THE IMPACT OF SUBNATIONAL REGION ON THE GROWTH OF NEW VENTURES: EMPIRICAL EVIDENCE FROM US VENTURE-BACKED FIRMS

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Recommended Citation
Available at: http://digitalknowledge.babson.edu/fer/vol34/iss14/2
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ABSTRACT

An extensive body of research has demonstrated that firm founding rates vary systematically across subnational regions. However, comparatively little research exists on whether new venture performance, post founding, is similarly impacted by locational factors. We implement a variance decomposition analysis to examine the impact that geographic region has on new venture growth, across a comprehensive sample of 3,893 venture-backed startups located in 139 US Metropolitan State Areas (MSAs), and operating in 59 industry sectors over the period 1980-2012. Our results suggest that the “region effect” is particularly important for firms that a) are at the earliest stages of business development and b) operate in industries where employees require a high level of general human capital.

INTRODUCTION

Research on the geography of entrepreneurship (see Plummer & Pe’er, 2010 for a review) has largely focused on explaining heterogeneity in entrepreneurial events; that is in understanding the factors that contribute to persistent regional (e.g., national, subnational) variations in new firm formation. In comparison, the degree to which regions matter, post-founding, for new venture performance remains less well understood (e.g., Gilbert, McDougall, & Audretsch, 2006).

Drawing upon resource-based perspectives on competitive heterogeneity in strategy and economic geography (e.g., Hoopes, Madsen, & Walker, 2003; Maskell, 2001; Sirmon, Hitt, & Ireland, 2007; Tallman, Jenkins, Henry, & Pinch, 2004), we investigate the extent to which regional advantages (e.g., Saxenian, 1996) can explain growth differentials within a comprehensive sample of high-technology, venture-backed startups. To do so, we utilize a variance decomposition approach (e.g., McGahan & Porter, 2002; Fitza, 2013), and answer the following questions: a) how much does region matter for new venture growth? b) is the identified “region effect” in turn contingent on other factors that shape the resource needs of the firm, such as its development stage (e.g., Ruhnka & Young, 1987) or the knowledge specificity of the industry sector (e.g., Coff, 1999; Neal, 1995) that it operates in?

Through this study we offer a number of contributions to the extant literature. First, in contrast to prior research that analyzes how locational factors affect the growth of new ventures by focusing on the effects in single industries or by using qualitative approaches (e.g., Folta, Cooper, & Baik, 2006; Gilbert, McDougall, & Audretsch, 2008, Saxenian, 1996), we use a comprehensive sample of growth-oriented ventures operating in a variety of different industries. This allows us to statistically assess the magnitude of the average effect of subnational region on new venture growth. In addition to providing these generalizable findings on a large-scale, we also qualify our results by including firm- and industry specific contingencies. Second, by using a variance decomposition approach, this study leverages recent work that has applied this methodology in the new venture context.
(e.g., Fitza, Matusik, & Mosakowski, 2009; Short, McKelvie, Ketchen, & Chandler, 2009). However, it extends this nascent body of research by exploring the regional effect, which has so far only been studied in the context of large, international firms and their foreign affiliates or subsidiaries (e.g., Chan, Makino, & Isobe, 2010; Ma, Tong, & Fitza, 2013). Relative to these studies, we also expect that our sample should allow for a stronger test of the region effect, since startups are particularly likely to be impacted by regional economic, political, and socio-cultural conditions. Lastly, our research also has important policy implications, as it is among the first to provide large-scale empirical validation for efforts that seek to promote regional economic development by fostering regional ecosystems of growth-oriented entrepreneurship.

**Theory & Hypothesis Development**

Why should regions matter for new venture growth? To answer this question, we primarily draw on resource-based perspectives on competitive heterogeneity in both strategy and economic geography, which suggest that firms can derive competitive advantages from the geographic regions that they are located in. While location-based resources are likely to be largely semi-rivalrous, non-excludable, and not firm-specific (e.g., Hoopes et al., 2003; Tallman et al., 2004), they can still contribute to differences in competitive advantages between firms (e.g., Deeds & Decarolis, 1999), both between and within regions. This is because: a) such resources are somewhat “regionally sticky” in that they are imperfectly mobile, and hence not equally accessible to firms in different regions, and b) even within a given region, firms differ in both their need and their ability to leverage and bundle such external resources with firm-specific assets (e.g., Maskell, 2001; Sirmon et al., 2007). In the sub-sections that follow, we expand on these theoretical ideas and discuss their applicability to new venture competitive heterogeneity, which we measure by observable differences in firm growth rates.

