedents and Outcomes of High Growth Firms

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CATCHING THE GAZELLE: ANTECEDENTS AND OUTCOMES OF HIGH GROWTH FIRMS

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DEDICATION

This dissertation is dedicated to hard-workers from humble beginnings; you can do it.

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ABSTRACT

This three-essay dissertation seeks to resolve some of the unanswered questions that exist about high-growth firms (HGFs). Paper I identifies the antecedents and outcomes of HGFs to better inform economic development policy. In explaining the theoretical and operational constructs of these concepts, a model of the situation of high-growth firms is developed, dubbed *the Model of High Growth Firm Antecedents and Outputs*. Antecedents to HGFs include an entrepreneurial mindset, firm strategic resources, and firm structural characteristics, while outputs of HGFs include regional innovation outcomes and regional economic outcomes. Paper II investigated the quantitative association between antecedents and outputs of HGFs. This paper used path analysis to test hypotheses within the *Regional High-Growth Firm Antecedents and Outcomes Framework*, and finds a strong positive association between most antecedents (human capital, startup capital, and business costs) and HGFs, a positive relationship between most antecedents and outcomes (employment and per capita income), and an association between HGFs and employment. Paper III establishes a typology of HGFs using cluster-discriminate analysis. Using a sample of 26,104 firms in the state of Ohio from the Quarterly Census of Employment and Wages, this paper finds that only a small portion of HGFs display high-growth characteristics described in the literature.

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CHAPTER I

INTRODUCTION

In 2017, AOL Co-Founder Steve Case established a $150 million fund that he named "Rise of the Rest." The purpose of this fund was to help foster entrepreneurship and innovation in the middle of the United States, within cities including Nashville, TN, Columbus, OH, and Charleston, SC (American entrepreneurship, 2017; Ross-Sorkin, 2017). The quest to move innovation and entrepreneurship to locations away from the coasts has been an economic development challenge for the last few decades. It was only in the last ten years that economic development professionals have started to embrace entrepreneurship as a means of job growth and prosperity.

The discussion surrounding the importance of entrepreneurship and small businesses as job generators began with Birch (1979) in the late 1970s, whose research indicated that small businesses are the most effective engine of growth in the United States. He reported that small firms created 66 percent of all new jobs from 1969 to 1976. Birch and Medoff (1994) found that it was not only small firms but a subset of these firms that were the engines of job growth. They called these job-generating firms "gazelles," another name for a high-growth firm. Birch, Haggerty, and Parsons (1993) found that these high-growth firms comprised 4 percent of total firms, but accounted for 70 percent of the new jobs created.

Investigating high-growth firms (HGFs) by scholars is valuable for two main reasons. First, a significant amount of resources is spent on entrepreneurship and small business development programs, therefore, studying high-growth firms will aid in public policy decision making and allow for better allocation of these resources. Second, as research shows, only a small percentage of firms are high-growth (Delmar, Davidson, & Gartner, 2003). Studying HGFs will help inform managerial policy to better guide entrepreneurs and small business owners' strategic decision making (Hitt, Ireland, Camp, & Sexton, 2001, 2002; Ireland, Hitt, Camp, & Sexton, 2001; Ireland, Hitt, & Sirmon, 2003). A considerable amount of energy and money is expended in the name of job creation to foster entrepreneurship and small business development. There is a vast amount of literature on firm growth, small business growth, determinates of firm growth (Dunne, Roberts, and Samuelson, 1989; Gabe and Kraybill, 2002; Hall, 1987; Hart & Prais, 1956; Mansfield, 1962; Samuels, 1965; Simon & Bonnini, 1958), and quantifying HGFs (Birch, et al., 1993; Birch & Medoff, 1994; Davidsson & Henrekson, 2002), but scant literature focused on fostering HGFs as a mechanism of economic development. There have been qualitative attempts to examine public policies directed at fostering HGFs (Mason & Brown, 2013; Shane, 2009). However, there have been fewer quantitative analyses of HGFs that investigate their distinct development paths and potential interventions that facilitate their growth.

This three-essay dissertation seeks to resolve some of the unanswered questions that exist about HGFs. Paper I seeks to identify the hypothesized antecedents and outcomes of HGFs from the literature to better inform economic development policy. Questions in Paper I center around: What are the antecedents and outputs of HGFs? How

can these antecedents and outputs be assembled into a system model? Paper II investigates the quantitative association between antecedents and outputs of HGFs and asks the question: What are the direct and indirect of effects of HGFs on regional economic outcomes? Paper III seeks to answer the question: How do HGFs grow, knowing that their growth is heterogeneous? What variables (and indirectly mechanisms) are drivers of high-growth?

The foundational understandings of HGFs are grounded in economics, regional science, business, and management theory. Economics and regional science see HGFs as agents of employment and wealth creation for the macroeconomy and as outcomes of regional resources and markets, while the business and management literature seek to identify the personal characteristics and strategic decisions of the entrepreneur as an actor. This paper uses the foundation of the management theory of the Resource-Based View (RBV) of the firm to ground its investigation across Paper I and Paper II. RBV posits that resources are heterogeneous and that firms strategically manage these resources to achieve competitive advantage (Ireland, et al., 2003; Rumelt, 1995; Wernerfelt, 1995). Resources can be tangible (i.e., capital) or intangible (i.e., knowledge), but it is the strategic use of these resources that help obtain their high-growth (Barney, 1991).

Chapter 2 (Paper I) adds to the entrepreneurship and management literature by examining the concept of high-growth firms (HGFs) and the system in which they operate. This paper seeks to identify the antecedents and outcomes of HGFs while examining the relationship of these elements to HGFs. These examinations can be found through grounding the investigation in the management theory of the Resource-Based

View (RBV) of the firm. In explaining the theoretical and operational constructs of these concepts, a model of HGFs is developed, dubbed *the Model of High Growth Firm Antecedents and Outputs*. Antecedents to HGF formation include an entrepreneurial mindset, firm strategic resources, and firm structural characteristics, while non-business outputs of HGFs include regional innovation outcomes and regional economic outcomes. Embedded at the center of this model is the HGF, acting as the economic agent between these antecedents and outcomes. This model encompasses the inputs and outputs of HGFs in the hope of better understanding and facilitating high-growth firm development.

Chapter 3 (Paper II) explores the essential resources that serve as antecedents of HGFs and then quantitatively tests the contributions of these antecedents and HGFs on regional economic outcomes. The goal of this chapter is to provide a quantitative framework for economic development directed at supporting the likelihood that HGFs will take hold and stay in a region. This paper uses path analysis to test hypotheses within the *Regional High-Growth Firm Antecedents and Outcomes Framework.* This chapter seeks to explore if elevated levels of regional entrepreneurial density, startup capital, and human capital result in greater levels of employment, high-growth firms, and per capita income. A goal of this chapter is also to examine if, as proposed, regional business costs are a control variable and if they vary based on product cycle and regional assets. This chapter also seeks to examine if, as proposed, a higher percentage of high-growth firms in a regional economy results in higher employment levels and per capita income.

Chapter 4 (Paper III) establishes a typology of HGFs. This chapter employs cluster-discriminate analysis similar to Hill and Brennan (2000) to identify like clusters of HGFs and overlay discriminate analysis on these clusters. This process was utilized to

help better see their functions and name them. This paper examines a universe of 26,104 HGFs in the state of Ohio from the Quarterly Census of Employment and Wages. This analysis seeks to identify patterns in growth, the method of growth, timeline of growth, and industry to see common identifiers in HGF clusters.

Finally, Chapter 5 provides a conclusion that summarizes the findings from the three papers (Chapters 2, 3, and 4). This chapter discusses how this dissertation is related to and contributes to the current academic literature. Moreover, this chapter proposes future directions for research in the area of HGFs.

Overall, this dissertation connects related literature from multiple disciplines to investigate the drivers and outcomes of HGFs to inform policy better. Although each essay explores different research questions and hypotheses, they are connected by the roles that HGFs play in regional in economic development. Academics and economic development specialists resoundingly call for public policies focused on HGFs; however, there are no policies at the state or national level focused on individual HGFs (Lerner, 2010; Mason & Brown, 2013). This dissertation seeks to understand all of the essential aspects of fostering HGFs and how economic development practitioners should consider HGFs in their portfolio approach (business acquisition, retention, attraction, and entrepreneurship) to foster prosperous regions.

CHAPTER II

HIGH-GROWTH FIRMS: UNDERSTANDING ANTECEDENTS AND OUTPUTS

Introduction

Over the last 25 years, the research of entrepreneurship has grown and has emerged as a field of study. Although business and economic literature have discussed the role of entrepreneurs within the context of the firm and firm growth for centuries, many scholars still struggle to identify whether entrepreneurship is a stand-alone area of inquiry. Within the last 25 years, however, entrepreneurship articles have had a more significant presence in 'A' journals (Busenitz, Plummer, Klotz, Shahzad, & Rhoads, 2014). Moreover, the subject of entrepreneurship is not restricted to one academic discipline; it has multidisciplinary roots in business, economics, and management theory.

The multidisciplinary nature of entrepreneurship has led some researchers to label it as a "hodgepodge" of research (Shane & Venkataraman, 2000, p. 217), and the lack of precise definitions has led to conceptual flexibility to suit various authors' interests (Coad, Daunfeldt, Holzl, Johansson, & Nightingale, 2014). Authors agree that there is a difference between entrepreneurship and owning a small business, but how to delineate the distinction between the two has proven problematic in the literature. Even though there is a significant range of opinion on how to classify entrepreneurship, there is a high

degree of consensus that high-growth firms (HGFs) – firms that have a high rate of growth over a specific period – should be labeled as entrepreneurial firms.

The business, management, economics and regional science literatures have developed different about HGFs, based on disciplinary traditions, methods, and lines of inquiry. The business and management literature examines firm-level decisions and traces their implications for business success and organization (Hitt & Ireland, 2000). The economics and regional science literatures focusing on the national and regional supply of HGFs emphasizing the role that factor inputs play in shaping the aggregate performance of HGFs. Of particular interest is the aggregate impact of these firms on regional economic outcomes—especially employment and income. (Birch & Medoff, 1994; Davidsson & Henrekson, 2002; Kirchoff, 1994).

Beyond examining HGFs for their contribution to the economy, no study has undertaken a theoretical examination of HGFs' benefit to the environment in which firms reside. This paper stands alone in its use of the management theory of Resource-Based View (RBV) of the firm, which posits that resources are heterogeneous and that firms strategically manage these resources to achieve competitive advantage. RBV suggests that HGFs take exceptional advantage of their resources to obtain their exceptionally high growth rates.

This paper addresses two critical questions: 1) What are the antecedents to the economic performance of HGFs in the aggregate and 2) what are the regional economic outcomes from HGFs? By grounding the theoretical examination of these research questions in RBV and explaining the operational constructs of these concepts, a model of high-growth firms in a regional economic context is developed and is titled the *Model of*

High Growth Firm Antecedents and Outputs. This model encompasses the inputs and outputs of HGFs.

Background

The foundational understandings of high-growth firms are grounded in business, economics, and management theory. These disciplines have examined the definitional constructs and differentiated these phenomena from other types of business activity. Early theorists reflected on who entrepreneurs are and what role they play in society. Ricketts (2006) examined the entrepreneur in economic history, finding that the image we now associate with an entrepreneur began to emerge in the 18th and 19th centuries when the constitutional powers of the monarchy and upper class began to be constrained and property rights enforced. Cantillon (1730) was one of the earliest philosophers to argue that entrepreneurs were rational decision makers who took the risk upon themselves to bring goods to the market. Marshall (1912) claimed that entrepreneurs were – at the core – business managers. Knight (1921), on the other hand, rejected Marshall and believed profit was related to uncertainty, not risk; probabilities could not be assigned to these uncertainties. It was not until Schumpeter (1942) that entrepreneurs began to be differentiated by the fact that they sought out and used innovation to bring products to market.

Before the early 2000s, most of the entrepreneurial literature defined the entrepreneurship field regarding who entrepreneurs were and what they did. Venkataraman (1997) showed that this limited the field because it ignored opportunity and individuals' enterprising nature. Beyond this, Shane and Venkataraman (2000) expanded their definition of entrepreneurship to include the creation of new organizations

(a.k.a. startups). From this expansion, the entrepreneur came to be defined not only as an individual acting in the market but also as a firm acting on behalf of an individual in the market. This definitional change allowed for the fact that the entrepreneur's knowledge was involved in creating the commercial venture (Venkataraman, 1997). Furthermore, "entrepreneurial opportunities" came to be defined "as situations in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships" (Eckhardt & Shane, 2003, p. 336). Through their framework, they identify that decision-making is an essential activity of entrepreneurs.

The management field integrated the disciplines of strategic management and entrepreneurship to evolve the concept of strategic entrepreneurship (SE), meaning strategic entrepreneurial endeavors (Hitt, et al., 2001, 2002; Ireland, et al., 2003; Ireland, et al., 2001). Within the SE literature, Ireland, et al. (2001) defined entrepreneurship "…as a context-dependent social process through which individuals and teams create wealth by bringing together unique packages of resources to exploit marketplace opportunities." They emphasize wealth creation as an essential component to the success of SE: "Wealth is created only when firms combine effective opportunity-seeking behavior (i.e., entrepreneurship) with effective advantage-seeking behavior (i.e., strategic management)." (Ireland, et al., 2003, p. 966).

The foundations for and development of the modern understanding of entrepreneurship is essential, but how to identify it when experienced? Acknowledging that the difference between entrepreneurs and small business owners falls into the categorization of a "fuzzy concept," or "one which posits an entity, phenomenon or

process which possesses two or more alternative meanings and thus cannot be reliably identified or applied by different readers or scholars" (Markusen, 1999, p. 870). According to Markusen, one way to know whether a phenomenon is a fuzzy concept is "by asking the question over and over, 'how do we know it when we see it?'" (1999, p. 870). Within the context of entrepreneurial research, the challenge is, thus, translating "fuzzy" understandings into a conceptual framework. Currently, there are vague abstractions of what an entrepreneur is. The media often foster these amorphous depictions. For example, an article in Forbes magazine explained the difference between an entrepreneur and a small business owner as based on different traits of the individual: Namely, "entrepreneurs are never satisfied with the status quo" (Marks, 2012). However, examining personal traits only contributes to "fuzziness." Examining the distinctive goals and characteristics of entrepreneurial firms and small businesses is a more objective approach for establishing a physical, outcome-based construct. The following section delineates differences between entrepreneurial ventures and small businesses, which will be referred to for the remainder of this article as "routine firms."

Entrepreneurial Ventures vs. Routine Firms

Schumpeter (1934, 1942) was the first to differentiate between entrepreneurial ventures and routine firms. His work identified innovation as essential to differentiating entrepreneurs from managers and distinguishing entrepreneurial ventures from routine firms. Schumpeter (1934) recognized that entrepreneurs were challenged to find and use new ideas in the market, and he identified five ways they could profitably promote innovation: 1) develop a new product or service; 2) develop a new method of production; 3) identify a new market; 4) discover a new source of supply, or 5) reorganize firms or

industries. From these five dimensions, a distinction can be drawn between those firms that employ such strategies and those that do not. Liebenstein (1968) built on the Schumpeterian framework to establish that the difference between entrepreneurial ventures and routine firms lay within the production function. Arguing that routine firms serve mainly a management function (where their primary activities and duties are routine within the industry, and the firm operates within well-established markets), Liebenstein contrasted this routine activity with entrepreneurial firms to identify an enterprise function (where not all of the activities are recognized or established, or the firm may be operating in new markets).

Carland, Hoy, Boulton, and Carland (1984) adhered to the Schumpeterian view of innovation as a component of entrepreneurial firms and echoed Liebenstein (1968) in asserting that management and routine functions characterize small businesses. Carland, et al. (1984) outlined definitional differences between small businesses and entrepreneurs to advance the discourse in the literature. The authors defined a small business as "any business that is independently owned and operated, not dominant in its field, and does not engage in any new marketing or innovative practices" (p. 358). In contrast, they defined an entrepreneurial venture as "one that engages in at least one of Schumpeter's four categories of behaviors: that is, the principal goals of an entrepreneurial venture are profitability and growth and the business is characterized by innovative strategic practices" (Carland, et al., 1984, p. 358). The authors removed "discover a new source of supply" from the Schumpeterian list since it is ambiguous and reflected the reality of turn on the 19th Century imperial empire building as an extension of mercantilism when Schumpeter began writing *The Theory of Economic Development*.

Kirchhoff's (1994) Typology of Dynamic Capitalism provides a way of differentiating routine firm functions from innovative firm functions in the literature. He identified four groups of firms based on differences in business growth and innovation rates: 1) economic core (low innovation rate, low growth rate), 2) ambitious (low innovation rate, high growth rate), 3) constrained growth (high innovation rate, low growth rate), and 4) glamorous (high innovation rate, high growth rate). Kirchhoff's theory offers a typology that helps clarify what entrepreneurial and routine firms look like and, more importantly, what the mechanisms of growth and stagnation are for each type.

Many firms start small and stay small (Haltiwanger, Jarmin, & Miranda, 2010). Moreover, Hurst and Pugsley (2011) noted that small and medium-sized enterprises behave very differently: Many firms that start small and stay small, for example, are concentrated within industrial sectors made up of service providers. In addition, Hurst and Pugsley (2011) found that, unlike entrepreneurs, small business owners often start their enterprises for non-pecuniary reasons. On the other hand, entrepreneurial ventures, which are characterized by innovation and growth, are found within almost all industries of the economy (Birch, 1979; Clayton, Sadeghi, Spletzer, & Talan, 2013; Davidsson & Henrekson, 2002; Woodward, Guimaraes, & Watson, 2011). It is easy to see the distinction between a growth-oriented entrepreneur who establishes and standardizes a new fast-food restaurant concept and sells franchises and the small business owner who purchases one of the franchisees.

More recently, Morris, Neumeyer, and Kuratko (2015) provided a typology of start-ups that is relevant to this conversation. They identified four categories of start-ups

based on their emphasis on growth, innovation, and reinvestment in the business. From this, they found that there are 1) survival, 2) lifestyle, 3) managed-growth, and 4) aggressive/high-growth ventures. As they characterized it, survival ventures are firms that live month-to-month and are necessity-driven. Lifestyle ventures are more stable and provide modest reinvestment in the firm but traditionally operate as sole proprietorships. Managed-growth ventures have steady growth over time with the periodic introduction of new products, continual reinvestment, and consistent business development. Aggressive/high-growth ventures have strong, innovative capacities with a national or international market focus (Morris, et al., 2015).

High-Growth Firms

The discussion surrounding the importance of entrepreneurship and small businesses as job generators began in the late 1970s when Birch (1979) declared that small businesses were the most active engine of growth in the United States. He reported that small firms created 66% of all new jobs from 1969 to 1976. Zeroing in on the crucial differentiating factor in growth rates, Birch, et al. (1993) found that high-growth firms comprised only 4% of total firms but accounted for 70% of new jobs created. Moreover, high-growth firms appear in all industries. Birch and Medoff (1994) found that not all small firms were the engines of job growth, but rather a specific subset of fast-growing small firms, they labeled "gazelles." As researchers began to investigate Birch's gazelle phenomenon, definitions began to change based on new theories and data sources. The name for these firms varies in the literature depending on the whims and muse of authors. Terms include "gazelles," "ambitious firms," "high-impact firms," and "high-growth firms."

The most-used high-growth firm (HGF) definitions are derived from Birch. He defined a gazelle firm as any business that grew 20% or more in sales for four consecutive years with initial base-year revenue greater than $100,000 (Birch, et al., 1993; Birch & Medoff, 1994; Davidsson & Henrekson, 2002). Boston & Boston (2007) used Birch's definition to examine African-American HGFs and determined through a survey that their cohort of owners was more likely to start businesses out of choice, rather than unemployment, and were more likely to take their company public than their non-HGF peers. Acs, Parsons, & Tracy (2008) defined HGFs as enterprises that double sales over a 4-year period and have an employment growth quantifier (EGQ) of at least two. Using this different definition of HGFs, Acs et al. (2008) concurred with Birch & Medoff (1994) that HGFs create almost all jobs in the economy, even though they account for a small percentage of all firms. Woodward, et al. (2011) examined HGFs in South Carolina using the Acs et al. (2008) definition, only making modifications due to data irregularities, and revealed – like other studies – that HGFs accounted for only a small percentage of the total firms from 2004 to 2008 (2.7%) but contributed to 67% of employment gains.

To provide a unified definition from a statistical agency, Eurostat and the Organization for Economic Cooperation and Development (OECD) in 2007 established their definition for high-growth firms. The Eurostat-OECD delineated an HGF as an enterprise with an average annualized growth rate higher than 20% per year over a 3-year period, with an initial employment level of 10 employees. (OECD, 2007) Establishing this definition has been helpful for analysis across OECD countries. Bravo-Biosca (2010) used this definition and found that Europe lagged behind the United States concerning the

ratio of HGFs to total firms; in European countries, 4.3% of firms were HGFs, on average, compared to 5.9% of all firms in the United States. Clayton, et al. (2013) followed the Eurostat-OECD definition for firms with ten employees or more but established a separate methodology for firms under ten employees. The authors used a "kink-point" approach, whereby any firm with fewer than ten employees that grew by eight employees, or 72.8% over three years (the equivalent of the 20% average annualized growth over a 3-year period), was classified as high-growth. Clayton et al. (2013) found that HGFs are equally concentrated in younger/smaller establishments and older/larger establishments. In addition, they discovered that the most substantial amount of gross job gains was due to firm births or older/larger establishments. The Federal Reserve Bank of Atlanta examined HGFs in Georgia using Clayton et al.'s (2013) definition, making minor modifications to address irregularities in their data, and found that only a small number of firms qualified as high growth in any year, but that these firms created a disproportionately large number of jobs in the state (Choi, Roberson, & Rspasingha, 2013).

A significant portion of the literature uses annual growth rates to classify HGFs. Kirchhoff (1994) delineated HGFs (a.k.a. glamorous firms) as those firms that grew within the top 10% of all firms each year. Stangler (2010) also defined HGFs as top annual performers, dividing them into the top 5% and top 1%. Besides considering top performers, other authors classify HGFs using the Inc. 500 list. Firms on the Inc. 500 apply for the designation and are ranked by annual revenue over a 3-year period (Inc., 2015). Drawing from Inc. 500 companies, Motoyama and Danley (2012b) examined HGFs at the state and metropolitan level and discovered that HGFs are spread across the

country; they are not just located in Silicon Valley and Boston. The location of HGF clusters in cities in the Rust Belt region indicates that regional population growth is not a necessary precondition to firm growth (Motoyama & Danley, 2012a, 2012b). On the other hand, Moreno and Casillas (2007) characterized HGFs as firms with growth rates that are higher than 100% over a relatively short period (typically 3 to 4 years). Using discriminant analysis, they established that HGFs have different characteristics than moderate-growth or declining firms (Moreno & Casillas, 2007).

Other researchers have offered additional dimensions of HGFs. Siegel, Siegel, and Macmillian (1993) performed a discriminant analysis on two pools of data. The first was survey data from 1,600 Pennsylvania companies who were relatively small and young companies. The second was a grouping of Price Waterhouse clients (now part of Price Waterhouse Coopers) (PWC) who were mostly larger than those from the Pennsylvania sample. Overall, the authors found four major findings: first, the overall discriminate analysis of both samples showed that the main discriminating factor between high- and low- growth companies was industry experience by senior management. Second, the high-growth Pennsylvania companies were more focused on revenue generation from a single product than their low-growth counterparts were; while the PWC high-growth companies sought to diversify their markets and products over their low-growth counterparts. Third, the Pennsylvania high-growth firms had fewer managers than their low-growth firms; the PWC high-growth sample, on the other hand, was more likely to have a balanced management team of a variety of talents. Lastly, the PWC high-growth sample identified fast market growth and the ability to identify sales leads and contacts as a discriminating factor from low-growth PWC counterparts.

Delmar, et al. (2003), used cluster analysis on a sample of Swedish high-growth firms from 1987 to 1996 to build a typology of HGFs. They had a seven-cluster solution and found firm growth was both multidimensional and heterogeneous. The sample split into those firms that grew internal employment and/or sales steadily (calling this "organic growth"), those that grew through mergers and acquisitions (termed "acquisition growth"), and combinations of the two (Delmar, et al., 2003).

Not only are there debates in the HGF literature regarding how to define the concept, but there are also debates as to which metrics are best to use to operationalize, define, and measure these definitions of high growth. Using a relative measure (e.g., percent change) can inflate the performance of smaller firms while using an absolute measure (e.g., level of employment) can over-represent the performance of larger firms. In addition, how a company grows is an equally important distinction. For example, a company can experience organic growth (by hiring employees to satisfy internal sales growth) or acquired growth (through mergers and acquisitions) (see Coad, et al., 2014; Delmar, et al., 2003). These variables and the measures used are significant because the way firms grow may indicate which policy mechanisms can best help facilitate job creation (Coad, et al., 2014).

Theoretical Perspective

Before assessing the framework of HGFs, it is essential to understand the framework's theoretical underpinnings. This paper starts with the assumption that, as firms distinguish themselves in the market, it is vital for them to find their competitive advantage. Moreover, firms generate sustained competitive advantage through

strategically utilizing their resources (Barney, 1991). From this perspective, this paper is grounded in the management theory of the Resource-Based View (RBV) of the firm.

RBV originated out of the failure of Ricardian economics to examine management as a force of competitive advantage, Penrose's examination of firm growth, and the birth of anti-trust legislation (Barney & Arikan, 2001). Most important for this examination was the work of Penrose (1959). Diverging from neoclassical economists, Penrose (1959) did not seek to identify the determinants of firm growth; instead, she assumed that firms would grow and sought instead to discover which principals governed growth. By asking this slightly different question, she unknowingly pioneered the RBV of the firm as a research strategy.

Wernerfelt (1984, 1995) was the first to articulate RBV as a way to understand and theorize what he saw as "business policy" (Wernerfelt, 1995, p. 172). RBV has been academics who study entrepreneurship and strategic management to frame research on firm performance (Alvarez & Buseniz, 2001; Barney & Arikan, 2001; Ireland, et al., 2003). In the context of this paper, RBV provides the theoretical grounding for the concept of entrepreneurship since the unit of analysis is the resource itself (Alvarez & Buseniz, 2001).

RBV makes several assumptions about the operating environment of businesses. RBV assumes that firms have access to heterogeneous resource pools and employ different resource portfolios (Ireland, et al., 2003; Rumelt, 1995; Wernerfelt, 1995). RBV examines the tangible and intangible resources needed for firm growth – whether– including all assets, information, and knowledge the firm possesses (Barney, 1991; Penrose, 1959). Firm resources can be classified into three categories: physical capital

resources (concepts such as technology, plant and equipment, geographic location, and raw materials); human capital resources (such as training, experience, relationships, managers, and workers); and organizational capital resources (firm organizations such as formal and informal planning, coordination systems, and inter- and intra-firm relationships) (Barney, 1991, p. 101). Meanwhile, Ireland, et al. (2003) examined RBV in the context of strategic entrepreneurship and showed that there are three resources for an entrepreneur to strategically manage -- financial capital, human capital, and social capital (defined as the relationships between individuals and organizations). This paper takes the stance that firm resources can be categorized as either physical capital, financing, human capital, organizational capital, or social capital. RBV provides a perspective of what entrepreneurs and firms value regarding their strategic business resources. It is these resources, and the strategic management of them, that provide a competitive advantage and results in wealth creation.

Model of High-Growth Firm Antecedents and Outputs

Exploring the theoretical and operational constructs of entrepreneurship, small businesses, and HGFs demonstrates that there are common threads between the academic literature of each, even if it is not acknowledged. Overall, the common thread distinguishing the difference between an entrepreneurial venture and a routine firm is rooted in Schumpeter's (1934) four behaviors of disruptive firms. Those firms that do not engage in some form of these behaviors are categorized as routine firms. Under this definition, routine firms are defined as small businesses.

This distinction serves as the basis for the model of high-growth firms within the entrepreneurship system: *The Model of High Growth Firm Antecedents and Outputs*

(Figure I). This model encompasses the inputs necessary for the development of HGFs and the typical outputs of interest present in the literature. The model considers entrepreneurs, small businesses, and high-growth firms as its research domain. Moreover, this model only applies to the HGF literature in advanced industrial economies, with specific emphasis on the U.S. economy. The antecedents to HGF success include an entrepreneurial mindset, firm-based strategic resources, and the firm's structural characteristics. Non-business-related outcomes of HGFs include regional innovation and regional economic performance. The section that follows puts forth seven propositions concerning *the Model of High-Growth Firm Antecedents and Outputs* and presents each using the literature to validate each one (Figure II).

Figure I. The Model of High-Growth Firm Antecedents and Outputs

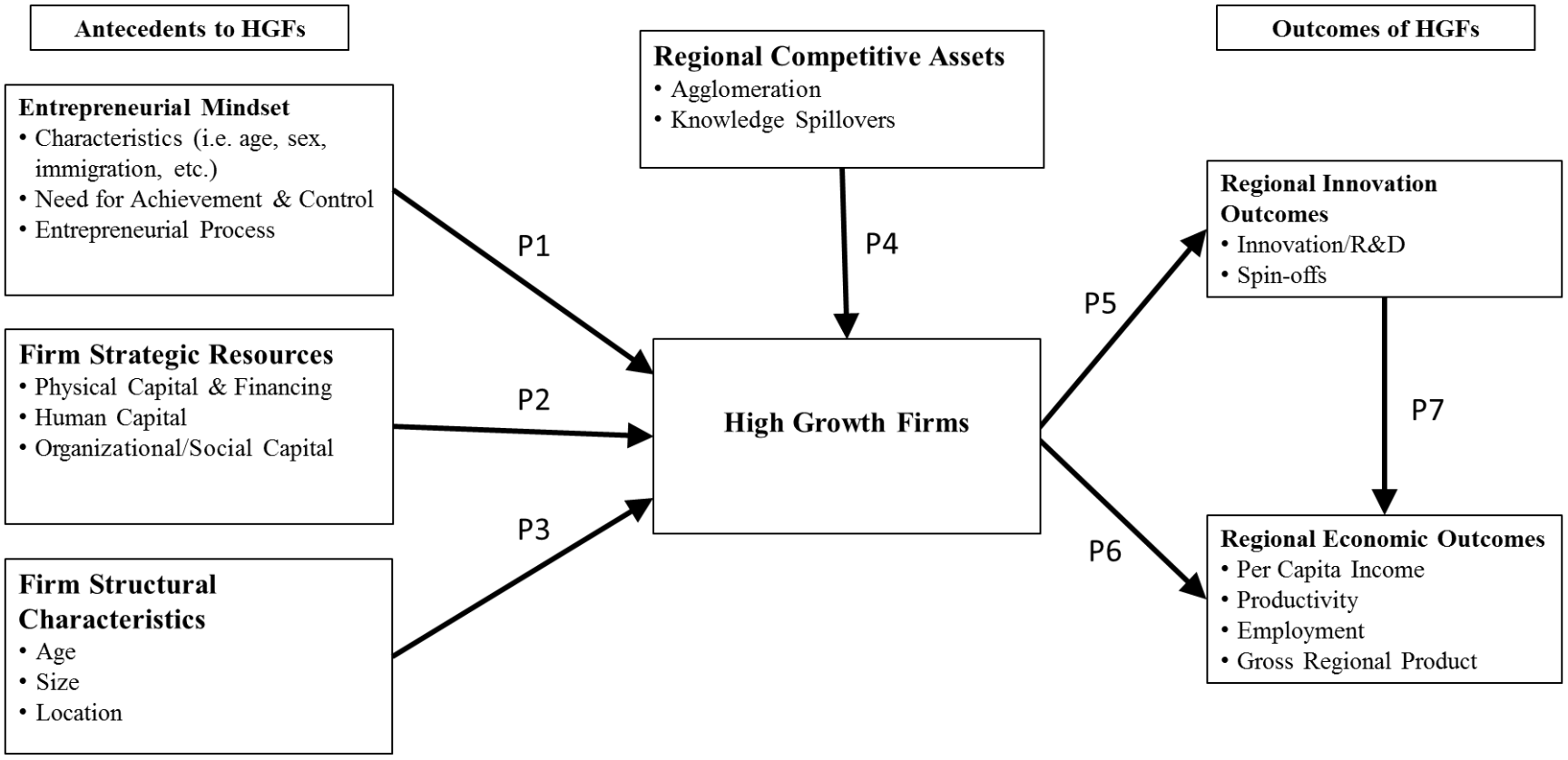
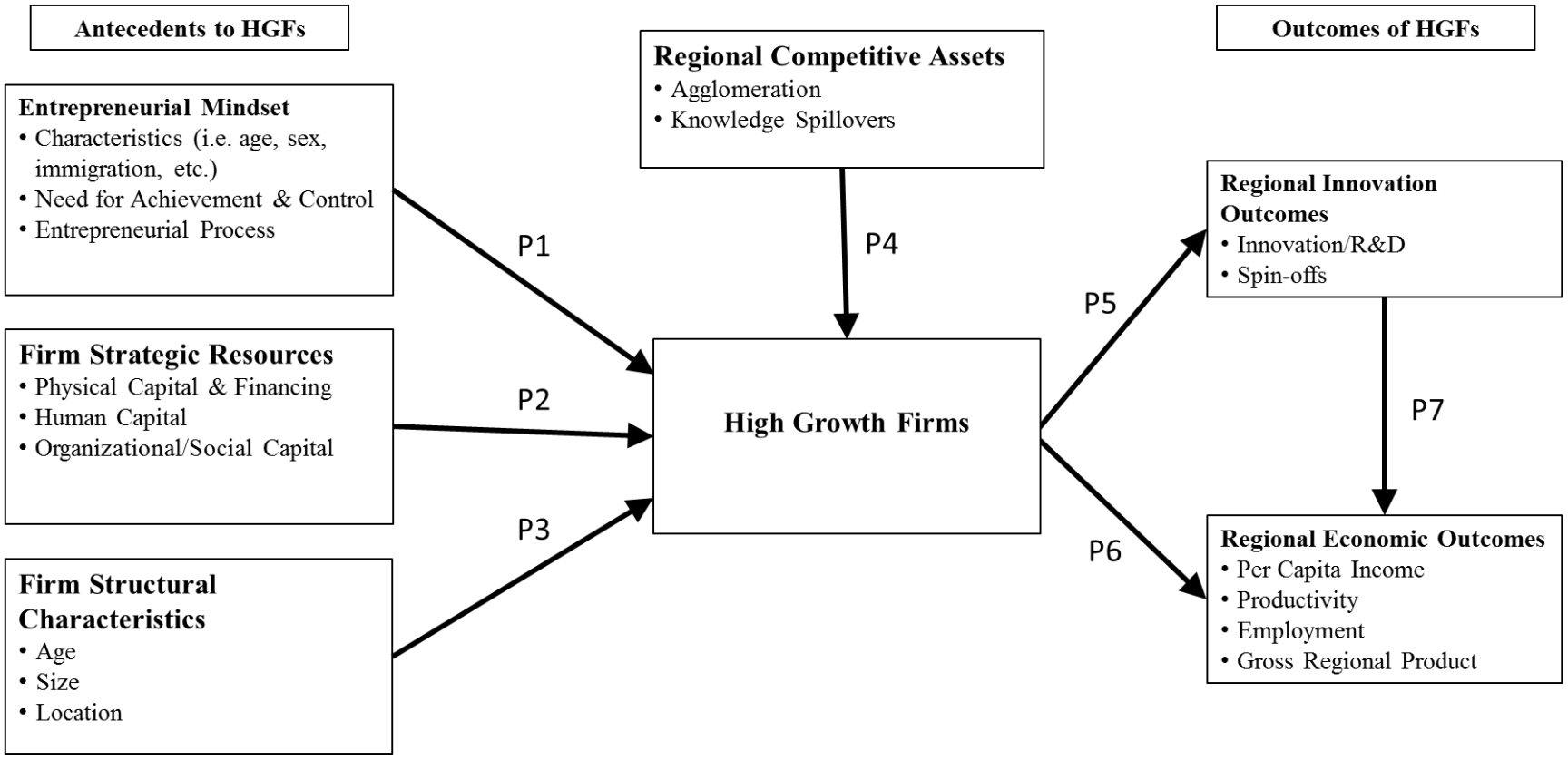


Figure II. Propositions of the Model of High-Growth Firm Antecedents and Outputs



Firm Antecedents and Outputs

This paper offers seven propositions overall and these propositions cluster into three different group. The first group of propositions concerns the antecedents of HGFs (firm characteristics, firm resources, and firms structural characteristics) and their relationship to HGFs success (Propositions 1 to 3). The second group of propositions is tied to regional competitive assets that contribute to HGF performance (Proposition 4). Lastly, the third group is propositions related to the association between HGF performance and regional economic outcomes, and the relation between regional economic outcomes. (Proposition 5 to 7).

> *Influence of Business Characteristics, Proposition 1: An entrepreneurial mindset distinguishes the leadership of HGFs from the leadership of traditional businesses, resulting in differences in the growth rates of the two types of business. An entrepreneurial mindset distinguishes business leaders in HGFs from that of routine firms, or small businesses.*

Many academic researchers have come to believe that high-growth entrepreneurs hold specific qualities or traits that differentiate them from standard business owners. McClelland (1961) developed one of the first psychological profiles of entrepreneurs and suggested that the need for achievement was their driving force. Brockhhaus and Horwitz (1986) echoed some of these sentiments and identified three main factors associated with the decision to become an entrepreneur: individual psychological factors (i.e., need for achievement, locus of control, propensity for taking risks, problem solving and innovative skills, and values), previous experiences (i.e., prior job dissatisfaction and role models), and personal characteristics (i.e., education, sex, and racial background). The

literature has pointed to other unique characteristics of entrepreneurs, such as a preference for autonomy (Hurst & Pugsley, 2011; Sexton & Bowman, 1985; Shane, Klovereid, & Westhead, 1991), access to large networks to leverage for information (Aldrich & Zimmer, 1986), and wealth (i.e., income differentials, personal income tax rates) (Parker, 2009). Overall, in a literature review on personality traits of entrepreneurs, Kerr, Kerr, & Xu (2017) found that most studies focus on the Big-5 traits (openness to experience, conscientiousness, extraversion, agreeableness, and narcissism), need for achievement, locus of control, pro-activeness, innovativeness, uncertainty, and the need for autonomy.

Translating entrepreneurial traits into the entrepreneurial process can help integrate the issue of relying solely on ex-ante expectations of what might happen during this process. Bygrave (1989ab) argued that the changing nature of the field of entrepreneurship should shift away from focusing solely on entrepreneurs' traits to include the entrepreneurial process, which is an ever-changing environment and system. Birley and Westhead (1994) categorized entrepreneurs into seven different types (insecure, followers, status avoiders, confused, tax avoiders, community, and unfocused) (p. 7), but these groups were not found to be an indicator of subsequent firm size or growth. The authors concluded that, although entrepreneurs' traits are important, incentivizing individual entrepreneurs based solely on their characteristics is bad public policy. This is similar to Shane's (2009) argument that it is terrible public policy to encourage individuals to become entrepreneurs because there is a low probability of any one specific venture generating jobs.

Entrepreneurs' traits and the entrepreneurial process are two distinct mechanisms that often operate in conjunction with each other, but they can also operate independently. An individual can have entrepreneurial characteristics without ever starting the entrepreneurial process, and an individual can begin the entrepreneurial process without having entrepreneurial traits. Gartner (1990) surveyed entrepreneurship scholars, business leaders, and politicians as to their definitions of entrepreneurship and performed a cluster analysis on the responses. Two main clusters formed: One group consisted of responses focusing on the characteristics of successful entrepreneurship (i.e., entrepreneur, innovation, growth, etc.). The second focused on the outcomes from entrepreneurship (i.e., creating value, profit/non-profit, etc.). Entrepreneurship for some is only about individual characteristics, while for others it is rooted in outcomes that provide societal benefits. Moreover, there is research that shows a strong connection between the mindset of individuals who create and develop HGFs (Boston & Boston, 2007; Siegel, et al., 1993).

Influence of Business Characteristics, Proposition 2: There is a significant relationship between firm strategic resources and HGF success.

Entrepreneurs can play the role of information managers within an organization, doing the vital work of strategic management gatekeepers (Casson, 2005). Alvarez and Barney (2007) determined that the role of strategy can vary significantly for entrepreneurs depending on the business opportunity, and this variation can influence the discovery of, or the creation of, a business idea. According to the authors, Discovery Theory implies a risky decision-making context where opportunities exist independent of the entrepreneur. In other words, the opportunity exists and has to be discovered by an

entrepreneur. The alternative is Creation Theory, where opportunities will not exist independent of the entrepreneur. That is, the entrepreneur invents something that did not exist before, and the opportunity had to be created (Alvarez & Barney, 2007). In the context of decision and strategy, Discovery Theory makes for a risk-based data collection and decision-making process, while the Creation Theory leads to an iterative and inductive decision-making process that relies on emergent and changing events.

The literature on the RBV of the firm is currently struggling with the implications of assumptions about the heterogeneity of entrepreneurs, particularly related to differences between novice entrepreneurs and habitual entrepreneurs, (Barney, Wright, & Ketchen, Jr., 2001). Research on entrepreneurship has demonstrated links to the process of starting and growing firms (Alvarez & Buseniz, 2001; Barney, 1991; Busentiz & Barney, 1997). Jovanovic (1982) demonstrated in the economic literature that as entrepreneurs learn they lower their chance of exit, RBV within management theory shows that entrepreneurs gain a competitive advantage as their knowledge creation and decision-making capacities evolve (Alvarez & Buseniz, 2001; Jovanovic, 1982). Knowledge and human capital are strategic resources that enhance and foster the probability of success in high-growth firms (Siegel et al., 1993).

In addition to information and human capital, RBV emphasizes the value of the strategic allocation of financial capital. However, many entrepreneurs find it extremely difficult to even access financial capital because of the perceived risks potential investors associate with new ventures, making conventional financing (i.e., bank loans) challenging to obtain (Keuschnigga & Nielsen, 2002). The U.S. Small Business Administration (SBA), an independent agency of the federal government, offers loans, grants, research

grants, venture capital awards, and other funding opportunities (U.S. Small Business Administration, 2016). Some states also offer loan guarantee programs. From these programs, the public assumes risks that private banks would consider inordinately high; in many instances, public employees make decisions on these loans and then work with local bankers to assemble offer packages (Marlin & Wurster, 1997).

There have been many public efforts to encourage entrepreneurship as a component of economic development. Lerner (2002, 2009, 2010), argued the importance of governments' use of venture capital as a policy mechanism to encourage entrepreneurship. Changing the mechanism by which individuals are encouraged to participate in entrepreneurship from "picking a winner" (Shane, 2009, p. 141) to a market-driven approach changes the way government is involved in entrepreneurship and small business policy. Two U.S. government programs that successfully help entrepreneurial ventures and small businesses raise capital are the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer Program (STTR). SBA administers the SBIR/STTR programs. Much has been written on the effectiveness of the SBIR/STTR programs in helping to create high-technology firms and foster innovation and competitiveness (Audretsch, 2003); generating a positive net economic benefit (Allen, Layson, & Link, 2012); and transferring the risk of investment to the government (Link & Scott, 2010). Additionally, public funding for research in the private sector more likely leads to commercialization (Link & Scott, 2012), and SBIR awardees are more likely to obtain follow-on funding than their peers (Lerner, 1999). More importantly, Qian and Haynes (2013) found that, even though the SBIR program's objective is to enhance commercialization, it is also an entrepreneurship policy because it

increases the rate of firm formation in the technology sector. Moreover, the authors concluded that the SBIR program is an essential program for small business capital infusion and that providing technical assistance to firms increases innovation and business growth.

The social and organizational capital of firms will influence competitive strategy and can become a source of competitive advantage, resulting in growth. Malecki (2012) argues that social capital is tied to the development of entrepreneurship and innovation because of these processes' reliance on proximity (through agglomeration and supply-chain networks). Moreover, learning (individual or regional) is interactive and may be informally transmitted involving many stakeholders. There are many ways to conceptualize social capital on a regional or organizational level, but operationalizing social capital poses a significant challenge. Malecki offered no variable of choice but stated that "…social capital is a concept that embodies how people function productively with other people, primarily locally but also at a distance." (2012, p. 1033). Strategic entrepreneurship suggests that entrepreneurs who manage their portfolios of resources to enhance their competitive advantage will achieve firm growth and financial reward; thus, strategic management of resources can be tied to HGF success.