**Between Region Effects - The Impact of Region on New Venture Performance**

Drawing on insights from the seminal work by Penrose (1959) on the growth of the firm, scholars in the resource-based tradition of strategic management have emphasized that the competitive heterogeneity between firms might, at least in part, be explained by distortions in factor markets. In particular, the immobility or imperfect mobility of factors can over-time lead to persistent differences in the access to resources and hence to sustained competitive differences between firms (e.g., Barney, 1986; Peteraf, 1993).

Along similar lines, economic geographers have long argued that factor immobility acts as a strong “centrifugal force” at the regional level (e.g., Krugman, 1998), and is one of the primary reasons behind the formation of economic “hot spots” and “blind spots” (e.g., Pouder & John, 1996); that is behind an unequal geographic distribution of economic activity across geographic space. Perhaps the most interesting finding from this body of research is that initial regional differences created by imperfections in factor markets persist over long periods of time. Authors have suggested that this occurs due to endogenously created economic agglomeration externalities such as geographically localized knowledge spillovers between resource-seeking firms (e.g., Agarwal & Braguinsky, 2014; Aharonson, Baum, & Feldman, 2007), which in turn reinforce factor market mobility barriers. Furthermore, such barriers are difficult to erode, even in the absence of an obvious economic benefit to clustering (e.g., in declining industries), as particular forms of economic activity become socially legitimized and associated with regions over time (e.g., Romanelli & Khessina, 2005).
In the context of growth-oriented new ventures, we expect that such persistent factor market immobility is a particularly important consideration. This is because the factors that firms in such contexts leverage to create value are largely intangible and location-specific. For instance, the key “raw material” is typically knowledge; such new ventures require access to specialized pools of managerial and technical “know how” to create value (e.g., Malecki, 2010, Matusik and Fitza, 2012). However, knowledge is regionally sticky since a large portion of it is tacit and requires face-to-face interactions for effective communication and exchange (e.g., Polanyi, 1966). Furthermore, even within the subset of knowledge that is more explicit and codified (e.g., patent data), high levels of complexity and causal ambiguity (e.g., Sorenson, Rivkin, & Fleming, 2006; Tallman et al., 2004) can render much of it immobile as a number of studies on the spatial extent of knowledge spillovers have demonstrated (e.g., Jaffe, Trajtenberg, & Henderson, 1993; Singh & Marx, 2013). In addition, beyond knowledge considerations, mobility barriers also exist in other strategic factor markets that growth-oriented new ventures rely on to create competitive advantages. For example, the availability of financing in the form of venture capital is highly uneven across regions (e.g., Chen, Gompers, Kovner, & Lerner, 2010). This is because investors largely prefer to invest in startups in close geographic proximity that they can monitor closely (e.g., Cumming & Dai, 2010) due to the substantial uncertainty and risks associated with these investments; thereby creating imperfections in the flow and access to capital between regions (e.g., Zook, 2002).

Lastly, as suggested earlier, these factor-specific mobility barriers are also likely to be self-sustaining and reinforced over time. For example in the context of growth-oriented new ventures, localized knowledge spillovers have been shown to impact firm performance (e.g., Gilbert, McDougall, & Audretsch, 2008) leading to an increase in the level of clustering over time. More broadly, the interactions between proximally located firms over time can lead to the creation of idiosyncratic, path-dependent traded and untraded interdependencies (i.e., social linkages) at a regional level (e.g., Saxenian, 1996; Storper, 1995). Scholars have also recently empirically demonstrated that variations in such “territorially localized social capital” (e.g., Laursen, Masciarelli, & Prencipe, 2012) can lead to sustained differences in firm performance across regions. Synthesizing the arguments discussed above, we therefore hypothesize that:

**Hypothesis 1:** A significant portion of variation in new venture performance is attributable to subnational regional effects.