Influence of Business Characteristics, Proposition 3: There is a significant relationship between firm structure and the growth rates of HGFs.

A significant amount of research has examined the relationship between firm structure and growth. Strides have been made in research exploring several facets of firm survival: Entrants only have a small amount of time to prove their worth (Geroski, 1995); efficient firms survive and inefficient firms fail (Jovanovic, 1982); survival of smaller

firms is heavily dependent on technology and firm age (Argwal, 1998); ownership structure and start-up size can shape survival (Audretsch & Mahmood, 1995); firm entry size is vital for low-tech products, but not significant in the high-tech arena (Agarwal & Audretsch, 2001); and survival of start-ups is enhanced through agglomeration because of skilled labor pools, larger numbers of suppliers, and customers attracted to the cluster (Pe'er & Keil, 2013).

The HGF literature has demonstrated strong ties to firm structure and positive HGF outcomes. Clayton et al. (2013) found that HGFs were either young and small firms or older firms, indicating that age and size of the firm are indicators of growth potential. Moreover, they noted that job creation emanated mainly from older firms. As noted earlier, firm location matters, too. Bravo-Biosca (2010) indicated that there were fewer HGFs in Europe than in the United States, a difference that may be due, at least in part, to Europe's regulatory environment (Haltiwanger, 2011).

Influence of Regional Competitive Assets, Proposition 4: Co-locations of HGFs generate positive knowledge and workforce externalities that benefit existing firms and new entrants and result in enhanced regional employment growth rates.

There is a significant discussion in the business, management, economics, and regional science literature regarding the importance of HGFs. The business and management literature seeks to investigate firm-level decisions and implications (Hitt & Ireland, 2000), while the regional science and economics literature focuses on the national and regional supply of HGFs and the amount jobs they create as an aggregate effect on the overall economy (Birch & Medoff, 1994; Davidsson & Henrekson, 2002; Kirchoff, 1994). Although these two literatures have different unit of analyses (the HGF

itself in the business literature versus HGF in aggregate in the regional science literature), they both reflect decisions and actions of individual firms (Baum & Wally, 2003; Hambrick & Crozier, 1985) and in the overall economy on firm performance (Hansen &Wernerfelt, 1989). This leads to the consideration of regional agglomerations and associated knowledge spillovers on regional economic performance.

Where firms locate is linked to the knowledge externalities, also known as the knowledge spillover effect. Knowledge spillovers are positive externalities that can give rise to new firms (Audretsch, 1995). The location of existing HGFs firms can generate knowledge spillovers that result in either firm births or attraction to take advantage of the spillovers. Moreover, existing firms can also benefit from spillovers from new entrants. Combining the concept of industrial innovation clusters with the product (and industrial) life cycle theory Audretsch and Feldman (1996) found that firms tend to co-locate at either end of the product lifecycle (the introduction and the declining stages). More importantly, they see that:

> Perhaps most striking is the finding the greater geographic concentration of production lends to more, and not less, dispersion of innovative activity. Apparently innovative activity is promoted by knowledge spillovers that occur within a distinct geographic region, particularly in the early stages of the industry life cycle, but as the industry evolves towards maturity and decline may be dispersed by additional increases in concentration of production that have been built up within the same region (Audretsch & Feldman, 1996, p. 271).

Therefore, as firms co-locate, they disperse innovative activity throughout them, and this is especially prevalent during the latter stages of an industry's life because the monopolistic concentration of production has been concentrated within the same firms within the same areas.

What Audretsch and Feldman (1996) identified regarding the industry life cycle and industry clusters is supported by findings from Porter (2000) regarding industry clusters. Firms co-locate in clusters because of competitive advantage, and this co-location feeds a more competitive environment (Porter, 2000). Moreover, specific firms act as anchors and industrial leaders, drawing other firms to them through their innovations; other firms will relocate to be closer to these more substantial, more innovative firms (Porter, 2000). Glaeser, Kerr, and Ponzetto (2010) sought to examine clusters of entrepreneurship and explore why employment growth is often strongly predicted by smaller establishment size. They concluded that entrepreneurship is higher when there are lower fixed costs, while still maintaining Chinitz's (1961) hypothesis that some areas have more entrepreneurs.

Influence on Regional Economic Outcomes, Proposition 5: There is a significant relationship between HGFs and regional innovation outcomes.

As noted earlier, HGFs occur in all sectors of the economy (Birch, Haggerty, & Parsons, 1993; Clayton, et al., 2013). Therefore, HGFs can be assumed to exist as both entrepreneurial ventures and routine firms. Since the literature has proven that HGFs are employment generators, I hypothesize that they, in turn, create value and influence regional economic outcomes. Entrepreneurs can gain information for innovative activity from three sources: other firms engaged in a similar industry (i.e., imitation), the outside world, and inside the firm (Winter, 1984). In addition, firms are always looking to maximize their functions of profit and utility with their consumers and the broader market (Audretsch, Coad, & Segarra, 2014).

One major by-product of HGFs is innovation. Innovation lies at the heart of economic development, facilitates aggregate economic growth, and requires entrepreneurship (Audretsch, et al., 2014). Innovation through technology investments is a direct way that HGFs can add value to both the firm and the regional economy. Scherer (1965) showed that inventive output increases with firm sales, while Jaffe (1986) found that research and development investment made by private companies and universities generates positive economic externalities for third-party firms. Many authors have found associations between larger firm sizes and considerably larger amounts of innovative activity. Plehn-Dujowich (2013) found that young firms are more innovative per R&D dollar than older firms.

Beyond contributing to their own and regional innovation, another positive outcome is knowledge externalities that benefit individuals both internal and external to the firm. The Knowledge Spillover Theory of Entrepreneurship establishes that knowledge creation produces externalities, and those spillovers create new ideas both within the business and among other businesses and potential entrepreneurs (Audretsch, 1995). Muller (2007) found that existing firms do not fully take advantage of new knowledge and that start-ups are more effective at capturing innovations derived from new knowledge. Qian and Acs (2013) showed that the absorptive capacity of knowledge spillovers has an indirect effect on entrepreneurship through knowledge creation. Moreover, entrepreneurial absorptive capacity allows entrepreneurs to understand new knowledge, appreciate its value, and take advantage of it by starting a business (Qian & Acs, 2013). Absorptive capacity is an essential element within a region's entrepreneurial system (Qian, Acs, & Stough, 2013). In addition, Colombelli, Krafft, and Quataro (2013)

found that publicly traded HGFs firms in France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom contributed to knowledge creation via a demand-pull framework. According to the authors, this type of framework differs in that sales growth creates an incentive for the firms to commit resources to activities associated with knowledge creation.

Influence on Regional Economic Outcomes, Proposition 6: There is a significant positive relationship between HGFs and regional economic outcomes (i.e., per capita income, productivity, employment, and gross regional product).

Beyond the economic outputs mentioned in Proposition 5, HGFs have been shown to contribute to regional economic outcomes – namely, per capita income, gross regional product, employment, and productivity. Researchers agree that these outcomes are essential to economic development, but there is far less agreement regarding the mechanism by which they are influenced by entrepreneurship and HGFs (Feld, 2012). The economics literature posits that individual knowledge accumulation is not subject to diminishing returns (Romer, 1990) and that spillovers can occur between firms (Marshall-Arrow-Romer [MAR] spillovers), within specialized industries (Porter spillovers), between citizens and businesses in urban areas due to density and diversity (Jane Jacobs spillovers), and from entrepreneurs exiting existing jobs and forming new firms (knowledge spillovers) (Acs, Brunerhjelm, Audretsch, & Carlsson, 2009; Glaeser, Kallal, Scheinkman, & Shleifer, 1992). The sociology literature, meanwhile, examines the horizontal networks across and between organizations (Saxenian, 1994), and the geography literature looks to the contributions made to positive economic outcomes due

to the attributes of the community and the way they growth and density of HGFs (Florida, 2005).

Examining the economic outcomes of productivity and per capita income demonstrates the importance of entrepreneurship within regional production possibility frontiers. As new businesses, products, and processes make industries more productive, there will be a shift in the production frontier. As Leibenstein explains, "part of the process is the interaction between the creation of economic capacity and the related creation of demand so that some rough balance between capacity growth and demand growth takes place" (1968, p. 77). Economic activity can be measured using gross product, as well as employment. Moreover, Mason, Bishop, and Robinson (2009) found that HGFs are more productive than more traditional businesses. They suggest that HGFs influence economies through "the positive impact of high-growth firms on aggregate productivity growth which occurs by displacing weaker firms and speeding up the reallocation of their resources to stronger firms" (p.28).

Influence on Regional Economic Outcomes, Proposition 7: There is a significant relationship between regional innovation outcomes and regional economic outcomes.

The innovative capacity of entrepreneurs and the firms they command has shifted focus away from the standard neoclassical economic explanation of economic growth is dependent on capital deepening or increasing amounts of labor into what Wennekers and Thurik (1999) call an "entrepreneurial paradigm." This paradigmatic shift is geared toward understanding the impact of new technology industries on economic growth rates. Capitalist economic growth is based on the efforts of Schumpeterian entrepreneurs; those

who are responsible for creative destruction where innovative new firms replace antiquated old ones. (Schumpeter, 1942; Wennekers & Thurik, 1999).

Regions can play an essential role in competitive innovative processes, chiefly when the traded products of a regional economy depends on intangible and non-tradable assets (knowledge, and specific technical competencies) that become the source of competitive advantage (Boschma, 2004).

Over the last 50 years, science and technology policy created to foster science and innovation has had a dual purpose – to facilitate the creation of new goods and services and to counteract market failures that inhibit spillovers associated with innovation, and knowledge transfer (Bartik, 1990). The rationale behind government intervention in the innovation process has been described as three-fold: "Innovation results in technological advance; technological advance is the prime driver of economic growth, and the government has a responsibility to encourage economic growth." (Audretsch et al., 2002, p. 173) R&D conducted by universities and industries "spills over" for other firms to exploit due to their proximity to the source, and these R&D investments made by private companies and universities, therefore, become positive economic externalities for third-party firms (Jaffe, 1986, 1989).

Conclusions

This paper has sought to integrate inputs, outputs, and exogenous factors relevant to understanding and to support the creation of high-growth firms. The *Model of High-Growth Firm Antecedents and Outputs* (Figure I) presented assembles a multidisciplinary approach to examining the antecedents of HGFs that contribute to their success, as well as the regional economic outcomes to which HGFs contribute. This paper used the

management theory of Resource-Based View (RBV) of the firm to ground its framework. RBV holds that resources are heterogeneous and that firms strategically manage resources to achieve competitive advantage.

Overall, seven different propositions were discussed to expand the understanding of the interaction between HGFs and antecedents and outcomes. The first grouping of propositions examined the antecedents of HGFs (Propositions 1 to 3). The antecedents of HGFs have a positive association with HGF outcomes. These antecedents (entrepreneurial mindset, physical capital, human capital, social capital, and firm structural characteristics), which are also essential resources under RBV, are important to HGF and should be strategically managed by firms to maintain a competitive advantage in the market.

The second and third groupings examined the relationship between HGFs and the regional environment. The second grouping is a single proposition that examined the relationship between regional competitive assets in an economy and HGFs. Regional assets such as agglomeration and spillovers can be important for HGF growth. Agglomeration economies can be vital for firm growth since the clustering of businesses can increase overall efficiency since firms benefit from agglomeration externalities garnered from production and consumption (purchasing) (Porter, 2000). In addition, regions play an integral process of business competition and innovation, mainly if the business depends on intangible resources, and interregional differentiation creates a competitive economy where regions seek to expand and improve their asset portfolio (Boschma, 2004). The last grouping of propositions examined the positive association between HGF growth and regional economic outcomes of HGFs (regional innovation

outcomes and regional economic outcomes). HGFs have been shown to contribute to regional economic outcomes and innovation since these firms not only helps grow the organization and increase wealth but harness new ideas to bring new products and processes to market.

It is important to acknowledge that although academics and economic development specialists resoundingly call for public policies focused on HGFs, there are no policies at the state, or national level focused on individual high-growth firms (Lerner, 2010; Mason & Brown, 2013). Brown and Mawson (2013) examined 49 HGFs in Scotland and determined that these firms often encounter what they coined "trigger points," times when strategic decision-making can influence a business' trajectory regarding growth and change. Their research demonstrates that the more public policy actors understand HGFs and their business processes, the more proper incentives can be offered to assist firms when they need it. However, as Mason and Brown (2013) note, there are very few policies enacted by governments to promote HGFs outside of innovation support and access to financing. In their literature review, Amit, Glosten, and Mueller (1993) examined the challenges to theory development in entrepreneurship studies. They noted that:

> There is no doubt that a theory of entrepreneurship should, indeed, reflect a range of economic, psychological, sociologic dimensions. It is unclear, however, what core aspects of entrepreneurship should be reflected in such theory, and how the various perspectives can be effectively integrated. One of the main challenges we face is that of identifying ex-ante, those aspects that can explain, ex-post, most of the variations in the performance of entrepreneurs and their ventures. (p. 824)

This paper assembled a model to foster entrepreneurship theory that encompasses the economic, management, psychological, and multidimensionality of entrepreneurship so that academics and practitioners can better reflect the ecosystems of HGFs.

CHAPTER III

HIGH-GROWTH FIRMS AND REGIONAL ECONOMIC OUTCOMES: ANTECEDENTS AND OUTCOMES

Introduction

Firms that grow at a rapid pace have intrigued economic development researchers and practitioners for more than 30 years. Early studies found that these "high-growth firms" represented only 4% of all U.S. firms but accounted for 70% of job creation (Birch, Haggerty & Parsons, 1993). This outsized impact on employment has spurred interest in ways to accurately identify potential high-growth firms (HGFs) at early stages and direct interventions toward removing risks associated with early-stage investment. There have been qualitative attempts to examine public policies directed at fostering HGFs (Mason & Brown, 2013; Shane, 2009). However, there have been fewer quantitative analysis of HGFs, their distinct development paths and potential interventions that facilitate their growth. This research seeks to expand the quantitative understanding of HGFs. Specifically, this inquiry examines the inputs and outputs of HGFs to improve understanding of how HGFs contribute to regional economic outcomes, focusing mainly on identifying inputs that contribute to HGF success.

The literature on HGFs sits within the business, economics, management, and regional studies literature. Most of the regional studies and economics literature focus on the regional impact of HGFs and seek to understand how aggregate HGF counts grow and decline over time, as well as the market forces that surround these changes. Studies have concentrated on the contributions of HGFs to employment and job growth in the U.S. economy (Choi, et al., 2013; Clayton, et al., 2013; Kirchhoff, 1994; Motoyama, 2014; Stangler, 2010), and there is a parallel literature stream examining the economy-wide contribution of HGFs in Europe (Bravo-Biosca, 2010; Delmar, et al., 2003; Moreno & Casillas, 2007; Organisation for Economic Co-operation and Development, 2007). The European studies tend to differ from the U.S.-centered literature in that they do not indicate the internal and external forces that influence HGF development. The business literature, on the other hand, focuses mostly on examining the microeconomic aspects of how individuals and businesses enter the market and the paths firms take to high growth (Brown & Mawson, 2013; Dubini, 1989). The business literature concentrates on individuals and how their strategic decision-making propels their firms to high growth; these individuals have often been shown to be motivated by a goal of wealth creation. These separate literatures provide the foundation for efforts directed at fostering regional entrepreneurial factor endowments (regional science/economics) and developing firm-level resources that foster successful high-growth firms (business/management).

This paper identifies the essential resources that serve as antecedents of HGF success and then tests the contributions of these antecedents on regional economic outcomes. The goal of this work is to provide a quantitative framework for economic development directed at supporting the likelihood that HGFs will take hold and stay in a

region. The literature argues that investing in HGFs is poor public policy because it is difficult to identify these firms early enough to provide for adequate intervention to influence the performance of either the firm or of its regional economy (Shane, 2009). This paper contributes to the academic and policy literature by identifying, quantifying, and testing antecedents to HGFs and their impact on regional economic outcomes.

The first section of this paper presents the theoretical background for investigating the contributions of HGFs to regional economic outcomes. This paper begins with a discussion of the regional studies literature on regional factor endowments and the business literature on the Resource-Based View (RBV) of the firm. The second section puts forth a conceptual framework that attempts to specify elements in the regional business environment that contribute to increasing HGFs and fostering regional job creation and prosperity through HGFs. The third section presents multiple hypotheses that testing this conceptual framework. These hypotheses help build a regional systems model of the contributions of HGFs to regional economic growth. This system model is tested using path analyses. The fourth section discusses the research design and methods. The final section presents results and connects them to the ongoing debate among scholars and practitioners surrounding the importance of HGFs in economic development practice.

Theoretical Background

Regional Studies Literature

Examinations of HGFs in the regional studies and economics literature tend to center on the regional economic impact of HGFs and the market forces that determine their aggregate behavior. These studies focus on the national and regional stock of HGFs

and their influence on the economy, particularly their contribution to employment (for a survey of the U.S. literature, see: Acs, et al., 2008; Birch, et al., 1993; Birch & Medoff, 1994; Choi, et al., 2013; Clayton, et al., 2013; Davidsson & Henrekson, 2002; Kirchoff, 1994; Motoyama & Danley, 2012a; Stangler, 2010; Woodward, et al., 2011). In a survey of the HGF literature, Henrikson & Johnanson (2010) examined 20 studies in the United States, Canada, and Europe and affirmed the previous findings that "a few rapidly growing firms generate a disproportionate share of all new net jobs compared with non-high-growth firms" (Henrikson & Johnanson, p. 240). There is also a thick European and international literature that examines HGFs' impact on employment, demonstrating that HGFs are job generators regardless of geography (Bravo-Biosca, 2010; Moreno & Casillas, 2007; Organisation for Economic Cooperation and Development, 2007).

Nightingale and Coad (2014) point out that data quality is a problem within HGF research and this, in turn, creates a significant amount of "definitional flexibility" since researchers have defined HGFs based upon what data they could obtain (p. 121). This inconsistency creates widely different definitions of entrepreneurship, startups, and HGFs. Overall, there is a consistent message in the HGF literature that HGFs tend to be one of the following: entrepreneurial (Goedhuys, & Sleuwaegen 2010; Saxenian, 2002), small and young (Czarnitzki & Delanote, 2013; Stangler, 2010), or innovative (Segaurra & Teruel, 2014). It is from this understanding that this paper defines HGFs to be entrepreneurial organizations, which tend to be startups.

HGFs not only contribute to jobs in regional economies, they also contribute to regional innovation because they tend to be centers of intense research and development activity and patent generation (Acs, et al., 2004; Acs, et al., 2009; Czarnitzki &

Delanote, 2013; Daunfeldt, Elert, & Johansson, 2016; Hölzl, & Friesenbichler, 2010). Eckhart and Shane (2011) examined HGFs at the industry level to determine why some industries have more HGFs than do others. They found a positive association between employment of scientists and engineers within an industry and HGFs. This finding reinforces observations of other researchers that innovation is an "important determinate of entrepreneurial opportunity" (p. 412). This emphasizes that the entrepreneur, and the decision maker within a HGF, are at the nexus of regional growth and innovation (Feldman & Francis, 2006; Feldman, Francis, & Bercovitz, 2005; Qian & Acs, 2013; Qian, Acs, & Stough, 2013).

Other studies examined the typology and dimensions of HGFs. Delmar, et al. (2003) used cluster analysis of Swedish HGFs from 1987 to 1996 to demonstrate that not all HGFs grow at the same rate or in the same ways. A seven cluster solution was found to characterize the various subsets of HGFs in the sample. Of the seven clusters, two displayed consistent growth patterns that are typically associated with the concept of HGFs in the literature. However, this research demonstrates that firm growth is multidimensional and heterogeneous.

Other studies have established typologies of HGFs using discriminant analysis, finding that HGFs have distinct characteristics separating them from non-HGFs. Siegel, Siegel, and Macmillian (1993) performed a discriminant analysis on two pools of data. The first was survey data from 1,600 Pennsylvania companies who were relatively small and young companies. The second was a grouping of Price Waterhouse clients (now part of Price Waterhouse Coopers) (PWC) who were mostly larger than those from the Pennsylvania sample. Overall, the authors found four primary findings from their study.

First, the overall discriminate analysis of both samples showed that the main discriminating factor between high- and low- growth companies was industry experience by senior management. Second, the high-growth Pennsylvania companies were more focused on revenue generation from a single product than their low-growth counterparts were; while the PWC high-growth companies sought to diversify their markets and products over their low-growth counterparts. Third, the Pennsylvania high-growth firms had fewer managers than their low-growth firms; the PWC high-growth sample, on the other hand, was more likely to have a balanced management team of a variety of talents. Lastly, the PWC high-growth sample identified fast market growth and the ability to identify sales leads and contacts as a discriminating factor from low-growth PWC counterparts.

Moreno and Casillas (2007) studied 6,814 small and medium-sized enterprises from a database of firms in Andalusia, Spain, and examined their economic and financial information for the years 1998, 1999, 2000 and 2001. They performed a discriminant analysis to identify firm characteristics and to classify businesses as being HGFs or not. In all, they found that HGFs are different from moderate-growers because HGFs are smaller in size, higher in resources, and in some cases, lower in financial resources.

Overall, the regional studies and economics literature builds a solid foundation for understanding HGFs in the aggregate and offers depth to the understanding of the economic contribution of HGFs. These studies also highlight the fact that HGFs can grow in a variety of ways. However, this literature only looks at the contribution of HGFs in national or regional economic contexts. These studies mostly neglect to examine the

forces that influence the growth paths of individual firms. In other words, they do not test what drives individual businesses to high growth rates.

Resourced-Based View of the Firm

The business and management literature on HGFs is dedicated to examining the personal characteristics of entrepreneurs and the characteristics of their businesses (Baum, Frese, Baron, & Katz, 2006; Brockhhaus & Horwitz, 1986; McClelland, 1961; Shepherd, 1999; Zopounidis, 1994), how and why individuals became entrepreneurs (Gartner, 1985; 1990; Hurst & Pugsley, 2011; Klovereid, 1992; Sexton & Bowman, 1985; Venkataraman, 1997), and the path firms take to achieve high growth (Baum & Bird, 2010; Shane, et al., 1991). Strategic management theory's Resource-Based View of the Firm examines the sources of competitive advantage that apply to regional economic development.