### Within Region Effects - Interaction Effects of Subnational Region

While imperfect or immobile factor markets can explain competitive heterogeneity between firms located in different regions, they are not suitable as a theoretical explanation for performance differences between firms located in the same region (e.g., Tallman et al., 2004). Hence, a resource-based explanation for *intra-regional differences* must necessarily account for firm-specific heterogeneity in the need and use of locational resources (e.g., McCann & Folta, 2011; Shaver & Flyer, 2000). In the context of growth-oriented new ventures, we specifically discuss how a firm’s developmental stage (e.g., Ruhanka & Young, 1987), and the knowledge-intensity of the industry that it operates in (e.g., Coff, 1999) can act as important contingencies in shaping locational factor dependencies (e.g., Sirmon, Hitt, Ireland, & Gilbert, 2011), and hence moderate the effect of region on new venture performance.
Interaction Effects of Region and Firm Developmental Stage

At their heart, dynamic resource-based theories of the firm (e.g., Helfat & Peteraf, 2003; Sirmon et al., 2011) highlight that the basis of competence and value creation changes as firms develop. While the focus of strategy scholars has largely been on how internal capabilities within the firm evolve (e.g., Winter, 2003), it is important to recognize that a firm's reliance and orchestration of external (e.g., locational) resources also changes over time (e.g., Sirmon et al., 2011).

At the nascent stages of formation firms often lack legitimacy and survival is a key concern. At this time in a firm's life cycle, internal resources (e.g., employees) are generally limited, and organizational routines are not well developed. Firms at this “seed stage” of evolution typically also do not have a well-defined business model or compete in product markets. The ability to initially leverage resources from the local community, for example through the pre-existing regional social ties of founding team members, can therefore serve as a key basis of differentiation in such firms (e.g., Beckman, 2006). Beyond the formal ties of firm members, such nascent firms are also likely to benefit significantly from the general expertise and take advantage of networking events in the local entrepreneurial community (e.g., Feld, 2012).

As startups mature however, we expect that their reliance on regional resources should decline for a number of reasons. First, prior research has indicated that more mature startup firms are less motivated to learn from co-located peers than nascent firms despite their increased opportunity to do so (e.g., Almeida, Dokko, & Rosenkopf, 2003) as they increasingly rely on formalized mechanisms such as alliances (e.g., Almeida et al., 2003; Rothaermel & Deeds, 2006). Second, studies on innovation have indicated that smaller, younger firms also benefit disproportionately from common pool resources such as regional R&D spillovers (e.g., Acs, Audretsch, & Feldman, 1994), again suggesting that locational factors decline as firms mature. Lastly, more mature startup firms are also more likely to seek resources from outside their immediate regional environments to create competitive advantages. For example, studies on technological search have shown that as startups mature they are able to overcome locational barriers and leverage resources from geographically distant locales (e.g., Phene, Fladmoe-Lindquist, & Marsh, 2006). Integrating these arguments, we therefore hypothesize that the effect of region will be conditional on the developmental stage (i.e. maturity) of new ventures such that:

Hypothesis 2: The impact of subnational region on venture performance will be larger for new ventures at early stages of development than for new ventures at later stages of development.

Interaction Effects of Region and Industry Knowledge Profile

Spillovers of knowledge between firms, for instance through employee mobility or spinoffs, can lead to localized learning effects within regions and industrial clusters (e.g., Malmberg & Maskell, 2006). These dynamics also serve to reinforce clusters of economic activity over time (e.g., Agarwal & Braguinsky, 2014) as they not only encourage the formation of spinoffs (e.g., Klepper, 2001) but can also attract resource-seeking firms (e.g., Aharonson et al., 2007). In general, an extensive body of literature has demonstrated that spillovers in knowledge-based agglomerations are both spatially localized and can contribute significantly to competitive advantages for the firms located there (see Breschi & Lissoni, 2001 for a review).
While individual firms might differ in the ability to absorb knowledge and hence benefit from such spillovers (e.g., McCann & Folta, 2011), we expect that on average, these dynamics are likely to be particularly important for growth-oriented new ventures operating in knowledge-intensive contexts (e.g., Gilbert et al., 2008). However, we suggest that the knowledge profile of the industry that a firm operates within, and more specifically the specificity of knowledge used, might shape the degree to which firms benefit from such regional spillovers. For example, in some industries, general human capital that is applicable across multiple settings (e.g., Becker, 1962) is particularly important, while in other industries employees rely to a much greater degree on acquiring firm and industry-specific skills (Coff, 1999; Kor & Misangyi, 2008; Neal, 1995). In addition to impacting a firm’s reliance on external sources of knowledge, this distinction is also important as it shapes the bargaining power of employees and rates of turnover (e.g., Coff, 1997). We expect that knowledge spillovers are most likely to occur for firms operating within industries that largely rely on general human capital, where knowledge is more likely to be embodied within the individual rather than within firms. In comparison, in industries where general human capital is less useful and employees are more likely to invest in acquiring firm-specific skills, knowledge spillovers mechanisms (e.g., employee mobility, spinoffs) are likely to be attenuated (e.g., Coff, 1997). Synthesizing these arguments, we therefore hypothesize that:

Hypothesis 3: The impact of subnational region on new venture performance will be larger for new ventures operating in industries with high levels of general human capital.