Over the past 20 years, a body of research has explored the influence of strategic management on entrepreneurship and firm growth. As Hitt and Ireland (2000) suggest, the interaction between entrepreneurship and strategic management occurs in six different domains: innovation; organizational networks; internationalization; organizational learning; top management teams and governance; and growth, flexibility, and change. The intersection of these domains has come to be known as strategic entrepreneurship (SE), a body of literature investigating how strategic management theory can further entrepreneurship and small business development (Hitt, et al., 2001, 2002; Ireland, et al., 2001; Ireland, et al., 2003).

The Resource-Based View of the Firm (RBV), derived from the strategic management literature, seeks to understand how firms develop and maintain competitive

advantages over others. Entrepreneurship and strategic management scholars have used the RBV lens to help differentiate firm performance and explore how certain firms succeed (Alvarez & Buseniz, 2001; Barney & Arikan, 2001; Ireland, et al., 2003). RBV posits that resources, whether tangible or intangible, are vital differentiators of firm advantage (Barney, 1991; Penrose, 1959). Barney (1991) identifies three categories of resources that can be strategically developed and managed for firm competitive – physical capital resources, human capital resources, and organizational capital resources. Kellermanns, Walter, Crook, Kemmer, and Narayanan (2016) use content analysis to catalog the resources cited most frequently in the academic literature and by entrepreneurs themselves. Overall, researchers and entrepreneurs identified the need for both tangible and intangible resources; however, entrepreneurs placed significantly less importance on human, organizational, and physical capital, while emphasizing the need for firms to build relationships and social networks.

It is important to note that strategic management focuses on larger, more established firms, while the entrepreneurship literature focuses on start-ups and smaller firms (Kellermans, et al., 2016). Strategic entrepreneurship is aligned with the HGF management literature because many researchers have tied HGF success to strategy. Kim and Mauborgne (1997) concluded that business strategy sets HGFs apart from their low-growth peers. Feeser and Willard (1990) conducted a matched-pairs analysis of firms in the computing industry to demonstrate that strategic decision-making differentiated HGF performance from low growth performance. Gundry and Welsch (2001) quantitatively examined attributes of women-owned HGFs and found six dimensions: 1) stronger entrepreneurial intensity, 2) greater willingness to incur opportunity costs, 3) a more

comprehensive range of financing, 4) strategic success factors (i.e., reputation, product quality, cash, and leadership), 5) emphasis on team organizational structure, and 6) strategy focus.

However, solely investigating entrepreneurs or HGFs ignores the interplay between the actions of entrepreneurs and managers of HGFs and the environment in which they operate. Recent literature has investigated the "ecosystem" of social, political, and capital constraints in which entrepreneurs manage (Spigel, 2017). Bruno and Tyebjee (1982) examined the "most frequently cited 'essential' factors" entrepreneurs require. These include venture capital availability, skilled labor, access to suppliers and customers, availability of land and support services. Dubini (1988) and Spilling (1996) investigated the components of the broader ecosystem in which entrepreneurs navigate, such as culture, family, economic influences, infrastructure, and capital, as they work to launch their new ventures.

There is one place where the HGF regional studies literature and the business literature intersect; this is in the use of social network theory to map and describe entrepreneurial networks. Social network theory examines the overall environment in which an entrepreneur exists (regional studies) and the individual entrepreneur's relationship to his or her ecosystem from the business/management perspective. Social network theory is derived from biology and maps the ties, structures, and mechanisms of organizations and their networks (Borgatti, Mehra, Brass, Labianca, 2009). Aldrich and Zimmer (1986) argued that an entrepreneur's network plays a vital role in the development of her or his business. Individuals leverage their networks for advice after their firms' startup phase (Johannisson, Alexanderson, Nowicki, & Senneseth, 1994).

Much of this literature operationalizes the vibrancy of entrepreneurial communities through measures of entrepreneur density, the roles of specific types of actors, the role of social connections among actors, and how these components result in positive entrepreneurial outcomes (Feldman & Zoller, 2012; Hoang & Antoncic, 2003).

How entrepreneurs connect to their social networks is vital to both their business success and positive regional economic outcomes. The co-working literature examines the phenomenon of entrepreneurs working in shared spaces, and how this shared workspace translates into shared social space, cooperation, and "knowledge leakage" between entrepreneurs (Bouncken & Reuschel, 2018). As entrepreneurs connect with each other and to a region's entrepreneurial ecosystem, they can offset information asymmetries by sharing best and worst practices as well as providing operating advice. Mentors are particularly helpful to novice entrepreneurs in garnering more resources, no matter the type, for firm success (St-Jean & Audet, 2012). As entrepreneurs connect with each other and the entrepreneurial ecosystem, they can discover and share resources that may contribute to positive outcomes.

Conceptual Framework

This study draws on models created by Gundry and Welsch (2001) and Davidson and Henrekson (2002) that use RBV to test a hypothesis about the relationship between firm inputs and outputs. The RBV assumes that firms utilize a wide variety of resources (physical capital resources, human capital resources, and organizational capital resources) and have different resource portfolios (Barney, 1991; Ireland, et al., 2003; Rumelt, 1995; Wernerfelt, 1995). RBV provides a framework to study how HGFs operate within the context of the economy and examine how HGFs employ these resources to produce

regional economic outcomes. Combining resources as specified by RBV, HGFs produce regional economic outcomes as the byproduct of their business operations and therefore influence their regional economies.

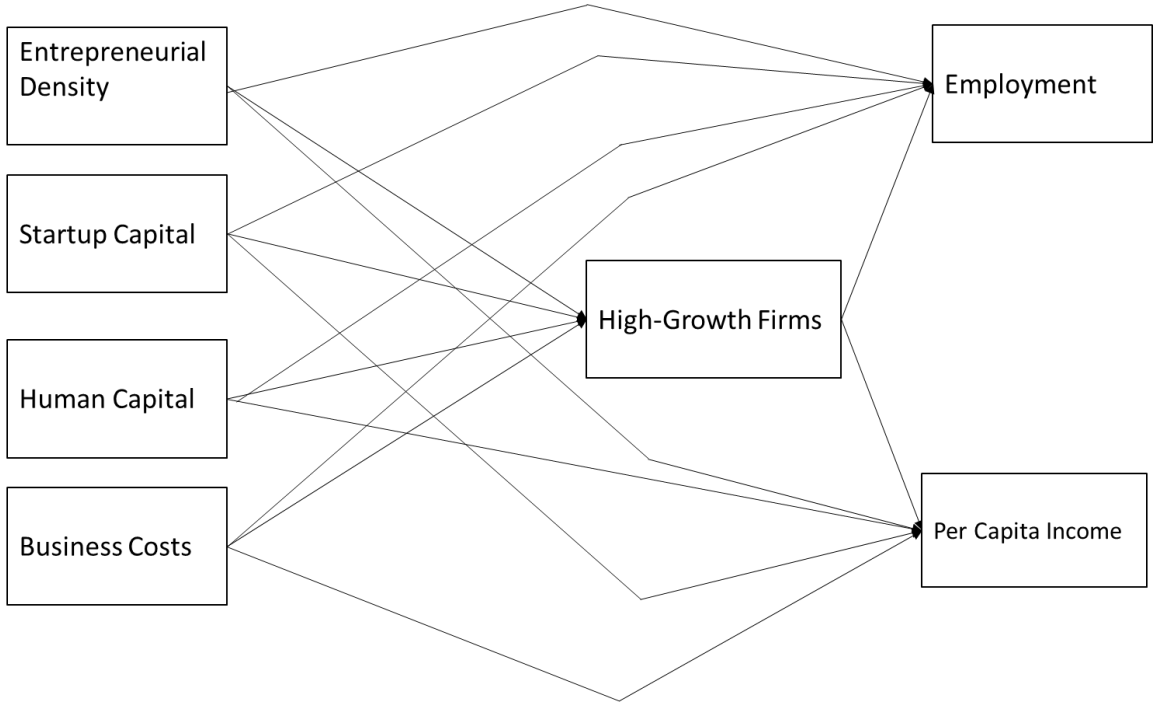
Grounding the model in RBV emphasizes the importance of resources to HGFs, especially physical capital and human capital (Audretsch, 2003), social capital (Florian, Lubatkin, & Schulze, 2003; Malecki, 2012), and startup capital (Lerner, 2002, 2009, 2010). However, the performance of HGFs is strongly tied to firm structure and regional endowments, which, for this model, are proxied as business costs (Bravo-Biosca, 2010; Clayton, et al., 2013). HGFs also contribute to the economic outcomes of their region through a variety of direct and indirect effects (Audretsch, 1995; Davidsson & Henrekson, 2002; Eckhardt & Shane, 2011; Leibenstein, 1968). This model considers not only the direct effects of antecedents to HGFs' performance but also the intermediate effects (indirect effects) that HGFs have on regional economic outcomes.

The key assumptions behind this conceptual model are that 1) there are essential resources (entrepreneurial density, startup capital, human capital, and business costs) that high-growth firms require in order to succeed or must contend with in their regional economic environment; 2) the resources or antecedents that are essential to the success of high-growth firms also contribute to regional economic prosperity; 3) HGFs contribute to regional economic prosperity; and 4) there are direct and indirect effects of antecedents and HGFs on regional economic outcomes.

The *Regional High-Growth Firm Antecedents and Outcomes Framework* (Figure III) conceptualizes inputs and outputs of HGFs in the context of RBV based upon the literature discussed. Economic outcomes are considered separate dependent variables

connecting to independent variables via paths within this model. First, entrepreneurial density is a resource within a region that spurs the development of HGFs, influencing employment, and per capita income growth rates. Second, startup capital is an vital firm and regional resource that fulfills the capital demands of growing HGFs resulting in regional employment, and regional income. Third, human capital is an essential resource because greater regional knowledge stock is assumed to contribute to firm growth with follow-on employment and income growth. Fourth, regional business costs are an important control variable because areas that have pervasive agglomeration economies will have higher operating costs as land rents and labor markets capture part of the value of the spillovers. Additionally, HGFs themselves are agents of positive regional business resources because they contribute to positive regional economic outcomes of employment gains and higher per capita incomes.

Figure III: Regional High-Growth Firm Antecedents and Outcomes Framework



Research Hypotheses

This section describes the *Regional High-Growth Firm Antecedents and Outcomes Framework* and how the model is operationalized (Figure IV). This model allows for the investigation of the relationships between the antecedents of HGFs on HGFs, HGFs on regional economic outcomes, and the antecedents of HGFs on regional economic outcomes.

Model Specification

This study tests the model's hypothetical relationships with path analysis. Path analysis allows for the examination of the interdependence between variables in a more structured manner than is possible with a correlation analysis. Path analysis is useful in making explicit the association between variables and the connections between an independent variable and a dependent variable in a system-like approach (Duncan, 1966).

However, path analysis requires a set of assumptions that are imposed by the researcher relying on the underlying theory and existing literature to establish hypothesized causality between the variables (Streiner, 2005). Endogenous and exogenous variables are established by their position along the paths established by the researcher (Streiner, 2005).

This section describes the results from a path model that operationalizes the *Regional High-Growth Firm Antecedents and Outcomes Framework,* which in turn is derived from both the RBV of the firm and regional factor markets. This model operationalizes the concepts delineated in Figure IV, allows for the investigation of the relationships between inputs and HGFs, HGFs and outcomes, and the direct impact of the inputs on the outcomes. This model is designed to determine the overall effects of the antecedents on HGFs, the impact of HGFs on regional economic outcomes, and the direct effect of the antecedents on regional outcomes. Five hypotheses are put forth about the direct and indirect relationships, or paths. Each of the proposed hypotheses contains three sub-paths (a, b, and c) to test the direct and indirect effects paths.

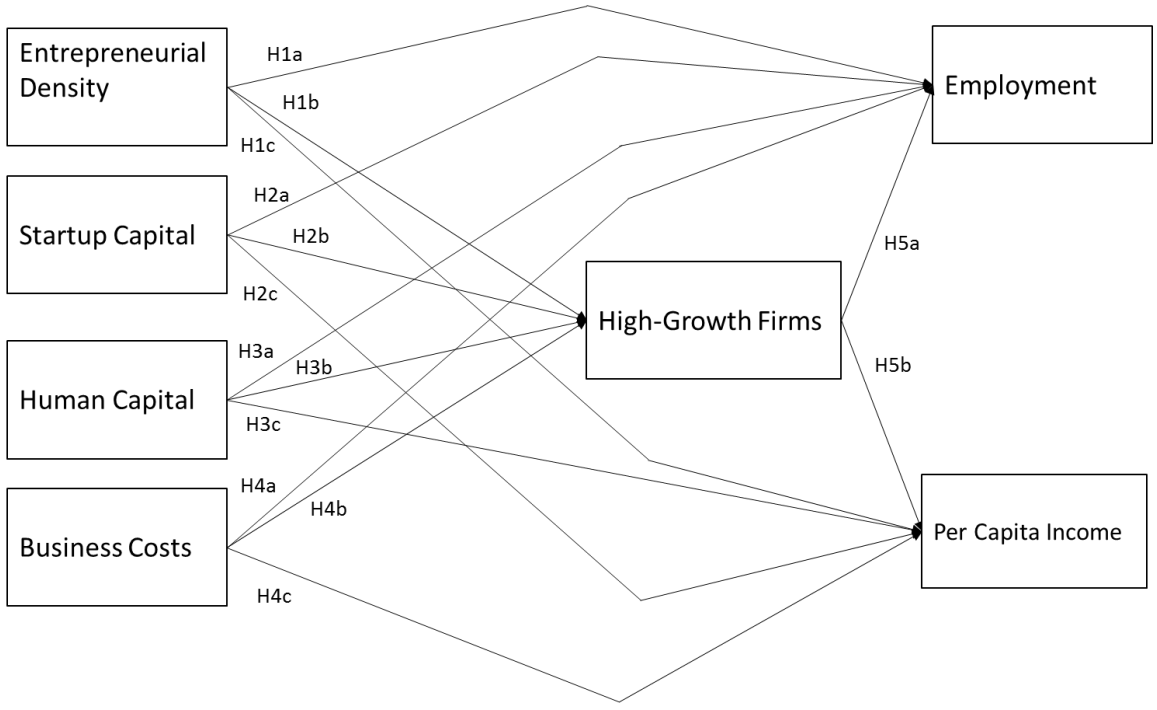
> Hypothesis 1: Regional entrepreneurial density is positively related to a) employment growth rates, b) the level of high-growth firms, and c) percent change in per capita income.
>
> Hypothesis 2: Regional startup capital is positively related to a) employment growth rates, b) the level of high-growth firms, and c) percent change in per capita income.

Hypothesis 3: Regional human capital is positively related to a) employment growth rates, b) the level of high-growth firms, and c) percent change in per capita income.

Hypothesis 4: Regional business costs are a control variable and vary based on the product cycle and regional assets. Regional business costs are positively related to a) employment growth rates, b) the level of high-growth firms, and c) percent change in per capita income.

Hypothesis 5: The percentage of high-growth firms in a regional economy is positively related to a) employment growth rates and b) percent change in per capita income.

Figure IV: Hypotheses of the Regional High-Growth Firm Antecedents and Outcomes Framework



Method

This study used path analysis to test the hypothesized relationships between the inputs and outcomes in the framework. This method is similar to that employed by Qian & Acs (2013) and Qian, et al. (2013; both articles investigated knowledge as it relates to regional systems of entrepreneurship. Path analysis is a method used because of its ability to go beyond the capabilities of multiple regression to examine more complex models. According to Qian et al. (2013), path analysis is beneficial because of its ability to distinguish between the direct effects and indirect effects of variables on outcomes. Streiner (2005) points out that, in addition to being able to examine more complex models than multiple regression, path analysis can help researchers compare different models and determine which best matches the data. However, path analysis is unable to establish causality and has limited abilities beyond justifying whether data fit the proposed model.

Research Design

This study used Metropolitan Statistical Areas (MSAs) as the unit of analysis to delineate each region and is a cross-sectional analysis of the association between antecedents and the performance of HGFs, while percentage change variables are used for outcome measures for the 355 MSAs[1] in the United States. Seven variables were constructed using available public and private databases and used in the path analyses. The target year for data collection was 2013; however, data for the variable *entrepreneurial density* were only available for 2012. Because entrepreneurial density measures the regional stock of entrepreneurs, a one-year lag was used (2012 data versus

[1] 355 MSAs were selected out of the universe of 388 MSAs due to data availability.

2013) to account for the lag between the creation of firms and their contribution to a region's entrepreneurial density. Regional outcome variables years were created to measure the impact of the performance of HGFs in 2013on economic growth and the growth in per capita income from 2014 to 2015. Table I describes the variables used and how they were constructed.

Table I: Variables and Variable Definitions

Variable	Measure Description	Year Used	Source
Entrepreneurial Density	(Number entrepreneurs + number of people working for startups or high-growth companies) / adult population in MSA	2012	Kauffman Foundation
Startup Capital	Venture capital raised ($Mil)	2013	Thompson Reuters
Human Capital	Percentage of individuals age 25 or older with a bachelor's degree or higher in MSA	2013	U.S. Census Bureau, American Community Survey
Business Costs	Cost of Doing Business Index, which includes labor, energy, and taxes.	2013	Moody's Analytics
Share of High-Growth Firms	Number of *Inc. 5000* companies/all firms in MSA	2013	Inc.com; U.S. Census Bureau Business Dynamics Series
Per Capita Income Growth Rate	Percentage change in personal income/MSA population	2014 to 2015	U.S. Bureau of Economic Analysis
Employment Growth Rate	Percentage change in private sector employment in MSA	2014 to 2015	U.S. Bureau of Labor Statistics

Direct and Indirect Antecedents of Regional Economic Outcomes

This model examines the direct, indirect, and total effects of the antecedents of HGF performance, the direct impacts of the antecedents on the one-year growth rate in two regional economic outcome variables, and of the direct influence of HGFs on the growth rate in these two regional economic outcomes. Direct effects are those where the connections between variables have unbroken paths. Indirect effects are those where HGFs mediate the relationships between the antecedents (entrepreneurial density, startup capital, human capital, and business costs) and economic outcomes (employment and per capita income). This next section identifies how the model is specified, the directionality of paths, and the operationalization of variables in the model.

Entrepreneurial Density

Entrepreneurs seek to start businesses for many reasons, but as Zimmer (1986) shows, the decision is a function of opportunity, motivation, and access to resources. Beyond this, Zimmer states that social networks and relationships are crucial to facilitating the entrepreneurial process. Density, from a managerial point of view, equates to the interconnectedness of an entrepreneur's contacts (Hoang & Antoncic, 2003; McEvily & Zaheer, 1999). Density is often referred to as an entrepreneur's social network but implies a very business-oriented network. Hoang and Antonic (2003) highlight the importance of assessing and measuring the relationships of entrepreneurs**.** Entrepreneurial success can be supported with large and dense networks of other entrepreneurs. A high density of entrepreneurs within an economic regions can increase the probability that a new business entrant will find champions and advisors early in the business development process, thus facilitating and encouraging an increased number of entrepreneurial ventures and improving the probability of the success of each (Huggings & Williams, 2011; Verheul, et al., 2001). The regional studies literature points to the importance of entrepreneurial density and the volume of entrepreneurial activities to regional economic growth and prosperity (Acs & Szerb, 2007; Audretsch & Keilbach, 2008).

For this model, entrepreneurial density was operationalized as the number of entrepreneurs and people working for entrepreneurs, startups, and HGFs in the region divided by the region's adult population (Ortmans, 2015). The entrepreneurial density measure encompasses entrepreneurs and those who work for them because both are taking risks in choosing to start a business or to work in a startup. Data for this variable

comes from the Ewing Marion Kauffman Foundation, which gathers information on entrepreneurs and startup employment and constructs an index where the closer a region is to 1, the higher is its entrepreneurial density.

Social networks and mentors are essential aides for entrepreneurs because they provide access to business-building resources. Access to regional social networks and mentoring are also important to facilitate the development of entrepreneurs. Therefore, entrepreneurial density is an independent variable in the model that has a direct effect on the level of HGFs, as well as a direct effect on regional economic outcomes.

Startup Capital

A resource all businesses need to succeed is startup capital. Startup capital and early-stage investment have long been recognized as important for building successful businesses and provide necessary encouragement for entrepreneurial activity (Lerner, 2002, 2009, 2010). Moreover, gaining access to startup capital is identified in the RBV of the firm as important to success (Barney, 1991; Ireland, et al., 2003). However, access to the funds required to launch and operate a new high growth business is particularly challenging and problematic for startups. Because many startups lack fixed assets, liquid assets, or an operating history, they often cannot be approved for institutional financing and instead rely on personal savings and money from family and friends to launch their ventures (Berger & Udell, 1998).

Additionally, external financing, as measured by venture capital (VC) investment, has been shown to be critical to firm growth, especially for high-technology startups (Florida & Kenney, 1988). In addition to providing firms with the money needed to operate and grow, VC investment is an essential signaling mechanism to other investors

and to the labor market that the recipient firms are credible and viable businesses (Davila, Foster, & Gupta, 2003). Signaling that a nascent business is credible may be partially responsible for why VC-backed firms tend to bring their products to market faster (Hellman & Puri, 2002).

VC shows a high degree of spatial concentration, are located near financial centers and produce spatial agglomeration benefits for entrepreneurs in those regional economies (Florida & Kenney, 1988). This spatial concentration increases not only firm growth rates directly but also generates indirect benefits for entrepreneurs in the region. VC firms support regional innovation and growth because they act "as both catalyst and capitalist [for entrepreneurs], providing the resources and the contacts to facilitate new business startups, spinoffs and expansions" (Florida & Kenney, 1998, p. 43). Samila and Sorenson (2011) found that an increase in VC investments contribute to an increase in firm starts with matching increases in employment and income, suggesting that venture capital stimulates more job creation than it funds. Because the literature finds a direct link between VC as an input to HGFs and regional economic outcomes, the model draws a direct path from VC to HGFs and a direct path from VC to positive regional economic outcomes.

For this study, the startup capital variable was measured as institutional VC investment (in dollars) raised in each county across the United States. VC investment does not capture all investment in firms, such as home equity loans, loans from family and friends, equity shares given to investors, volunteer time, and other important ways firms gather business-building resources. However, VC does indicate a formal investment from another party to a startup, and VC investment tends to be focused on startups. Data

for startup capital was obtained from Thompson Reuters as VC raised in millions of dollars at the county level and aggregated to the MSA level using the 2013 U.S. Census Bureau MSA delineation file (U.S. Census Bureau, 2016).