METHODS

Sample

To obtain a wide-scale sample of growth-oriented new ventures, we used data from the VentureXpert database provided by Thomson Financial. This database has been used extensively for research on both venture capital firms and venture-backed startups operating in knowledge intensive sectors of the economy (see Dushnitsky & Lenox, 2005 for a review). To construct our sample, we followed prior research that has used VentureXpert data and used an analytical approach similar to ours (see Fitza, Matusik, & Mosakowski, 2009 for a detailed description of the sample and analytical approach). After excluding missing data, our final sample consisted of 7,813 observations (i.e. inter round periods (see below)) from 3,893 venture capital-backed startups over the period 1980-2012. These ventures operated in 139 different Metropolitan State Areas (MSAs) across 59 industry sectors (defined using Standard Industrial Classification codes). Our use of the MSA as the regional unit of analysis is consistent with prior economic geography research using venture-backed startups (e.g. Deeds & Decarolis, 1999; Stuart & Sorenson, 2003) and also improves upon previous variance decomposition studies on regional effects (e.g. Chan et al., 2010 estimated regional effects at the state level)\(^1\).

Analytical Approach

We utilized a simultaneous analysis of variance (ANOVA) estimation technique to estimate the importance of factors that lead to competitive heterogeneity among growth-oriented new ventures. Using this method, we are able to attribute portions of the variance in the dependent variable to individual effect classes (e.g., Ma, Tong, & Fitza, 2013; McGahan & Porter, 2002). Following the work of Fitza et al. (2009), we first assessed the importance of firm (i.e. the new venture), development stage, owner (i.e. VC investor), industry, and year effects. In addition to
these previously established effects, we also examined the impact of region of primary interest to this study. Furthermore, to estimate within region effects (i.e., whether the region effect is in turn contingent on other variables) we estimated interactions between the region and development stage, and region and industry respectively. Specifically, we estimated the following equation for our dependent variable:

\[
Growth_{i,r} = \mu + \lambda_{rg,r} + \alpha_{yr} + \gamma_{yr} + \xi_{rg,yr} + \nu_{cr} + \tau_{yr} + \varepsilon_{fr} \tag{1}
\]

Following prior literature (e.g., Fitza et al., 2009; Gompers & Lerner, 2000), we investigated differences in firm performance in this context using a valuation-based metric of new venture growth. We explain this metric in greater detail in the measures section below. On the right hand side, the first term \(\mu\) is a constant equal to the grand mean. The term \(\lambda_{rg,r}\) captures the region effect, \(\alpha_{yr}\) captures the year effect (a measure of macro-economic conditions), \(\gamma_{yr}\) the development stage effect, \(\xi_{rg,yr}\) the region – development stage interaction effect, \(\nu_{cr}\) the industry effect, \(\tau_{yr}\) the firm effect, and \(\varepsilon_{fr}\) the residual. In addition to applying this model across the entire dataset, we also constructed data subsamples to test our hypothesized interaction effects (H2 and H3).

Each effect in the model is represented by a set of dummy variables, and the magnitude of each effect represents the increase in explained variance (R²) in the model. While variance decomposition methods have increasingly been used in the fields of entrepreneurship and economic geography, our study is the first to examine subnational region effects in the new venture context. Table 1 provides a comparison of our study with relevant prior research.