Human Capital

In traditional models of economic growth, the production function consists of two components, labor and capital, and only by increasing one or both can economic growth occur (Lerner, 2009). Abramowitz (1956) found that 85 percent of U.S. economic growth between 1870 and 1950 was due to innovation and increased productivity. His study indicated that innovation and knowledge, not solely traditional productivity increases, increased economic growth. Solow (1956) indicated that it was not only physical capital and labor that accounted for growth but technological change laying the groundwork for New Growth Theory. New Growth Theory conceptualized technology as endogenous to economic growth and envisioned human capital as the vital source of technological progress **(**Lucas, 1993; Mathur, 1999; Romer, 1986, 1990). Moreover, because knowledge is not subject to decreasing returns to scale like other production function components (i.e., capital and labor), knowledge has positive externalities for the economy and is a crucial component to progress (Romer, 1990).

Because knowledge is concentrated in individuals, entrepreneurship is an instrument through which knowledge spills over into the broader economy and toward the commercialization efforts of other startup firms (Thurik, 2009). "[K]nowledge is assumed automatically to spill over from the firm or organization generating that knowledge for commercialization by third-party firms" (Audretsch, 2007, p. 66). Knowledge spillovers indicate externalities of proximity (physical and social geographic

distances) and help in the transmission of ideas, resulting in more ideas to further innovation (Glaeser, et al., 1992).

There has been a large volume of literature exploring the effect of human capital on entrepreneurial activities (Acs & Armington, 2004; Lee, Florida, & Acs, 2004). The knowledge spillover theory of entrepreneurship is a model that shifts from "exogenously assumed firms to individual agents with new knowledge endowments" (Acs, et al., 2009, p.18). To test their model, the authors regressed knowledge stock, research and development exploitation by incumbent firms, and barriers to entrepreneurship on entrepreneurship and found that entrepreneurial activity tends to be greater where more knowledge stock exists.

Human capital is seen to be a contributor to both HGF success and improved economic outcomes. At the regional level, studies examined the connection between college graduation rates and new firm formation rates (Qian, et al., 2012) and the linkage between entrepreneurship education and the establishment of high-growth firms (Galloway & Brown, 2002). For example, Abel and Gabe (2011) showed that a one percentage point increase in residents with a college degree results in a two percent increase in gross regional product per capita. Additionally, Eckhardt and Shane (2011) examined whether changes in technology affected the distribution of new HGFs. They found that growth in the employment of scientists and engineers resulted in an increase in the birth rate of new high-growth firms, thereby, reinforcing the link between increased human capital (i.e., more well-educated scientists and engineers) and the success of HGFs. Considering the previous research, the directionality in the model is from the paths of human capital influencing HGFs and human capital influencing the regional

growth in employment and per capita income. Data for the human capital variable in the model are from the U.S. Census Bureau American Community Survey and are measured as the percentage of individuals age 25 or older in a region who have at least a bachelor's degree for the year 2013.

Business Costs

Location theory, as expressed in classical economic geography, emphasizes transportation and labor costs as factors of business location (Bhat, Paleti, & Singh, 2014; Capello, 2014). Bartik (1985) examined how unionization rates, taxes, and other characteristics influence site selection decisions of manufacturers and found that these costs affect business location decisions. Although this finding implies that businesses would be discouraged from locating in expensive cities, Porter (2000) showed that businesses tend to cluster together, even in locations that have high business costs (i.e., labor, taxes, and rent) because they benefit from agglomeration externalities garnered from production and consumption (purchasing). This finding was reinforced by Bhat, et al., (2014), who examined business location decisions at the county level in Texas to better understand the impact of agglomeration economies and diseconomies, industrial specialization, human capital, fiscal conditions, transportation infrastructure, and land development patterns. They found that business location decisions weighed industry specialization and human capital as the most essential demand-side factors and considered infrastructure and land development as the most important supply-side factors. Thus, regional endowments must align with both the supply and demand needs of a business for it to locate in the region.

Each region has its own combination of regional endowments that contribute to positive entrepreneurial outcomes. It is important to account for regional differences in transportation, human capital, and infrastructure to control for regional endowments that influence business location decisions. Regional business costs are a proxy for regional endowments of these factors because, as firms co-locate in a geographic area shared pools of labor, suppliers, and consumers are developed; these shared resources give rise to spillovers and positive externalities (Harris, 2011). While these shared resources can generate positive externalities for businesses, they may also create more competition among businesses in a regional industrial cluster (Porter, 2000).

The Cost of Doing Business Index from Moody's Analytics was used to control for the production characteristics of a region. The Cost of Doing Business Index incorporates four sub-indices – 1) Unit Labor Cost Index, 2) Energy Cost Index, and 3) a combination of Office Rent and State and Local Tax Burden into a single index. The Cost of Doing Business Index weights the component indices, with labor costs given a 65% weight, energy costs a 15% weight, tax burdens a 10% weight, and office rents and state and local taxes a 10% weight (Franz, 2011).

Direct Antecedents on Regional Economic Outcomes

High-Growth Firms

HGFs are at the center of the *Model of Regional High-Growth Firm Antecedents and Outcomes,* and the analysis is center around these firms. As previously discussed, policymakers focus intently on HGFs due to their potential as employment generators for local economies. Recent studies have examined the impact of HGFs in Georgia (Choi, et al., 2013), South Carolina (Woodward, et al., 2011), and across the United States

(Clayton, et al., 2013) using employment. These studies have found that while HGFs make up a small percentage of the overall business population, they make a disproportionately large contribution to employment growth, replicating the long-standing findings of Birch et al. (1993) and Birch and Medoff (1994). However, most of these analyses use descriptive statistics and do not explicitly engage in statistically valid hypothesis testing.

There has been significant work within entrepreneurship studies linking business startups to job creation (Birch, 1979) and gains in gross product and per capita gross product (Carree & Thurik, 2010; Carree, van Stel, Thurik & Wennekers, 2002). There is also substantial literature detailing the relationship between HGFs and regional employment growth (Acs, et al., 2008; Birch, et al., 1993; Birch & Medoff, 1994). Employment growth is measured using regional, or metropolitan, private sector employment from the U.S. Bureau of Labor Statistics and regional per capita income data are acquired from the U.S. Bureau of Economic Analysis. In most of these studies, change in economic outcomes was measured in years that followed the activities of the HGFs.

In the model examined in this paper, HGFs act as intermediaries that convert entrepreneurial density, human capital, startup capital, and business costs into regional economic outcomes. Moreover, as an intermediary economic actor, HGFs are expected to make an independent contribution to employment and per capita income. The number of *Inc. 5,000* firms in a metropolitan area divided by the total number of firms in each MSA

provided a standardized, or normalized, measure of the presence of HGFs in a metropolitan area.[2]

Descriptive Statistics

Table II provides descriptive statistics for each of the variables used in the model. Some metropolitan areas in the sample did not receive any startup capital investment or did not have any HGFs. These values were marked as zeros, rather than missing values, because they are true zeros due to the absence of a positive value. Most of the variables had a wide dispersion as documented by the standard deviations reported in the table. For example, human capital in the region with the highest share of adults with a bachelor's degree and above is five times higher than the MSA with the smallest proportion. The z-score method was used to standardize the data in a range of 0 to 1 for all variables so that they share the same scale.

Table II: Descriptive Statistics

Variable	Observations Metropolitan Areas	Mean	Standard Deviation	Minimum	Maximum
Entrepreneurial Density	355	114.7	37.1	21.9	247.7
Startup Capital ($Mil)	355	$95.3	$600.3	$0.0	$8,420.0
Human Capital	355	26.7%	8.3%	11.3%	58.5%
Business Costs	355	90.2	10.0	67.8	158.7
Per Capita Income Growth Rate	355	$0.04	$0.02	-$0.11	$0.94
Employment Growth Rate	355	0.02	0.02	-0.05	0.07
Share of High-Growth Firms	355	0.0005	0.0006	0.0000	0.0033

2. The number of businesses in a metropolitan area is from the U.S. Census Bureau, Business Dynamics Statistics. There are limitations to the use of Inc. 5,000 firms because individual firms apply for the designation and are ranked by their annual revenues over a three-year period (Inc., 2015). This may increase the selection bias of the firms within this sample since they are self-selecting themselves to apply for the designation. Many authors use the Inc. 500/5,000 listing as a definition for high growth and have had robust studies leading to important conclusions (Eckhardt & Shane, 2011; Motoyama, 2014).

Table III displays the correlation matrix for all variables in the model. Almost all of the correlations in this model are significant at the 99% level ($p<.01$), however, this can be attributed to the extraordinarily large sample size (Warner, 2008). It is essential to investigate the magnitude of each correlation to determine its independence and the absence of potential multicollinearity. This is particularly important to prevent multicollinearity in a path model to avoid model sensitivity and weakening the statistical power of the model (Hair, Black, Babin, Anderson, & Tatham, 2006). No variables have extremely high degrees of correlation since no variable exceeds 0.60.

Table III: Correlation Matrix

	1	2	3	4	5	6	7
1. Entrepreneurial Density	1.0000						
2. Startup Capital	0.1923***	1.0000					
3. Human Capital	0.4472***	0.2858***	1.0000				
4. Business Costs	0.1455***	0.2749***	0.2756***	1.0000			
5. Employment Growth Rates	0.4989***	0.1460***	0.2230***	0.0606	1.0000		
6. Per Capita Income Growth Rates	0.1116**	0.1709***	0..1875***	0.1413***	0..3890***	1.0000	
7. Share of High-Growth Firms	0.2921***	0.3350***	0.5810***	0.3236***	0.2169***	0.1400***	1.0000
Observations	355	355	355	355	355	355	355

Note: ***: p<.01; **: p<.05; *: p<.10

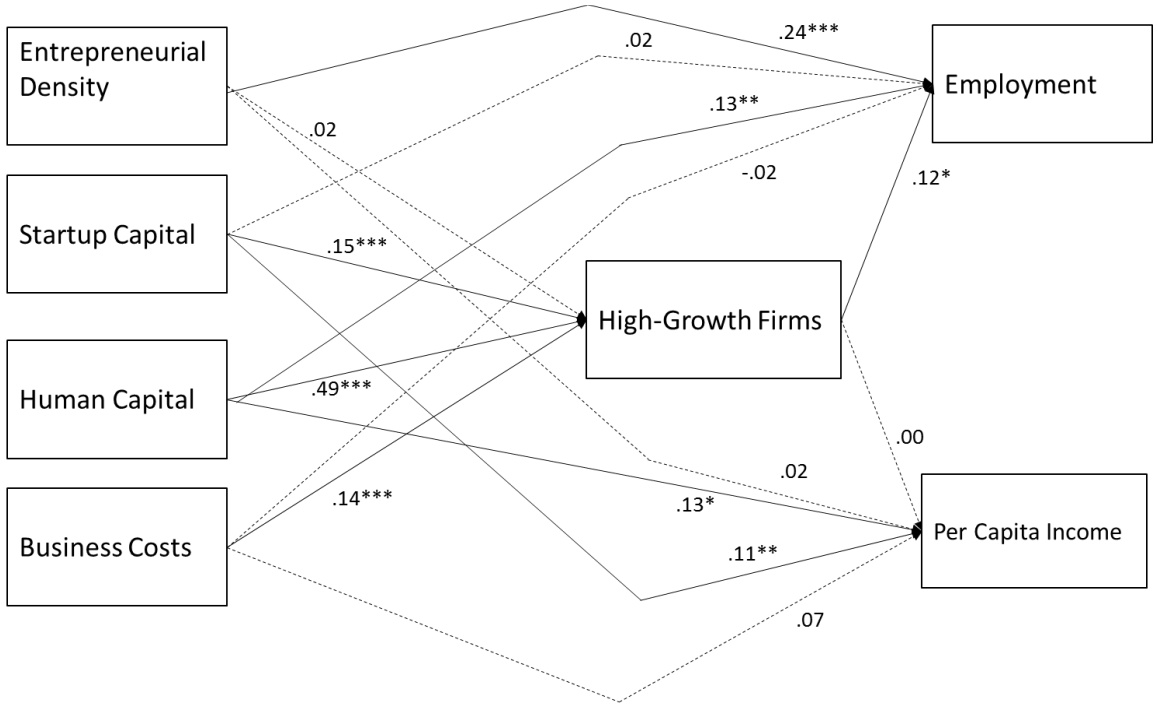
Analysis and Results

The path model (Figure V) displays the relationships between the variables and the coefficients of each path. The path analyses were conducted using STATA 14 and the SEM command to investigate the framework and the hypotheses specified.[3] Because there are large differences in the scales of each variable, all data were standardized using z-scores. Path coefficients (also known as β coefficients or standardized regression coefficients) represent the change in standard deviation from the mean.[4] Figure V displays the results for the two path models. One explaining the one-year growth rate in employment from 2014 to 2015 and the other the one-year growth rate in per capita income. Both models pass the goodness-of-fit indices for path analysis models. Bowen and Guo (2009) report that for an acceptable model the *p*-value for the chi-square statistic should be no smaller than 0.05. Chi-square measures the distribution of the data to determine whether variables are independent.

[3] Although the SEM command indicates a "structural equation model," this command is also used for path analysis.

[4] For example, as seen in Figure V, the path between startup capital and HGFs is 0.15 and significant; therefore, if startup capital increases by 1 standard deviation from its mean, innovation is expected to increase by 0.15, its own standard deviation from its own mean, while holding all other paths constant.

Figure V: Path Coefficients of Regional High-Growth Firm Antecedents and Outcomes Framework



Note: ***: p<.01; **: p<.05; *: p<.10; nonsignificant results marked with a dotted line. Goodness-of-fit index: x^2 106.12 (p-value: 0.000); dotted line indicates nonsignificant result. $R^2 = 0.463$

Direct Effects

Figure V displays the path diagrams with the path coefficients of the relationship between regional entrepreneurial density, human capital, startup capital, business costs, high-growth firms, and the regional economic outcomes of the one-year growth rate in employment and the one-year growth rate in per capita income. As shown in the figure, entrepreneurial density has a significant positive effect on the employment growth rate (.24) affirming the hypothesis. The density of entrepreneurs in a region directly increases the one-year private-sector employment growth rate, affirming the literature that shows

that entrepreneurial density and entrepreneurial activities contribute to economic growth and prosperity (Acs & Szerb, 2007; Audretsch & Keilbach, 2008).

Beyond this, practitioners point to the importance of entrepreneurial networks to a thriving regional entrepreneurial environment (Feld, 2012; Hwang & Horowitt, 2012; Taich, Piazza, Carter, & Wilcox, 2016). When entrepreneurs concentrate in a given locality the region benefits from the spillover effects that this proximity facilitates. Moreover, what this model shows is that having a larger number of individuals who start companies or take on the risk of working in a startup firm are associated with positive regional economic outcomes.[5] Practitioners Taich, et al. (2016) drew a similar conclusion after interviewing entrepreneurs in Northeast Ohio. They found talent attraction to be key to a strong entrepreneurial environment. When jobs are more plentiful overall in an area, the individual risk to workers from joining in a startup is smaller because they will likely be able to find another job in the area if the startup fails (Taich, et al., 2016).

The model reveals no significant relationship between entrepreneurial density and the proportion of HGFs in a regional economy and the one-year growth rate in per capita income. This indicates that entrepreneurial density is important for the health of the economy (employment), but is not significantly associated with increasing the proportion of HGFs in the regional economy or increasing the per capita income growth rate.

The model demonstrates that the absolute amount of startup capital raised in a metropolitan area has significant and positive direct effect on the share of HGFs in the number of businesses in a metropolitan economy (.15) and on increasing the per capita income growth rate (.11). However, it was not significantly associated with the one-year

[5] Entrepreneurial density in this model is measured by number entrepreneurs plus the number of people working for startups or high-growth companies.

employment growth rate (.03). These findings reinforce both the academic and practitioner literature that identify the importance of VC investment in the growth of startups.

Beyond the formal private VC investments enumerated in this model, there is a wide variety of public and philanthropic programs to assist small businesses in acquiring capital necessary for growth. The best-known program is the Goldman Sachs 10,000 Small Businesses program, which provides small business owners with education designed by Babson College[6] and connects them to resources and capital to help grow their businesses. The program boasts that 78 percent of graduates' report growing business revenues within 30 months of completing the program, compared to the 47 percent of businesses that reported increasing their revenues in 2016 (Goldman Sachs, n.d). The model reported on in this paper indicates that programs, such as Goldman Sachs' that provide access to capital, as well as education and networks, will increase the success rate among business startups and contribute to income growth and business success in metropolitan regions.

The human capital variable in the model had a strong positive relationship with the proportion of HGFs in a region's economy (.49), the one-year employment growth rate (.13), and the one-year growth rate in per capita income (.13) affirming all three human capital hypotheses. This finding is consistent with the literature, indicating that the greater the human capital in a region, the greater the rate of entrepreneurship (Davidsson & Honig, 2003; Mathur, 1999; Unger, Rauch, Frese, & Rosenbusch). Human capital, as

[6] Babson College is a leading entrepreneurship research university.

measured by bachelor and advanced degree attainment (.13), held a significant, albeit weak, relationship to the one-year growth rate in per capita income.

Business costs showed a significant positive relationship with only the share of HGFs in the economy (.14). The relationship indicates that HGFs have a slight, but significant, tendency to be located in areas with high business costs. The lack of association between business costs and regional economic outcomes (change in private sector employment and change in per capita income) indicates that across 355 metropolitan areas businesses costs are not associated with changes in these outcomes. Lastly, the proportion of HGFs in the economy showed a significant positive relationship with the one-year percent change in private sector employment (.12), affirming an argument made in the literature that HGFs are regional job generators (Henrekson & Johansson, 2010).

Interestingly, HGFs do not have a significant direct effect on growth in per capita income, despite having a positive effect on the growth in private sector jobs. There is literature identifying wealth as a motivating factor as to why entrepreneurs start firms (Hitt & Ireland, 2000; Hitt, et al., 2001), but there is scant literature as to whether HGFs contribute to overall increases in income.

Indirect Effects

Path analysis is a unique way of examining the connection between variables and observing the indirect effects that variables have on outcomes. This study investigates the direct, indirect, and total effects of the model. Direct effects are the connection between variables that have an unbroken path, while indirect effects assess the broken, or

mediated, paths. Total effects are the sum of direct and indirect effects.[7] Table IV provides the summary of the direct, indirect, and total effects between each independent variable (entrepreneurial density, startup capital, business, costs, and the proportion of high-growth firms in the business base of the economy) and each dependent variable (one-year growth rates in employment and per capita income). It is essential to understand that the direct effects in Table IV correspond to the path coefficients in Figure V. The indirect effects are the contribution or deduction that HGFs have on the independent variable (entrepreneurial density, startup capital, human capital, or business costs) via the mediating variable (the proportion of HGFs in the business base) to achieve the total effect on the dependent variable (employment or per capita income).[8]

Table IV. Summary of Standardized Effects on One-Year Growth Rates in Employment and Per Capita Income

	Dependent Variable: Employment			Dependent Variable: Per Capita Income		
Independent Variable	Direct Effects	Indirect Effects	Total Effects	Direct Effects	Indirect Effects	Total Effects
Entrepreneurial Density	0.24***	0.00	0.24***	0.02	0.00	0.02
Startup Capital	0.02	0.02*	0.04	0.11**	0.00	0.11**
Human Capital	0.13**	0.06*	0.19***	0.13*	0.00	0.13**
Business Costs	-0.02	0.02	0.00	0.07	0.00	0.07
Percent High-Growth Firms in Economy	0.12*	(no path)	0.12*	0.00	(no path)	0.00

Note: ***: p<.01; **: p<.05; *: p<.10;

[7] For example, there is a direct effect between startup capital and employment, and there is an indirect effect of high-growth firms on the relationship between startup capital and employment. The total effect takes into account both of these paths (Figure V).

[8] Since HGFs only have a direct effect on employment and per capita income as the model is specified, the indirect effects are 0.

The proportion of HGFs has a small indirect effect on the employment and per capita income one-year growth rates through most of the independent variables in the model. The indirect effects of HGFs on employment growth are slight, with the largest indirect effect of through the proportion of HGFs in the economy relating to human capital (.06). This shows that increasing the proportion of HGFs in a region's business base has a weak indirect effect on employment. Although the percent of HGFs in the economy has a significant relationship to employment (.11), the indirect effect of startup capital and business costs it is weak. Examining the indirect effects of the independent variables, mitigated through HGFs, on the one-year growth rate in per capita income reveals even weaker results. As can be seen in the table, the proportion of HGFs in the economy has either no effect or decreases the power of the independent variables on the growth rate in per capita income. This result only reinforces the earlier finding regarding the fact that the proportion of HGFs in a region's business base was not significantly related to the one-year growth rate in per capita income. Income growth may be part of a much longer-term process than is employment growth.

Discussion

This study sought to test quantitatively the relationships between inputs and outputs of HGFs on regional economies. This paper presented a theoretical background for the investigation of HGFs grounded in the regional science literature and the Resource-Based View (RBV) of the firm. Several articles in the regional science and management literature investigated high-growth firms as mechanisms of growth and income creation but missing from the literature is an ecosystem approach to the

contributions of HGFs to their regional economies. Grounding this study in RBV of the firm establishes a theoretical framework for understanding the critical inputs to HGF success. Much of the current literature has examined HGFs and their role as job generators in the economy. This analysis examines the relationship of the proportion of HGFs in the business base of an economy to one-year employment and income growth rates.

A regional systems model of economic success centered on HGFs was drawn from the literature and established as the *Regional High-Growth Firm Antecedents and Outcomes Framework.* This framework set HGFs as an intermediary between regional resources and regional economic outcomes. In other words, the proportion of HGFs in the business base of the economy was assumed to act as the conduit that harnesses business resources (inputs) to produce positive regional economic outcomes. Path analysis was used to test this framework.

Of the HGF antecedents (entrepreneurial density, startup capital, human capital, and business costs) specified in this model, human capital had the greatest effect on the density of HGF in the business base and on the regional economic outcome of one-year growth in per capita income. Findings reinforce much of the existing literature on the importance of human capital and knowledge in generating innovation and economic growth (Romer, 1990) and in fostering entrepreneurship (Acs, et al., 2004).

A positive association was seen in the model between the proportion of HGFs in regional economies and the one-year employment growth rate. This finding also reinforces the literature identifying HGFs as regional job generators. In fact, the model

may undervalue the contribution of HGFs to regional employment because HGFs tend to be younger and smaller than other firms (Clayton, et al., 2013).