**Measures**

**Dependent variable.** We investigate performance differentials between new ventures by measuring differences in firm growth. Growth is a particularly important performance metric to investigate in the startup context (e.g., Gilbert et al., 2006), as it enables firms to overcome the liabilities of adolescence and smallness (e.g., Bruderl & Schussler, 1990) that can lead to premature failure. However, large-scale secondary empirical studies in the new venture context are typically hampered by the lack of detailed financial and employment data. Therefore, following prior research in the context of venture-backed startups (e.g., Fitza et al., 2009), we use the increase (per month) in the valuation of a portfolio company \(i\) in the period between two investment rounds (the difference between the post money value of round \(n\) and the pre money valuation of round \(n+1\), divided by the number of months between the two rounds), known as the inter-round period \(r\), as a well validated measure of firm growth (see Gompers & Lerner, 2000 for a detailed description of this metric).

**Firm development stage.** For each investment round, the VentureXpert database identifies the development stage (e.g., Ruhnka & Young, 1987) of financed startup firms. Following prior research (e.g., Fitza et al., 2009), we were therefore able to classify the observations in our sample into seed, early, expansion, late, and pre-IPO/pre-acquisition stages. We used these groups for a sub-sample analysis to examine the impact of region for firms at different stages of development (see Figure 1a).
Industry knowledge profile (use of general human capital). To estimate the degree to which industries differ in their usage of general human capital, we calculated the average level of educational attainment of firm employees in a given industry (e.g., Coff, 1999; Wolff, 2000). This data was obtained from the Current Employment Statistics database published by the US Department of Labor. This database reports the percentage of employees for six levels of education (less than a high school diploma, high school only, some college, associate degree, bachelor only, master, or PhD). We assigned numbers from 1 to 6 to these levels, and used these to calculate the median level of education for each industry in our sample at the 3 digit SIC code level. We then split our sample at the median education level to construct sub-samples of high and low levels of general human capital, and analyzed the region in each sample (see Figure 1b).

Results

Table 2 reports the percentages of total variance of new venture growth explained by each effect class. We also report results from prior variance decomposition studies that have used VentureXpert data (Fitza et al., 2009) to study growth in new ventures, and those that have examined subnational regional effects (Chan, Makino, & Isobe, 2010; Ma et al., 2013).

Other than the main effect of development stage, we find that all other effects in our model are statistically significant. Effect sizes in our study are largely comparable to the earlier work by Fitza et al. (2009), taking into account differences in the time span and industries examined in the two studies. In support of hypothesis 1, we find that the region effect is significant and explains 2.03% of the variance in new venture growth. It is important to note that while the magnitude of this effect size is relatively small, and much of the variance in growth can be explained by firm and ownership effects, region is the most important external effect class, explaining a greater portion of the variance in venture growth than either year or industry effects.

The two prior studies examining region effects (Chan et al., 2010; Ma et al., 2013) were carried out in samples of subsidiaries of mature firms, across different institutional contexts (e.g., China), and used different spatial units of analysis for regional definitions (e.g., states or provinces instead of US MSAs). Hence, results from these studies in Table 2 are provided for illustrative purpose rather than as a basis for direct comparison. Yet it is interesting to note that the identified region effect in our study is similar in magnitude to the effects identified by these authors.

With respect to within region (i.e. interaction) effects, we find that the region-development stage interaction explains 5.56% of the variance in new venture growth, while the region-industry interaction explains 6.55% of the variance in new venture growth. To test hypothesis 2 and 3 we also conduct subsample analyses partitioning our data by firm development stage and the level of human capital in the firm's industry of operation respectively. In figures 1a and 1b, we illustrate the results of these additional tests.

As illustrated in Figure 1a, region effects matter most for firms at the seed-stage of development in that stage regions explain 14.32% of the variance in growth. However, as firms mature, the region effect declines explaining 5.33% for early-stage firms, 2.81% for expansion-stage firms, 2.61% for late-stage firms, and only 0.45% of the variance in growth for firms at the pre-IPO/pre-acquisition stage. Hence, we find support for hypothesis 2. As figure 1b illustrates we find that the
region effect explains 5.61% of the variance in growth for firms operating in industries with high levels of general human capital, relative to 1.75% of the variance in growth for firms operating in industries with low levels of general human capital. Hence, we also find support for hypothesis 3.

**Discussion**

Research on the geography of entrepreneurship has largely focused on examining regional variations in rates of entrepreneurial entry. In contrast, the performance implications of new venture location choice post-entry have received limited attention in the literature to-date. The purpose of our study was to address this important gap through a comprehensive empirical analysis of firm performance in growth-oriented, venture-backed startups.