The lack of an observed relationship between the proportion of HGFs in the business base and the one-year growth rate in regional per capita income suggests the next frontier in HGF research. Most of the literature on HGFs investigates the importance of these firms regarding job creation; however, little research exists as to the contributions these firms make to overall regional prosperity and income creation. In the model presented here, the fact that the proportion of HGFs in the business base is shown to be associated with one-year job growth but not the one-year growth in per capita income is intriguing. Policymakers look to high-growth firms to contribute to the health of their economies through job creation, sales output, and higher wages. However, if these firms do not create wealth in the region, the contribution of these firms and public support for them may need to be reassessed.

CHAPTER IV

ESTABLISHING A TYPOLOGY OF HIGH-GROWTH FIRMS: LESSONS FROM THE STATE OF OHIO

Introduction

Policy makers and practitioners over the last few decades have focused on examining high-growth firms (HGFs), due to their potential for creating job growth and prosperity. Numerous academic and practitioner accounts (Acs, et al., 2008; Birch, et al., 1993; Birch & Medoff, 1994) have praised HGFs as the engine of job growth throughout the United States. This discourse can be viewed as moving economic development away from the zero-sum game of business attraction, retention, and expansion--which is dependent upon factors that economic development has little, if any, control over (Rubin, 1988)—and toward a positive sum process of fostering innovation and entrepreneurship (Buss, 2002; Mathur, 1999).

The national conversation has shifted in the last ten years so that economic development organizations have made entrepreneurship a priority, a change that began with the creation of the Office of Innovation and Entrepreneurship within the U.S. Economic Development Administration (EDA) under the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and

Science (or COMPETES) Reauthorization Act of 2010 (U.S. Economic Development Administration, n.d.). This act incorporated entrepreneurship as a policy mechanism. America COMPETES marks a significant shift from traditional EDA investments in infrastructure, construction, and disaster recovery, and toward fostering innovation and entrepreneurship. There is still vagueness that surrounds identifying and fostering entrepreneurship and HGFs to contribute to economic development gains. It is easy to see the benefits of business attraction and development since when a company relocates from another location or expands, it can generate jobs. Entrepreneurship and fostering HGFs can be a lengthy process involving many economic development actors and professionals to help seed, grow, and foster an idea into a business. This lack of clarity regarding who, how, why, and, most importantly, when can lead to funding fatigue in economic development entrepreneurship. This paper looks to help fill this gap in the literature by creating a typology of HGFs in Ohio using methodologically sound quantitative techniques.

The underlying assumption made to justify supporting HGFs is that they will hire new workers in response to business growth, but this may not necessarily be the case. Firms grow in a variety of ways: hiring new workers in response to internal sales growth or by acquiring other companies via mergers and acquisitions and brining some of their workers. Moreover, the rate of growth can be unpredictable as well.

This paper looks to empirically examine the typology of HGFs using a variety of growth measures and characteristics based on the literature that underlies this area of research. This literature review surveys the appropriate literatures in business, economics, and regional studies. The literature review informs a cluster and discriminant analysis on

26,104 HGFs in the state of Ohio. The cluster analysis places each HGF into a relatively homogeneous subset of the universe and the discriminate analysis identifies the statistical reasons why the clusters are homogenous.

Theoretical Background

Firm growth is a complicated and multifaceted process that has interested economists and management professionals for decades (Audretsch et al., 2014; Delmar et al., 2003). According to Birch and other scholars, the reason why HGFs are of interest in economic development policy is that a small number of firms generate a disproportionately large share of new jobs. This observation has been reinforced by the results from a number of studies examining the United States (Birch, et al., 1993; Birch & Medoff, 1994), the United Kingdom (Anyadike-Danes, Hart, & Du, 2015; Brown & Mawson, 2016), Spain (Segarra & Teruel, 2014), and Italy (Arrighetti & Lasagni, 2013). Most of these studies have examined the economic impacts of HGFs—new jobs, more output, and higher productivity. However, few studies have examined the heterogeneous growth pattern of HGFs.

Investigating the mechanism of firm growth is not a new conversation and traces its roots back to the early twentieth century. French engineer Robert Gibrat determined that the growth rate of a firm is independent of its initial size, a rule now called "Gibrat's Law of Proportionate Effect" (Samules, 1965; Santarelli, Klomp, & Thurik, 2006). Gibrat's Law implies that growth among businesses is distributed as a log-normal function and that firm growth is normally distributed, and their growth rates are randomly distributed (Hölzl, 2009). Scholars have long debated Gibrat's work, with some affirming that growth is independent upon initial size (Hall, 1987; Hart & Prais, 1956; Mansfield,

1962; Simon & Bonnini, 1958), while others bring data to bear against Gibrat's hypothesis (Dunne et al., 1989; Gabe and Kraybill, 2002; Samules, 1965).

Penrose (1959) took a more management-focused approach to firm growth and determined that growth is intrinsic to learning-while-doing. As managers and executives become more familiar with their roles, they become more competitive and efficient in their jobs and can focus less on managing and more on value creation. In fact, Jovanovic (1982) proved that as entrepreneurs learn, they have a lower chance of failure. Williamson (1967) introduced a theory of the firm that discusses the cumulative loss of control between hierarchical levels of a firm. Meaning, the larger the firm, the less control management has over decision-making power at different levels. The management literature sees the growth of HGFs as a process intrinsically tied to the strategic management of the organization (Kim & Mauborgne, 1996; Nicholls-Nixon, 2005; Parker, Storey, & van Witteloostuijn, 2010).

Measurement of Growth

There are a variety of approaches to measuring firm growth, which creates inconsistencies in the conceptualization and operationalization of firm growth (Weinzimmer et al., 1998). This ambiguity not only offers a disservice to the entrepreneurship discipline but also impedes the advancement of the literature. McKelvie and Wiklund (2010) rightfully note that many researchers have been quick to evaluate how *much* a firm grows, rather than start with the first question of *how* a firm grows. Through their literature review, the authors find that it is "virtually impossible to arrive at a classification scheme that allows us to summarize the literature succinctly in a meaningful way." (McKelvie & Wiklund, p. 263). Nightingale and Coad (2014) note that

the search classification scheme of firm growth can be a perpetuating system, since "demands for positive evidence [in entrepreneurship research] which create a shift toward increasingly positive interpretations as one moves from analysis, through the grey literature, to policy." (p.124).

Much of the literature on this subject debate what type of firm growth should be used as indicators to define HGFs (i.e., employment or sales), how to measure of these indicators (i.e., absolute or relative to other firms), and how best to combine these elements to capture the concept of high growth. Delmar (1997) surveyed fifty-five articles to assess the choice of growth indicator and construction of indicator. He found that the most numerous variables (in descending order) were the change in sales, employment, performance, market share, and assets. The most common measurement of the indicators was (in descending order) relative change, absolute values, log absolute values, and log relative change. Some scholars suggest that the literature should strive to find a single or limited way to calculate growth (Chandler and Hanks, 1993; Delmar, 1997; Weinzimmer, Nystrom, & Freeman, 1998). However, Delmar, et al. (2003) disagreed with this since growth is multifaceted and the "use of multiple measures of firm growth would likely provide a complete picture of any empirical relationships as well as provide a way to test the robustness of any theoretical model to misspecifications in the dependent variable." (p. 195). Not only are the indicators chosen called into question, but the computation of the indicator can influence the results of a firm growth study. The use of relative growth measures (e.g., percentage change) can inflate the performance of smaller firms while using an absolute measure (e.g., level) can enhance the performance

of larger firms. In addition, the way in which a company grows is an equally important distinction (Delmar et al., 2003).

In all, there are many ways a firm can grow, but understanding the mechanisms that contribute to that growth is significant because those mechanisms can provide indications for policy that can help facilitate job creation (Coad, et al., 2014). Do firms hire their employees and then take on additional labor as needed, or do they acquire other companies and personnel growth through acquisitions? Penrose (1959) points out that firms that hire their workers and grow organically will have a smoother growth pattern, compared with their counterparts that grow through mergers and acquisitions. Strategic management points out that there are advantages and disadvantages to both types of growth. According to Lockett, Wiklundm, Davidsson, and Girma (2011), organic growth allows for the shared experience of all workers as they grow with the firm, while acquired growth allows for the quick addition of a bundle of resources that can increase productivity. This study builds upon that idea to examine the multidimensionality of firm growth from multiple indicators and measures.

Scholars have created many different definitions of HGFs. Some definitions include changes in employment or sales as the measurement indicator (Clayton et al., 2013), others use a mixture of a minimum level of employment and consistent growth rates as the qualifier as a threshold to be considered a member of the cohort (Organization for Economic Co-operation and Development, 2007). Beyond this, studies use varying time periods to calculate growth rates, ranging from one to six years; some are measures are consistent with the literature, others appear to be randomly selected (i.e., Acs, et al., 2008; Stangler, 2010).

HGFs and Industries

In the wake of deindustrialization and structural economic changes of many U.S. cities, especially in the Midwest, economic development policies sought to overcome unfavorable market outcomes from offshoring, trade, and changes in defense spending by trying to pivot away from their traditional economic bases and trying to attract and support high-technology (HT) industries (Bartik, 1990; Malecki, 1984; Markusen & Carlson, 1989).

Over the last twenty years, scholars have examined how technology influences regional economic growth and entrepreneurship (Acs, et al., 1994; Jaffe, 1986, 1989; Lendel, 2010). This literature arose from the hypothesis that technology industries and research universities significantly contribute to their economies through regional spillovers and innovation relay. Examining the influence of high-technology industries as it relates to HGFs is a useful contribution to economic development policy and practice since publicly supported entities are investing time, effort, and sometimes money in HGFs and high-technology (HT) industries.

The literature on HGFs in HT industries is mixed. Some authors point out that investing public economic development resources in this sector is not worthwhile since these firms have at best modestly higher growth rates than do businesses in non-HT industries (Brown & Mason, 2014; Coad & Rao, 2008). Other analysts have found positive results, in particular, HT industries (Eckhardt & Shane, 2011; Segarra & Teruel, 2014).

Daunfeldt, Elert, & Johansson (2016) examined the industrial distribution of HGFs in Sweden from 1997 to 2008, exploring the assumption that policymakers should

target HT firms because they are assumed to be high-growth. They found via logit regression models that industries with high R&D intensity have a lower share of HGFs than non-R&D intensive industries. Coad and Rao (2008) examined innovation and sales growth of HT firms by matching NBER patent data with the Compustat database to assemble sales, patents, and R&D expenditures by Standard Industrial Codes (SIC) from 1963 to 1998. They found that these firms only showed modest growth and concluded that these firms could grow for a variety of reasons, not just through innovation. Brown & Mason (2014) investigated technology entrepreneurs in the United Kingdom and found that many of these firms are small, with few of them becoming HGFs.

Mayer (2011) in her book on *Entrepreneurship and Innovation in Second Tier Regions* indicates there are three models of high-technology development: 1) a world-class research university fostering a HT ecosystem (i.e., Stanford and Silicon Valley), 2) research institutions and federally funded laboratories playing the same role, and 3) a few areas that lack either a research university or a major research laboratory have fostered a high-technology business base fueled by other anchor institutions (i.e., military facilities or expenditures and/or the presence of private science-based companies). For the current examination on HGFs in the state of Ohio, it is critical to note that Mayer placed Cleveland into the second category, whereby the presence of a research university (i.e., Case Western Reserve University) was not enough to foster a high-technology industrial cluster and that concerted efforts must be placed in facilitating these spillovers from research institutions.

Mohr and Garnsey (2011) examined the characteristics of Cambridge, England's tech-based HGFs to determine the likelihood these firms exhibit certain characteristics

(resource endowments, serial entrepreneurs, and venture capital investment among others) and the inverse if firms that display particular characteristics are HGFs. They estimated a multi-level longitudinal cohort model and found that high-growth firms benefitted from access to venture capital and intergenerational learning as a result of being allied with either spin-offs or serial entrepreneurs. A majority of the firms examined by Mohr and Garnsey benefited from receiving assistance from venture capitalists to back technology that was previously developed in a corporate or academic setting. Additionally, they found that tech-based HGFs successfully engaged in alliances with other businesses more often than non-HGFs and, in addition, they had different alliance patterns from non-HGFs that chose to use alliances.

From a strategic management perspective, Feeser and Willard (1990) examined the founding strategy and performance of high- and low- growth HT firms from the *Inc. 100* listing, discovering that the founding strategy was vital in the early stages of a firm and often influenced its growth trajectory. Willard, Krueger, & Feeser (1992) expanded on this by examining HT high-growth manufacturing firms from the Inc. 100. They found that firms with CEOs who were the founder of the company were smaller in size and took their company public on average 2.3 years earlier than non-founder CEOs.

Colombelli, et al., (2013) examined the technological exploration strategy of HGFs to determine if they pursued a demand-pull strategy (creating goods from demand) or technology-push strategy (creating technology and bringing it to market without clearly having a target market in mind). Technology-push strategies are associated with the firm not knowing specific uses to applications for its technologies and letting the market guide product development. These scholars examined publicly traded firms in the

UK, Germany, France, Sweden, Italy, and the Netherlands and found that HGFs "do not necessarily follow pure models of innovation patterns" (p. 266). Instead, they can be viewed as representing a mix of strategies. Thus, the strategic decisions of the owners/CEOs within the high-technology industries can affect the outcome and performance of the firm.

Toward a Typology of High-Growth

Over the years, scholars have sought to identify what a HGF looks like and how it grows. Dwyer & Kotey (2016) looked at three aspects of HGFs: 1) the psychology and demographics of owners, 2) management practices and strategy, and 3) organizational characteristics. These factors shape how management forms, assembles the firm, and manages the firm creates the growth orientation of the firm. Similarly, Wennberg (2013) conducted a literature review of thirty studies from the management perspective of HGFs and found five major groupings of the current literature: managers' leadership in HGFs; managers' business experience in HGFs; formal structures and adaptive capacities in HGFs; innovation in HGFs; and profitability and growth of HGFs. In the end, he finds that HGFs are, "more often founded and/or managed by a larger management team, managers of HGFs are likely to be highly educated and have prior industry and leadership experience, and that different types of innovativeness may be differentially related to rapid growth." (p. 14).

Surveys of the literature have confirmed the variability of HGF measurement. Henrekson and Johansson (2010) surveyed the literature on HGF and found that employment and sales are usually operationalized to represent growth indications measured in an absolute or relative measure, with total growth most commonly used

because of data availability. Daunfeld, Elert, and Johansson (2010) extended Henrekson and Johansson's (2010) examination to eight additional studies, totaling twenty-eight, to determine if using different selection criteria (i.e., employment or sales) would result in different firms being chosen. Their study found that as proposed, different firms qualified as high-growth based upon the definitions used. Additionally, it was found that definitions matter in cohort selections. Similarly, practitioner investigation by Piazza, Austrian, Lendel, Alexander, Cyran, Hoover, and Leach (2016) reinforced this concept, replicating ten HGF definitions from the literature, and determined that definitions do matter; how HGFs are classified and defined will drastically impact the number of firms contained in the cohort. Daunfeldt, Elert, and Johansson (2014) examined whether or not policy implications depend upon the growth indicator chosen by examining firms that grew by employment versus productivity. Their study concluded that different high-growth HGFs were identified using employment versus productivity. Additionally, their study found that young firms are more likely to be high-growth no matter the definition.

To alleviate measurement burdens from earlier studies, Delmar, et al. (2003) looked to determine the demographic characteristics of high-growth firms using administrative data. The authors performed a cluster analysis of Swedish high-growth firms from 1987 to 1996, yielding a seven-cluster solution. Firms were categorized as *Super Absolute Growers*, firms that displayed high absolute growth[9] in employment and sales (a definition of high-growth firms); *Steady Sales Growers*, firms that had a strong development in absolute sales, but negative development in employment, which indicates this cluster is predominately large firms; *Acquisition Growers*, firms that displayed

[9] Absolute growth refers to the total growth in the number of employees or sales.

growth in absolute sales and total employment, but were negative in organic employment, which implies that growth was through mergers and acquisitions; *Super Relative Growers*, the cluster that had the highest growth in comparable firms and the highest share of growth years, which along with *Super Absolute Growers*, showed consistent signs of acting as high-growth firms; *Erratic One-Shot Growers,* firms that displayed a negative development in absolute sales and employment, substantial one-time increases, and high standard deviation in sales; *Employment Growers,* firms that had employment growth higher than their sales growth; and finally, *Steady Overall Growers*, firms that had strong development in absolute sales and employment growth. Overall, this research shows that firm growth is multidimensional and heterogeneous. Recent studies have examined this also.

Coad, Cowling, and Siepel (2017) use Structural Vector Autoregressions to identify how firms grow and seek to determine the "distinct causal relationships between different growth indicators." (p. 538) Using data from the United Kingdom, they sought to explain the causal relationship between sales, employment, profits, and assets. In the population of firms, they found that employment growth initiates the firm's growth, followed by sales. In HGFs, profits are the initiator of growth to other variables, including a positive causal effect on sales and assets. Thus, indicating that HGFs that have profit growth end up reducing their employment growth, and firms do not necessarily put profits back into the business. Shepherd and Wicklund (2009) tracked Swedish firms from 1994 to 1998 to assess the timeline and method of firm growth. Assessing the Pearson product-moment correlations of different measures of firm growth with the age of the firm, they find that absolute employee growth, relative employee

growth, and absolute sales growth have high or moderate concurrent validity. These findings indicate that some measures of growth can substitute for each other when discussing firm growth.

As Demir, Wenneberg, & McKelvie (2017) point out there are three main reasons for the fragmented nature and assessment of HGFs throughout the literature. They point to 1) inconsistent measures to quantify high-growth, 2) the brief nature of growth, and 3) challenges in determining what strategies are needed for high-growth. Establishing typologies and common constructs within the literature are essential in theory building. As previously noted, the clusters and dimensions identified by Siegel et al. (1993) and Delmar, et al. (2003) show that even though these firms are all classified as high-growth, they have vastly different characteristics. To date, there has not been a uniform typological investigation of HGFs in the United States. This study seeks to fill this gap by identifying a typology of high-growth firms in Ohio.[10]

Research Design and Data

Scholars create and develop typologies to understand complex systems, develop theories, and understand the cause-effect relationships within a system (Doty & Glick, 1994; Fiss, 2011). Some scholars have criticized the use of typologies as methods of classification, rather than theory building (McKelvey, 1982; Rich, 1992). However Doty and Glick (1994) argue that typologies should not just be ideas organized into a structure, rather "typologies are complex theoretical statement that should be subjected to quantitative modeling and rigorous empirical testing." (p. 231). This paper expands the

[10] Due to data limitations, the study area is limited to the state of Ohio. However, the state of Ohio has consistently been representative of the United States due to its large manufacturing and service sectors.

use of typologies in the context of HGFs to assess the mechanisms of growth within HGFs in the state of Ohio to overcome the deviancies suggested by Doty and Glick. The multidisciplinary nature of this analysis seeks to meld the management literature with the economic development and regional economics literatures.

Ketchen & Shook (1996) evaluate the use of cluster analysis within the strategic management literature and found that cluster analysis by itself can call into question the validity of the results since the technique relies on the judgment of researchers to establish the cluster cutoffs. These scholars suggest implementing cluster analysis in conjunction with other statistical methods to establish validity and test theoretical models. The current study used cluster-discriminate analysis pioneered by Hill, Brennan, and Wolman (1998), and Hill and Brennen (2000) to overcome validity issues solely using cluster analysis as the classification method.

Cluster analysis is a multivariate technique that seeks to group objects based upon characteristics and can be used for taxonomy description, data reduction, and relationship identification (Hair, et al., 2006). This study employs hierarchical cluster analysis (HCA) to establish relationships between multivariate data points. HCA produces non-overlapping clusters that are nested in nature and is a helpful data reduction technique when attempting to classify large datasets into a hierarchical structure or typology. HCA clusters on the squared Euclidean distances between similar observations. Ward's method of cluster observations was used to assemble homogeneous groups by seeking to minimize the variance within clusters (Aldenderfer & Blashfield, 1984; Ward, 1963). Discriminate analysis that uses these clusters as *a priori* groupings assists our economic understanding of the clusters by testing group differences statistically. In short, cluster

analysis provides a set of homogenous groups, and discriminant analysis informs why the observations group together.

Quarterly Census of Employment and Wages (QCEW) microdata was employed for this analysis. The Center for Economic Development at Cleveland State University maintains a file of QCEW microdata under a contract with the Ohio Department of Job and Family Services (ODJFS).[11] QCEW is derived from state unemployment insurance (UI) tax records and has information on employment and wages at the establishment level. The data contains information on the name of the business, its address, industry classification, Employer Identification Number (the number assigned by the U.S. Internal revenue service for tax purposes), UI and reporting unit number (assigned by each state in the United States). Due to data availability and confidentiality restrictions, this analysis could only be performed for the state of Ohio.

The unit of analysis is the quasi-firm. As defined by the U.S. Bureau of Labor Statistics (2012), a firm is a "legal business, either corporate or otherwise, and may consist of one establishment, a few establishments, or even a very large number of establishments." There is an essential distinction between a firm and an establishment. An establishment is an individual worksite where commerce takes place; an establishment can also be a firm. Only the data from the state of Ohio was used for the current study since the researcher only had access to this state and it represents the universe of all business from which the cohort was created. All data were summed to the unit of the firm within the state of Ohio; therefore, the unit was conceptualized as a quasi-firm.

[11] ODJFS approved the use of QCEW microdata for the use in this dissertation research

This research concentrates on post-recession Ohio and examines quasi-firms from 2010 to 2015. The National Bureau of Economic Research announced that the most recent U.S. recession ended in June 2009; however, the recovery in Ohio took much longer due to the state's dependence on manufacturing and almost total shut-down of all local auto manufacturing (Bello, 2009; Hirsch, 2014; Kavanagh, 2008; National Bureau of Economic Research, 2010).

Following the study of Delmar et. al. (2003) to establish a universal database of firms, three qualifiers were placed on the model: 1) only private sector employment, 2) all non-zero employers, and 3) firms had at least twenty employees in the end year. Then in order to qualify as high-growth, firms must be in the top 10 percent of all firms in one or more of the following areas for the initial year (2010): 1) Absolute Total Employment Growth - annual change in numbers of employees or monetary units; 2) Absolute Organic Employment Growth; 3) Absolute Payroll Growth; 4) Relative Total Employment Growth - annual percentage change in employees or sales; 5) Relative Organic Employment Growth; or 6) Relative Payroll Growth. These qualifiers are consistent with the overall literature that consistently sets an employment qualifier on HGF cohorts (Piazza et al., 2016).

This study replicated the eighteen variables used in the Delmar, et al. (2003) study (pp. 200-203).[12] Table V describes the variables used for this analysis.[13] Variables 1a-f examined the overall growth rate of the firm in both absolute and percentage terms. The variety of growth measures used in the analysis sought to identify or delineate any firm

[12] The Delmar, et. al. (2003) study used 19 different variables to perform its cluster analysis. One variable, regularity of growth via organic growth could not be computed using the QCEW data and was excluded.
[13] Payroll was proxied for sales due to data availability.

growth patterns between using absolute growth (which has been suggested to inflate large firms) and relative growth (which has suggested to inflate smaller firms) (Coad, et al., 2014; Nightingale & Coad, 2013). Categories 2-5 sought to examine the frequency of growth of firms. Category 2 investigated the relative number of growth and high-growth years of the firm, seeking to determine if firms have multi-year growth or high-growth. Category 3 inspected the standard deviation of growth to identify the overall dispersion of growth via the change in employment and payroll; the larger the number, the more volatility the firm had year-to-year in its growth. Category 4 examined the regularity of growth so the number of years a firm experiences high-growth or growth; this can attest to the consecutive years of growth by a firm. Category 5 considered growth in relation to the maximum size of the firm; calling this variable "one-shot growth." Lastly, Category 6 sought to identify different types of growth either through employment or sales, or vice versa.

Cluster and discriminate analysis are sensitive to outliers (Aldenderfer & Blashfield, 1984). Therefore each 5 percent tail of every variable was analyzed to assess outliers. In all, sixteen firms were removed from the dataset, resulting in 26,104 HGFs for this analysis. Also, all the data entered into the model was entered as a z-score for each firm to scale the data from 0 to 1.

Table V: Variables for Cluster Analysis & Discriminate Analysis

1. Average Growth Rate:	
a. absolute total employment	A large value that indicates the firm achieved a high absolute growth (scaled 1-10)
b. absolute organic employment	
c. absolute payroll	
Average annual change:	
d. relative total employment	A large value that indicates the firm achieved a high relative growth (scaled 1-10)
e. relative organic employment	
f. relative payroll	
2. Regularity of growth I: The relative number of growth and high-growth years	
a. growth years in relative total employment	A large value indicates the firm exhibited growth during the majority period
b. growth years in relative payroll	
c. high-growth years in relative total employment	
d. high-growth years in relative payroll	
3. Regularity of growth II: Standard deviation of growth over time	
a. standard deviation of relative total employment	A large value indicates high dispersion; growth pattern is disruptive
b. standard deviation of relative payroll	
4. Regularity of Growth III: Duration of development	
a. relation between the number of both positive and negative changes in absolute employment growth in relation to the number in existence	A high value displays a tendency for frequent changes in the growth rate
b. relation between the number of both positive and negative changes in payroll growth in relation to the number in existence.	
5. Regularity of Growth IV: One-Shot growth*	
a. share of highest single growth in absolute total employment to the maximum size achieved	A high value indicates firm growth occurring during one period.
c. share of highest single growth in absolute total payroll to the maximum size achieved	
6. Dominant type of growth: Ranking total employment growth to organic employment growth or payroll growth	
a. The relation between payroll and employment growth ranked	A large value indicates high payroll growth in relation to growth in total employment
b. The relation between organic employment and employment growth ranked	A large value indicates high organic growth in relation to growth in total employment

Note: * The variable 5b. "Regularity of Growth IV – Absolute organic employment was not able to be created due to data limitations.

Source: Table V modified from Table 4. Variables used in the Cluster Analysis. From "Arriving at the High-Growth Firm" by Frederic Delmar, Per Davidsson, and William B. Gartner. *Journal of Business Venturing*, 18, 2003, p. 202.

Results

Cluster Identification

Cluster analysis is a methodology that groups like entities in stages, but this technique does not indicate an optimal cluster. This paper investigates the agglomeration coefficients to identify clusters to avoid "researcher judgment" bias in selecting a cluster solution (Everitt, 1993; Hill & Brennen, 2000; Ketchen & Shook, 1996). The agglomeration coefficient is the sum of the within-group variance combined at each stage of clustering. The cluster solution decision rule indicates that "when there is a marked increase in the agglomeration coefficient, the previous stage of the cluster solution is a candidate solution." (Hill & Brennan, 2000, p. 73). Table VI displays components of the agglomeration schedule of the cluster analysis at each stage of clustering.[14] The first column displays the number of clusters created by SPSS, the second column shows the step of clustering (n=26,104), the third column displays the slope of the agglomeration coefficient,[15] and the last column marks the acceleration.[16]

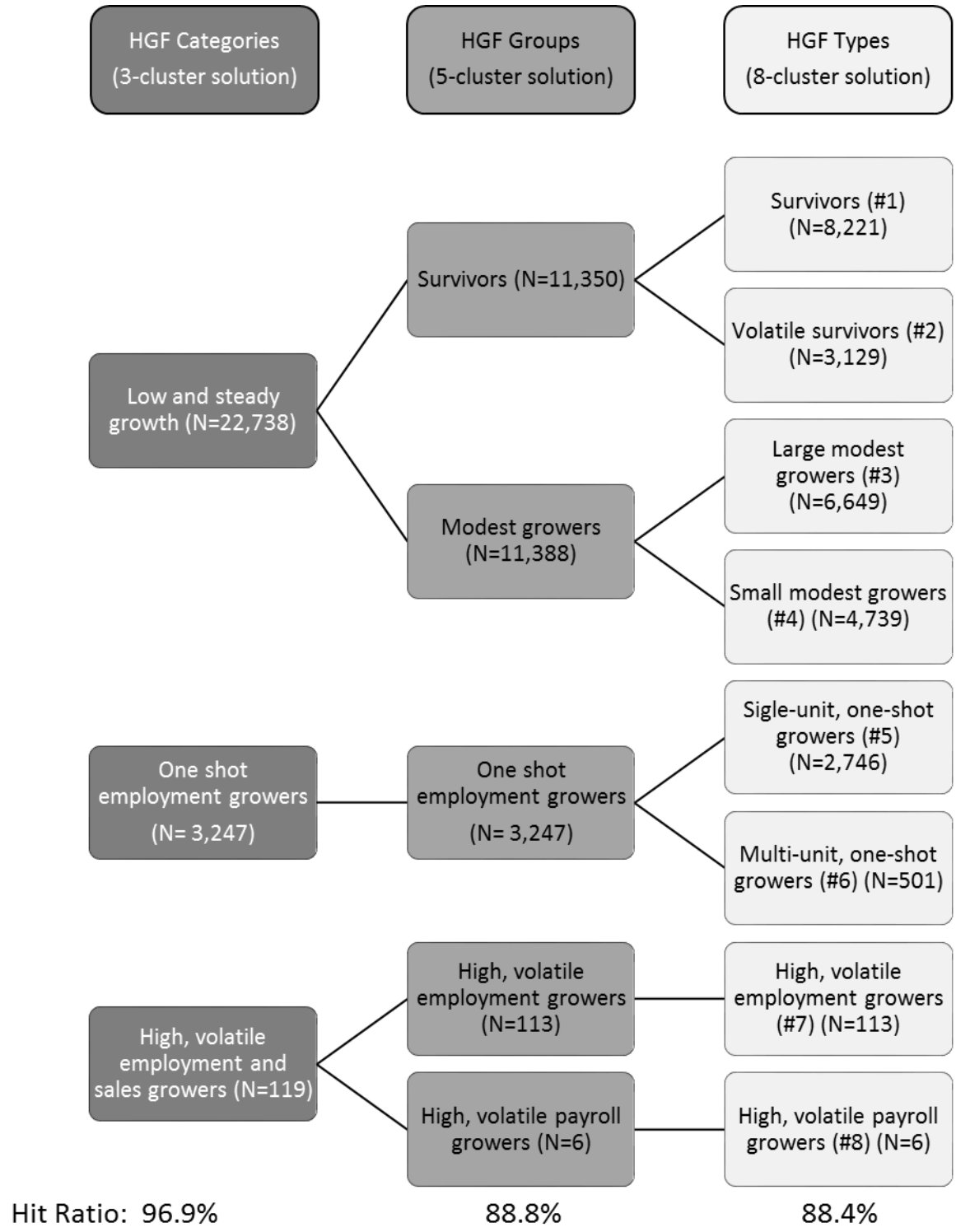
[14] The agglomeration coefficients are not displayed in this table due to confidentiality restrictions.
[15] The slope is the percentage change in the agglomeration coefficient, indicating the second moment of the agglomeration schedule.
[16] Acceleration is measured as the percentage change of the slope, indicating the third moment of the agglomeration schedule.

Table VI: Hierarchal Cluster Analysis Agglomeration Schedule

Number of Clusters	Stage of the Clustering Procedure	Slope: % Change of Agglomeration Coefficient	Acceleration: % Change of Slope
9	26,095	5.423	1.554
8	26,096	5.448	0.467
7	26,097	5.918	8.622
6	26,098	6.946	17.374
5	26,099	7.942	14.339
4	26,100	9.773	23.046
3	26,101	10.285	5.239
2	26,102	13.199	28.334
1	26,103	15.879	20.310

There are three candidate solutions to the cluster analysis: 8-cluster, 5-cluster, and 3-cluster solution. These are all indicated by increases in the agglomeration coefficients, substantial changes in the slope, and acceleration. Using the combined outputs of both the cluster and discriminate analysis the appropriate cluster solution is chosen. Figure VI illustrates the 8-cluster, 5-cluster, and 3-cluster solutions in a cluster map showing the nested nature of HCA. The 8-cluster HGF types cluster into the three primary HGF categories. For example, Volatile Survivors in the 8-cluster solution join with other clusters to form the Low and Steady Growth HGF cluster. The hit-ratio statistics from the discriminate analysis, which indicate the percentage of firms classified correctly in the discriminate analysis, are marginally different from the 5- to 8-cluster solution (88.8% versus 88.4%). The 8-cluster solution produces unequal group sizes, some of which have a small number of firms within the cluster, potentially causing a confidentiality issue in

Figure VI: Cluster Map



Source: Quarterly Census of Employment and Wages; The Center for Economic Development

the data in further discussions in this study. Consequently, cluster #7 (High, volatile employment growers) and cluster #8 (High, volatile payroll growers) are aggregated together for discriminate and industrial analysis in subsequent sections of this paper.

Discriminant Analysis: Interpreting Cluster Analysis

The discriminate analysis results in several important outputs to help examine the model, including the functions' performance within the model. Box's M is a null hypothesis test of homogeneity in the discriminate analysis, testing the equality of covariance/variance matrices. The equality of these matrices is an underlying assumption of conducting a discriminate analysis. For the current discriminate analysis, the Box's M is significant, indicating that there is no difference in covariance/variance matrices. Hakstian, Roed, and Lind (1979) indicated that if Box's M is significant, unequal groups exist, and if large variances are linked with smaller samples, then robustness of the test is not guaranteed. Thus, since this analysis involves a large population (N=26,104) Box's M can be too strict of a test for large samples sizes, as Box's M Test is susceptible to departures from normality (Tabachnick & Fidell, 2007). The overall dataset for this research multivariate is normal, based upon testing for skewness, kurtosis, and multivariate normality. Since larger sample sizes and unequal groups possess greater variances and covariance than groups with smaller samples size, it is still reasonable to reject the null hypotheses (Tabachnick & Fidell, 2007). The use of Pallai's trace is acceptable if Box's M is significant and group sizes are unequal (Warner, 2008). The Pallai's trace test for these discriminate functions is significant at the 99% level ($p<.01$), indicating that the null hypothesis can be rejected, that there is a difference between the groups.

The decisive step in examining the cluster-discriminate analysis is to identify the variables that contribute to each function. The Wilk's Lambda, indicating the statistical significance of the discriminate functions, is statistically significant at the 99% level (<.001). Table VII displays the variables that contribute the most to each function, their correlation to the function, as well as the overall amount of variance each function explains (in bold).

High-Grower (Function 1): Function 1 (High-grower) overall explains 35.3 percent of the variance in the overall model. The variables that have the highest correlation to this function are the two variables that examined the regularity of growth through the relative number of high-growth years of firms via employment and payroll. The strong positive correlation between these variables indicates that firms exhibited high-growth through most of the study period (2010 to 2015). These results intuitively hold based upon the phenomenon of HGFs to have consistent high-growth. Both high-growth years in employment and payroll are correlated with Function 1, indicating that the mechanism of growth (employment or payroll) is inconsequential to their high-growth performance.

Volatile Grower (Function 2): Function 2 (Volatile Grower) explains 26.4 percent of the overall model variance, and the two variables that have the highest correlation to the function are those that examine the volatility of growth of firms. The variables that measure the volatility are payroll growth, which has the highest correlation to Function 2 at 79.1 percent, and employment volatility, at 41.3 percent. Overall, this variable measures the relationship between positive and negative changes in employment for the

years the firm is in existence, indicating that HGFs grow and contract at a higher rate than in HGFs.

Low, steady grower (Function 3): Function 3 (Low, Steady grower) explains 19.9 percent of variance to the model, and all variables are strongly negatively correlated with it; indicating an inverse relationship with these variables and the function. The standard deviation of relative total employment has the highest correlation to the function (-.521), but the negative association suggests that this function is described by firms that have minimal dispersion in the percentage change of employment. The negative correlation of the variable *Share of highest single growth in absolute total employment to the maximum size achieved* (-.520) also indicates that this function is described by growth over many periods of time, not just one. Both annual change in relative total and organic employment are negatively correlated with Function 3 (-.478 and -.477, respectively), signifying that this function describes low relative growth year-to-year.

Consistent Grower (Function 4): Function 4 (Consistent grower) explains 11.7 percent of total variance and has two variables that describe the function. The variables that are highly correlated with this function are both growth years in relative payroll (.641) and in total employment (.568). If Function 1 describes the phenomenon of high-growth, Function 4 describes consistent growth, but not necessarily high-growth.

High-absolute grower (Function 5): Function 5 (High-absolute grower) explains 6.2 percent of total variance and is represented by variables that measure absolute growth in level terms. The three variables of the average growth rate of absolute total employment (.814), absolute organic employment growth (.708) and absolute payroll (.755) indicate those firms with the most substantial changes. These three variables all

suggest that this function describes large growing firms since absolute changes in employment and payroll are associated with larger employers (Coad, et al., 2014).

Growth related to the core business (Function 6): Function 6 explains less than 1 percent (0.6%) of the variance in this model. The two variables that are weakly correlated with this function are those that rank employment growth for other variables (payroll and organic employment). This ranking seeks to examine if the firm grows in dominate type of way that is related to the core of their business function.

Table VII: Correlations between the Discriminating Variables and the Discriminate Functions

Functions	Correlation Coefficient
Function 1: High-grower	**35.3**
High-growth years in relative total employment	.632
High-growth years in relative payroll	.607
Function 2: Volatile Grower	**26.4**
Relation between the number of both positive and negative changes in payroll growth in relation to the number in existence.	.791
Relation between the number of both positive and negative changes in absolute employment growth in relation to the number in existence	.413
Function 3: Low, steady grower	**19.9**
Standard deviation of relative total employment	-.521
Share of highest single growth in absolute total employment to the maximum size achieved	-.520
Average Annual Change: relative total employment	-.478
Average Annual Change: relative organic employment	-.477
Function 4: Consistent grower	**11.7**
Growth years in relative payroll	.641
Growth years in total employment	.568
Function 5: High-absolute grower	**6.2**
Average Growth Rate: absolute total employment	.814
Average Growth Rate: absolute organic employment	.708
Average Growth Rate: absolute payroll	.755
Function 6: Growth related to core business	**0.6**
The relation between payroll and employment growth ranked	.443
The relation between organic employment and employment growth ranked	.325

Note: Percentage of total variance explained for each function displayed in bold

Table VIII presents the group centroids for each dependent variable group (clusters) and the six discriminate functions. Group centroids are the average predicted values for each discriminate score for each cluster group and can aid in understanding the relationship between the functions and clusters. A two-tailed T-test is used to determine if each group's centroid is statistically significant. Only five of the functions have a statistically significant relationship with any of the seven cluster groupings.

Table VIII: Dependent Variable Group Means for each Discriminant Function

Cluster Group	Function					
	High-grower	**Volatile Grower**	**Low, steady grower**	**Consistent grower**	**High-absolute grower**	**Growth-related to core business**
Survivors	0.038	-1.630	-0.556	0.059	0.101	-0.159
Volatile Survivors	-1.254	-0.177	-1.107	-1.370	0.110	0.399
Large Modest growers	-1.266	1.828*	0.107	-0.085	-0.033	-0.160
Small Modest growers	0.146	-0.056	0.637	1.505	-0.489	0.218
Single-unit, one-shot growers	3.272***	0.288	1.783*	-1.312	-0.348	-0.007
Multi-unit, one-shot growers	1.442	0.789	1.876*	1.125	4.583***	0.199
High, volatile growers	13.730***	7.397***	-12.900***	2.341***	0.170	0.025

Note: *** is the 99.0 percent confidence interval (2.57 critical value); ** is the 95.0 percent confidence interval (1.96 critical value); *is the 90.0 percent confidence interval (1.65 critical value)

Description of HGFs: Growth Survivors

Survivors (N=8,221) are the largest cluster grouping in this analysis, accounting for more than 30 percent of the firms in this analysis, and describe firms that solely qualified as HGFs based upon cohort selection.[17] After these firms were selected for the cohort analysis, they showed very little positive change in employment or payroll to mark them as growers, let alone as HGFs. The cluster displayed limited growth in employment and payroll and low volatility. None of the high-growth functions from the discriminate analysis were statistically associated with this cluster. The industrial composition of this cluster is mostly service-providing firms (N=6,166) (Table IX). These firms would not be classified as HGFs in the traditional understanding of "high-growth."

Volatile Survivors (N=3,129) are within a similar cluster tree of Survivors, but this cluster shows more volatility in its growth than solely cluster #1 (Survivor). This cluster can be described by firms that, like Survivor, qualified as HGF in their first year and then just managed not to close businesses. Beyond their Survivor siblings, this cluster saw negative annual changes in employment and payroll after qualifying for the HGF cohort analysis and high volatility in payroll and employment growth. None of the high-growth functions from the discriminate analysis were statistically significant to this cluster. These firms were mostly composed of service-providing business (Table IX). This cluster of firms would not be characterized as HGFs.

[17] To qualify has a HGF for this study firms must have been in the top 10% of all firms in one or more of the following areas: 1)Absolute Total Employment Growth - annual change in numbers of employees or monetary units; 2) Absolute Organic Employment Growth; 3) Absolute Payroll Growth; 4) Relative Total Employment Growth - annual percentage change in employees or payroll; 5) Relative Organic Employment Growth; or 6) Relative Payroll Growth.

Large Modest Growers (N=6,649) are the second-largest cluster grouping, representing one-quarter of firms in this analysis (25.5 percent), and can be characterized by larger firms that showed small to model growth from 2010 to 2015. This grouping is weakly positively associated (at the 90 percent level) with Function 2 (Volatile Grower), indicating that these firms grew and contracted. More than one-third of this cluster (76.6 percent) were service-providing firms. These firms would not be classified as HGFs.

Small Modest Growers (N=4,739) are the third-largest cluster grouping in this study, consisting of 18.2 percent of the HGF population. This cluster is distinguished by single-unit employers[18] that have small to modest growth. None of the high-growth functions from the discriminate analysis were statistically associated, and 71.8 percent were service-providing businesses; this cluster would not be classified as "high-growth."

Description of HGFs: Traditional HGFs

Single-unit, One-Shot Growers (N=2,746) is a consistent cluster that maintains its grouping from 3-cluster solution to 5-cluster solution and splitting off into single-unit, one-shot growers in the 8-cluster solution. This cluster is characterized by single-unit firms with moderate employment growth. Also, this cluster experiences some volatility in its growth trajectory. Function 1 (High-Grower Function) was positively statistically significant with this cluster at the 99% ($p<.001$) level, indicating that this cluster achieved high-growth over multiple years in growth or payroll. Function 3 (Low, steady grower) was positively statistically significant at the 90% ($p<.10$), indicating that these firms saw a low annual change in relative employment and had a small standard deviation in

[18] The QCEW database distinguished between single-unit employers and multi-unit employers. Single-unit employers are businesses that only have one location, while multi-unit employers have more than one location.

employment. Although these firms had low, steady growth, they did see growth for a bulk of years in the cohort (2010 to 2015). These firms would be classified as "high-growth" under the traditional understanding of a HGF.

Multi-unit, one-shot growers (N=501) is the second-smallest cluster in the cohort representing just 1.9 percent of all HGFs in the cohort. Firms in this cluster are characterized by having multiple worksites for one firm and seeing employment growth in a single time period. Function 4 (High-Absolute Grower) was positively statistically significant with this cluster at the 99% ($p<.001$) level, indicating that this cluster had large changes in total employment, organic employment, and payroll, which is indicative of large, multi-location employers. Moreover, Function 3 (Low, steady grower) was positively statistically significant at the 90% ($p<.10$), demonstrating a small dispersion in relative employment. These firms would be classified as "high-growth" under the traditional understanding of a HGF, but with the understanding that these are expansion businesses within a corporate structure.

High, volatile growers (N=119) is the smallest cluster, consisting of less than 1 percent of the HGF cohort (0.46 percent). These firms have large absolute and relative employment and sales growth, and volatility in employment and payroll growth. Function 1 (High-Grower Function) was positively statistically significant with this cluster at the 99% ($p<.001$) and a group centroid of 13.730, representing a high level of significance. Function 1 shows that this cluster achieved high-growth over multiple years in growth or payroll. This grouping was negatively statistically associated with Function 3 (Low, steady grower) at the 99% ($p<.001$) and a group centroid of -12.900, representing a high level of significance. Function 3 indicates steady growth, but since this cluster had a

negative association with the function, this indicates that these firms grew rapidly quickly; which is also consistent with the positive association with Function 2 (Volatile Grower) and Function 4 (Consistent Grower). These firms would be considered by traditional academic and Practioner literature as pure-HGFs; this is the only cluster that would qualify under these definitions.

Industrial Patterns of HGFs

Understanding the type of growth of a HGF is only one part of the story: By looking at the industrial structure of HGFs, one can determine if there are external factors to the business that can contribute to their success (i.e., competitive advantage, industrial makeup, and agglomeration). Table IX displays HGF counts by industry grouping, HGF counts by cluster grouping, and HGF counts by cluster and industry grouping.[19]

It is important to understand first the underlying structure of HGF counts by industry to see if HGFs behave and a different manner in aggregate than all firms in the economy. The first column in Table IX displays the total count of HGFs, no matter their cluster, within grouped industries. The interesting finding from this column reveals the percentage of HGFs per industry grouping is like that of the percentage of establishments and employment in the state of Ohio by industry (Appendix Table I). These results indicate that overall aggregate of HGFs, irrespective of cluster, shows that same industrial makeup as all firms in the state of Ohio.

A Pearson Chi-Square analysis (χ^2) was run on the association between HGF cluster totals by industry grouping (Table IX) and industry groupings for all establishments in the state of Ohio (Appendix Table I). χ^2 examines the observations

[19] Industries were aggregated at the 2-digit NAICS level due to confidentiality restrictions.

between two variables with the expected observations if the relationship between them were random (O'Sullivan & Rassel, 1999). The χ^2 between these two variables is not significant indicating that there is no difference between these groups, showing that the overall industry dispersion of HGFs and all firms in the state of Ohio are the same.

Examining HGF counts by cluster, especially by *Survivors* (Clusters 1 to 4) and *High-growth* clusters, shows a different story than HGFs in aggregate. Survivor clusters (#1-4) show the same industrial patterns as non-HGFs in the economy, indicating one-sixth of the cohort is divided somewhat equally in four groupings, while Natural Resources, Mining, and Constructing represents 5 percent to 10 percent of HGF counts. For example, the *Volatile Survivors* (Cluster 2) reported roughly 18 percent to 20 percent in all industry groupings, except manufacturing (15 percent) and natural resources, mining, and construction (6 percent). This pattern is consistent with all of the Survivor Clusters (#1-4).

The *High-growth* clusters (Clusters 5 to 7), on the other hand, show different industrial patterns with roughly 30 percent of HGFs in Information, Financial Activities, and Professional and Business services, and a lower percentage in Education and Health Services. This industrial composition is indicative of those industries (Information, Financial Activities, and Professional and Business services), which are export-orientated versus population-serving industries (Education and Health Care Services) (Porter, 2003; Tiebout, 1956). Export-orientated industries are important for regional and state growth since the population is fixed (and in the state of Ohio declining), therefore for firms to increase growth they have to find new markets exogenous to the region or state.

Table IX: HGFs by Industry Grouping

Industry Grouping[20]	TOTAL		Custer Group													
			Survivors (#1)		Volatile Survivors (#2)		Large Modest Growers (#3)		Small Modest Growers (#4)		Single-unit, One-shot Growers (#5)		Multi-unit, One-shot Growers (#6)		High, volatile Growers (#7)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Natural Resources & Mining; Construction	**2,024**	**8%**	561	7%	179	6%	506	8%	336	7%	413	15%	15	3%	14	12%
Manufacturing	**4,506**	**17%**	1,494	18%	478	15%	1,049	16%	1,000	21%	368	13%	108	22%	9	8%
Trade, Transportation, & Utilities	**5,178**	**20%**	1,535	19%	558	18%	1,378	21%	1,078	23%	512	19%	97	19%	20	17%
Information; Fin. Activities; Prof. & Bus. Services	**5,147**	**20%**	1,410	17%	694	22%	1,205	18%	859	18%	771	28%	171	34%	37	31%
Education & Health Services	**4,088**	**16%**	1,313	16%	645	21%	1,096	17%	602	13%	350	13%	68	14%	14	12%
Leisure & Hospitality; Other	**5,161**	**20%**	1,908	23%	575	18%	1,415	21%	864	18%	332	12%	42	8%	25	21%
TOTAL	**26,104**	**100%**	**8,221**	**100%**	**3,129**	**100%**	**6,649**	**100%**	**4,739**	**100%**	**2,746**	**100%**	**501**	**100%**	**119**	**100%**

Source: Quarterly Census of Employment and Wages; The Center for Economic Development

[20] Natural Resources and Mining & Construction (NAICS 11, 21, 23); Manufacturing (NAICS 31-33); Trade, Transportation, and Utilities (NAICS 42, 44-45, 48-49, 22; Information, Financial Activities & Professional and Bus. Services (NAICS 51-56); Education and Health Services (NAICS 61-62); and Leisure and Hospitality & Other (NAICS 71-72, 81).

The *High-growth* clusters industrial composition is consistent with the national analysis by Clayton, et al. (2013) and the examination of HGFs in Georgia by Choi, et al. (2013). Clayton, et al. (2013) found that of their nationwide cohort of HGFs, 46.2 percent was in construction; professional, scientific, and technical services; health care and social assistance; and accommodation and food services. Choi, et al. (2013) found the highest industry shares of HGFs in Georgia from 2006 to 2009 were in construction, professional services, healthcare, retail, manufacturing, and wholesale trade. The comparisons from these two studies show that the Ohio case study of HGFs is not unusual and does not go against the established trend in the literature. Moreover, this study reiterates that even regional variation of HGFs is similar.

As discussed, recent literature has pointed to the fact that HGFs are not in the high-technology sector, and research also looked to explore the composition of high-technology industries and HGFs. Table X displays the count of HGFs classified as high-technology based upon Hecker (2005).[21] Only 2,576 firms qualified as high-technology, representing just 9.9 percent of all HGFs in this cohort. More than 83 percent were classified in the *Survivor clusters* (Clusters 1 to 4). This reinforces that, in the Ohio experience, high-technology firms cannot be classified as HGFs in this study, which is reinforced in the literature by Daunfeldt, et al. (2016) from their examination of HT-HGFs in Sweden.

[21] Hecker identifies 44 high-technology North American Industry Classification System (NAICS) industries through an investigation of high-technology occupations cross walking them to industries. These 44 industries are listed in Appendix Table II. NAICS codes were based upon the 2102 update.

Table X: High-Tech HGFs by Cluster Grouping

High-Growth Category	Number of HT-HGFs	% within HT	% of all HGFs
Survivors (Clusters 1-4)	2,137	83.0%	8.2%
HGFs (Clusters 5-7)	439	17.0%	1.7%
TOTAL	2,576	100.0%	9.9%

Source: Quarterly Census of Employment and Wages; The Center for Economic Development

Discussion and Conclusion

This paper investigated the typology of high-growth firms using a variety of growth measures and characteristics to examine how and why HGFs grow, and how this growth is heterogeneous. Through cluster-discriminate analysis, a small portion (3,366 of 26,104) of HGFs that were in the cohort could justly be categorized as "high-growth." The remainder of these firms were termed *Survivors*, which are firms that can be classified as high-growth and, although in the top 10 percent of all firms in one or of six growth categories,[22] displayed no growth after being put into the cohort, merely surviving. HGFs should be coined "ghosts" rather than "gazelles" for their lack of appearance, but they consistently haunt economic development practitioners.

The findings of this study were consistent with Nightingale and Coad (2014), who recognized that most startups end up being slow-growth firms rather than HGFs. Furthermore, the authors describe the most typical scenario for entrepreneurs as hard-working individuals who use their savings to start a restaurant in a competitive market, and if the business is around in a few years, then it only has displaced a similar firm in

[22] 1) Absolute Total Employment Growth - annual change in numbers of employees or monetary units; 2) Absolute Organic Employment Growth; 3) Absolute Payroll Growth; 4) Relative Total Employment Growth - annual percentage change in employees or sales; 5) Relative Organic Employment Growth; or 6) Relative Payroll Growth

the market. Many of these firms create and destroy jobs in the economy but serve as pecuniary benefits to the owners (Hurst & Pugsley, 2011).

This study supports that there is more than one path to high-growth, with HGFs growing over multiple years, or in a single spurt that can sustain them for a while. Additionally, the current study found, economic development facilitates transactions for all types of business relocation and expansion but does not consider facilitating mergers or buyouts as a component of its function. Young, Hood, and Peters (1994) explored the idea that multinational corporations (MNC) could open subsidiaries in regions furthering regional cluster development and competitive advantage. Based upon findings of this paper, the Multi-unit, One-shot Growers cluster (Cluster #6), which was considered a high-growth cluster, was composed mostly of large firms, and fostering of mergers within these firms could further growth and foster competitive advantages to increase innovation and productivity. This study shows economic development practitioners that it is important to know what businesses are in an economic development service area and going door-to-door to understand their needs to help each business grow and stay competitive is essential. This high-touch approach to economic development is the current practice and is the behavior in which most economic development practitioners excel. Continuing this type of behavior is not just economic development practice but creates positive economics for the region.

The industry composition of firms categorized as *High-Growth* reveals that most of these firms are in professional and business services, which is consistent with the literature. Also, the result of the examination of HGFs within HT industries indicates that most of these firms are in the *Survivor* clusters and not in *High-Growth* clusters, which is

also consistent with the literature. This analysis was based upon examining those forty-four HT industry codes (NAICS), which were categorized as HT by Hecker (2005). This study shows that HT, as categorized by Hecker, does not facilitate HGFs. One reason for this finding is that technology is a fast-moving industry that has traditionally not been able to be captured adequately through government statistics (Feldman & Lendel, 2010). The Ohio Third Frontier (OTF), a technology-based economic development program in the state of Ohio, bases its funding on technology streams under the idea that "a high-performing innovation network creates and sustains high-wage jobs, and that the state [of Ohio] must not only expand its innovation potential but also convert these ideas into new products." (Austrian & Auerbach, p. 168). Moving away from industries into technology streams allows for more flexibility in industry and product in more of a model that business would employ rather than the government.

This paper shows the incongruence of economic development policy to foster HGFs and the actual number of opportunities in the market for these firms to exist. Dennis (2011) indicates that the basic issue for policymakers is jobs, since "policymakers need jobs; smaller firms produce jobs; thus, small business remains a central focus for many policymakers" (p. 92). This study did not examine the growth of these firms in employment terms; it cannot directly disprove Birch and Medoff's (1994) findings that HGFs disproportionately contribute to overall job growth. However, the false importance practitioners place on fostering HGFs can be noted as a result of the current study.

The findings that most firms, and even HGFs, are not "high-growth" have important implications for economic development practice. According to Holzl (2013), selectively picking "winners" based upon industries or technologies is not a wise strategy

because growth is difficult and rarely persistent. However, choosing to invest in creating more entrepreneurs through teaching entrepreneurship and fostering an entrepreneurial mindset can create an ecosystem that fosters job churning.

There is robust management literature (Davis, Hall, & Mayer, 2016; Rauch & Frese, 2007) that seeks to identify and foster an entrepreneurial mindset (EM) in individuals. Exploring economic development opportunities that align with fostering EM in individuals can harness the capacity that lies in many people to be entrepreneurs. Davis, et al. (2016) constructed an entrepreneurial mindset profile (EMP) to identify adequately individuals who have EM but also identified ways to help foster EM through traits and skills. These authors show that organizations and businesses can foster EM by identifying these traits and helping employees overcome weakness or funnel them into professions that suit their talents.

When economic development practitioners seek to create the next Silicon Valley, the output they are looking for is more jobs, but the process is more complicated, as it involves the creation of a regional culture that is not averse to the risk of starting a business. By focusing HGFs' creation on the inputs of these firms, entrepreneurs, and managers, rather than just the creation of jobs, it takes a human capital approach to economic development (Mathur, 1999). Encouraging entrepreneurship and an EM enhances the spillovers from entrepreneurs and non-entrepreneurs. This human capital approach then teaches individuals to become more an agent of their density and adverse to risk and therefore increasing prosperity through increased productivity. This proactive approach to fostering EM should move away from the reactive approach of picking winners, selecting industries, and looking for those ghosts.

CHAPTER V

CONCLUSION

The research in this dissertation is located at the intersection of regional science, economics, businesses, and management literatures examining high-growth firms (HGFs). This process included identifying the antecedents and outcomes of HGFs, identifying the relationship between these elements, testing these elements statistically, and examining the different growth patterns of HGFs. This chapter examines how this dissertation contributes to the current literature while examining the future directions of study based on the results contained within it. Specifically, this dissertation can be viewed as filling missing gaps that exist in the literature in the following ways: 1) merges literature across disciplines to establish a comprehensive typology of antecedents and outputs of HGFs, 2) analyzes and assess the nature of HGFs in the United States, and 3) takes into consideration practitioner and policy when establishing its research.

Using a multidisciplinary approach to examine HGFs contributes to the existing literature by associating related, albeit different, concepts within multiple disciplines to help establish a cohesive typology of the necessary antecedents and outcomes of HGFs. Earlier business and management literature examined the personal characteristics of entrepreneurs, strategic management by individuals to steer their companies to high-

growth, and how resources are used by firms to foster growth and create wealth. This individualistic approach to examining entrepreneurship and HGFs helps in understanding individual motivations to create firms and foster firm growth. The economics and regional science literature, on the other hand, has previously sought to identify the outcomes of HGFs to determine how these firms in the aggregate contributions to regional job growth and prosperity. By drawing on the business and regional economics literatures, the perspective of entrepreneurs is joined with the economic development and policy perspective to understand motivations within the aggregate.

This dissertation melds these areas of literature under the framework of the Resource-Based View (RBV) of the firm. RBV theorizes that resources (physical capital resources, human capital resources, and organizational capital resources) are vital differentiators of firm advantage and the control and management of these resources are critical to firm success (Barney, 1991; Penrose, 1959). RBV helps create a useful typology for both the management and regional science disciplines to better understand the interrelation of entrepreneurs and regional economic development outcomes, since both understand the use of strategic resources within their discipline (in management see Alvarez & Buseniz, 2001; Barney & Arikan, 2001; Ireland, Hitt, & Sirmon, 2003) (in regional science see Porter, 2000).

The literature on HGFs has sought to investigate the impact HGFs have on regions by quantifying the number of HGFs in a given region (Acs, et al., 2008; Birch, et al., 1993; Birch & Medoff, 1994; Choi, et al., 2013; Clayton, et al., 2013; Davidsson & Henrekson, 2002; Kirchoff, 1994; Stangler, 2010; Woodward, et al., 2011), the extent to which HGFs cluster (Motoyama & Danley, 2012ab), and compare HGF performance

with non-HGFs (Boston & Boston, 2007). However, much of this literature sought to describe HGFs solely in terms of descriptive statistics, rather than test hypotheses as to the determinates of HGFs. This dissertation not only describes HGFs in the United States (Paper II) and in the state of Ohio (Paper III), but it tests their importance to the overall economic environment. Paper II indicates that HGFs have an association with employment within a region, but they are weak mediators between antecedents of HGFs and outcomes. Paper III describes the nature of high-growth firms in the state of Ohio and challenges the commonly held belief that HGFs are everywhere in the current economy. Instead, there are very few HGFs, with the majority acting as survivors, holding on to their market shares.

The literature examining how to define HGFs is scattered at best, with some articles reporting that a HGF is a firm with years of consecutive growth in sales (Birch, et al., 1993; Birch & Medoff, 1994; Davidsson & Henrekson, 2002), others having growth in indicators with an initial condition of employment (i.e., greater than twenty employees) (Choi, et al., 2013; Clayton et al., 2013; OECD, 2007). Even with all of the variability in definitions, these identifiers show that several years of growth is a component of identifying these firms. These stringent definitions indicate not many firms can be classified as high-growth (Delmar et al., 2003; Henrikson & Johnanson, 2010). Consistent with the literature on HGFs, Paper III found that although many firms can be designated as HGFs, the reality is few firms can be classified as "high-growth" based upon the definitions used in the literature. Of the 26,104 firms categorized as high-growth based upon an initial definition, just 3,366, or 12.9% of the firms in the universe, met the statistical criteria revealed in the cluster-discriminate analysis as being HGFs.

This dissertation not only contributes to the academic literature, but it also looks to inform economic development practice and policy. HGFs are an essential component for economic development practitioners. This can be seen in how the International Economic Development Council (IEDC), the most significant association for economic development, has held information sessions for its members on HGFs (International Economic Development Council, 2017). Identifying and understanding HGFs is key to economic development professionals so they can find the firms early, offer support to help them grow, and invest public dollars wisely. This dissertation shows that having a people orientated strategy is the best way to encourage HGFs. Paper III shows that HGFs are rare, but firms that survive and contribute to the economy at a slower pace are more prevalent. Moreover, investing in the education of people can affect the stock of HGFs in a given area (Paper II).

Focusing economic development efforts toward a human capital approach to economic development can encourage entrepreneurship and an entrepreneurial mindset (EM). The spillovers from entrepreneurs and non-entrepreneurs can create an overall benefit by teaching individuals to become agents of their own destiny and adverse to risk, therefore increasing prosperity through increased productivity. This strategy is a proactive economic development approach that examines the economy as a whole, rather than finding winners and losers. This strategy, however, is risky for economic developers to pursue since their main determinates of success are job creation and high income in the short-run. The human capital strategy is a long-term growth strategy that looks to create more entrepreneurs, increase the knowledge stock of the population, and increase prosperity overall. In the end, teaching individuals to become entrepreneurs and to foster

an entrepreneurial mindset is key to creating more firms; in the hope that one of these will become high-growth.

There are limitations to the findings of this dissertation. The primary limitation comes from data unavailability. Paper II examined the antecedents and outputs of HGFs at the MSA level. Most variables for the model were able to be specified based on existing literature, but as more data becomes available, this model can be tailored to specific concepts that currently cannot be measured in the aggregate (i.e., entrepreneur social networks, business loans, and firm transaction costs). For Paper III, although microdata were used to specify HGFs at the firm level, the database was limited to establishments located in the state of Ohio. This limitation caused complications as some Ohio's metropolitan areas cross the state's boundary, such as Cincinnati, which stretches into Kentucky and Indiana, the Youngtown MSA, which reaches into Pennsylvania, and Toledo which is closely aligned with Southeast Michigan. The same applies for a number of Ohio's micropolitan areas and counties. This paper used the concept of a quasi-firm to indicate to the reader this limitation.

There are areas of research on HGFs identified within this dissertation that can be expanded. The first is to examine further the relationship between income growth and HGFs. Paper II showed that there was a lack of association between HGFs and growth in regional per capita income, suggesting that HGFs do not play a role in regional income growth. Most of the literature on HGFs investigates their importance as job creators; however, to date, there are no academic publications on the contributions HGFs make to regional average income growth. Economic Development practitioners look to HGFs as a

source of new jobs, but if these firms do not increase incomes, their importance to broad-based economic development needs to be reassessed.

The second and third areas are specific to the practice of economic development. The second is to investigate the impact and contribution of a human capital approach to economic development could make to fostering more entrepreneurs and HGFs over time. Examining how these people-based policies contribute or detract from the more place-based policies of economic development in the long-run will be an interesting examination. The third is to use new data and tools on economic development incentives[23] to assess how much public support is given to HGFs and if this support ends up furthering the development of the region. For example, the Ohio Third Frontier boasts that it created 3,074 new jobs, $1.6 billion in follow-on equity, and $1.6 billion in revenue (Ohio Department of Development, n.d.), but are all the public expenditures in this program seeing results? Some reports point to yes (Clouse, 2017), while others are unsure (Schiller, 2003). Using all of the new data at our disposal investigating these costs and benefits could be essential to the future of economic development and entrepreneurial support. The future frontiers of HGF research show promise for both academic knowledge and practitioner information.

[23] In March 2017, the W.E. Upjohn Institute released Panel Database on Incentives and Taxes developed by Institute Senior Economist Tim Bartik. This database is intended to be the most comprehensive data on business incentives by state and local economic development agencies.

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APPENDIX

Table XI. Establishment Counts by Industry Category, 2013-2015

Industry Category	2013		2014		2015	
	Count	%	Count	%	Count	%
Natural Resources and Mining; Construction	24,957	9%	24,898	9%	25,108	9%
Manufacturing	15,702	6%	15,582	6%	15,493	6%
Trade, Transportation, and Utilities	67,464	25%	67,519	25%	67,887	25%
Information, Financial Activities, Professional & Business Services	81,480	30%	81,926	30%	82,965	30%
Education and Health Services	31,451	12%	32,879	12%	32,879	12%
Leisure and Hospitality & Other	51,573	19%	51,423	19%	51,184	19%
	272,627	100%	274,227	100%	275,516	100%

Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Table XII. High-Tech NAICS Codes and Descriptions

NAICS Code	NAICS Description
1131	Timber Tract Operations
1132	Forest Nurseries and Gathering of Forest Products
2111	Oil and Gas Extraction
2211	Electric Power Generation, Transmission and Distribution
3241	Petroleum and Coal Products Manufacturing
3251	Basic Chemical Manufacturing
3252	Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing
3254	Pharmaceutical and Medicine Manufacturing
3255	Paint, Coating, and Adhesive Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
3332	Industrial Machinery Manufacturing
3333	Commercial and Service Industry Machinery Manufacturing
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing
3339	Other General Purpose Machinery Manufacturing
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3343	Audio and Video Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
3346	Manufacturing and Reproducing Magnetic and Optical Media
3353	Electrical Equipment Manufacturing
3364	Aerospace Product and Parts Manufacturing
3369	Other Transportation Equipment Manufacturing
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers
4861	Pipeline Transportation of Crude Oil
4862	Pipeline Transportation of Natural Gas
4869	Other Pipeline Transportation
5112	Software Publishers
5171	Wired Telecommunications Carriers
5172	Wireless Telecommunications Carriers (except Satellite)
5174	Satellite Telecommunications
5179	Other Telecommunications
5182	Data Processing, Hosting, and Related Services

Source: Listing of NAICS codes from “High-technology employment: a NAICS-based update” by Hecker (2005)

Table XII. High-Tech NAICS Codes and Descriptions (Continued)

NAICS Code	NAICS Description
5191	Other Information Services
5211	Monetary Authorities-Central Bank
5232	ecurities and Commodity Exchanges
5413	Architectural, Engineering, and Related Services
5415	Computer Systems Design and Related Services
5416	Management, Scientific, and Technical Consulting Services
5417	Scientific Research and Development Services
5511	Management of Companies and Enterprises
5612	Facilities Support Services
8112	Electronic and Precision Equipment Repair and Maintenance

Source: Listing of NAICS codes from "High-technology employment: a NAICS-based update" by Hecker (2005)