**Contributions & Implications**

The results of our study primarily contribute to the small but growing body of literature linking locational factors to the growth of knowledge-based, high-technology ventures. At present, the findings in this research stream are limited in their generalizability. This is because existing research has almost exclusively been conducted in the context of single industries (e.g., Folta, Cooper, & Baik, 2006; Gilbert, McDougall, & Audretsch, 2008), relied on small-samples (e.g., Motoyama & Danley, 2012), or used qualitative case-based approaches (e.g., Saxenian, 1996). Our research design explicitly seeks to address this gap in the literature, by both quantifying the magnitude of the average “region effect” and exploring firm and industry-specific contingencies in the context of a comprehensive sample.

We also make a secondary contribution to the variance analysis literature (see Bowman & Helfat, 2001 for a review). This methodology has its origins in corporate strategy where researchers have traditionally used it to study the relative importance of firm, corporate, and industry effects on firm performance (e.g., McGahan & Porter, 1997; Rumelt, 1991). Scholars have only recently extended its use to other fields such as entrepreneurship (e.g., Fitza, Matusik, & Mosakowski, 2009; Short, McKelvie, Ketchen, & Chandler, 2009), and international business (Makino, Isobe, & Chan, 2004). Most recently, researchers have also used this method to quantify subnational regional effects (e.g., Chan, Makino, & Isobe, 2010; Ma, Tong, & Fitza, 2013). Our study is therefore a natural extension of this technique into the context of growth-oriented new ventures, allowing us to validate findings from earlier studies while also adding to a base of comparison for future work.

Lastly, our analysis is also of relevance to policy makers interested in facilitating regional economic development through growth-oriented entrepreneurship. Within this community, there has been significant interest and effort in using systems-based approaches (e.g., Scott & Davis, 2007) to both map and build “regional entrepreneurial ecosystems” (e.g., Isenberg, 2010; Mason & Brown, 2013). Our results should help qualify and justify these efforts, as in the absence of a rigorous demonstration of the link between regional ecosystems and the growth dynamics of early-stage firms much of the rationale for such approaches has been largely either theoretical (e.g., Venkataraman, 2004) or anecdotal (e.g., Feld, 2012).
Limitations and Avenues for Future Research

Like all studies, ours is not without its limitations. For instance, our sample is restricted to new ventures that have received at least two rounds of venture capital financing and that have valuation data available. While this is potentially problematic, we ran a series of sensitivity tests (available upon request) similar to Fitza et al. (2009) to ensure that our sample was representative of the population of firms in the VentureXpert dataset. More generally, we also recognize that the use of venture-backed startups also limits the applicability of our findings to new ventures that rely on alternate forms of financing. However, since our interest is primarily in studying these dynamics in the context of growth-oriented startups, venture-backed firms are a good population to examine (e.g., Davila et al., 2003). Lastly, as with all variance decomposition research, our study does not examine the precise link between potential causal mechanisms and individual effect sizes. Instead, variance decomposition studies suggest that a certain effect is of a large enough size to warrant further examination. As such they are a useful starting point for future theory building and detailed empirical analysis.

We conclude by briefly highlighting our key findings. Our results indicate that on average, ~2% of the variance in new venture growth can be explained by regional differences. The region effect is also the largest effect in terms of influences external to the firm, and is larger than both industry (0.69%) and macro-economic year (1.9 %) effects. Furthermore, subsample analyses of our data indicate that region effects are amplified for firms at the earliest stages of development (the effect is ~15% in seed-stage firms), and for firms operating in industries where knowledge spillovers are more likely to occur (the effect is ~6% in industries with high levels of general human capital). Synthesizing our findings then, we are able to clearly demonstrate that regions do indeed matter for new venture growth.

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ACKNOWLEDGEMENTS

The authors would like to acknowledge Markus Fitza for his efforts with respect to the data collection for this study.

NOTES

1. However it also complicates our analysis since, unlike state boundaries, MSA delineations change over time. Spatial definitions and concordance files can be found at the webpage of the Bureau of Economic Analysis (https://www.bea.gov/regional/docs/msalist.cfm), and the Federal Communications Commission (http://transition.fcc.gov/oet/info/maps/areas). For this study, we updated our definitions of MSAs through the sample based on BEA releases. We will also test the robustness of our current findings presented here using alternative specifications such as EAs (economic areas) and CMSAs (consolidated metropolitan statistical areas).
References


Table 1. Comparison of Variance Decomposition Studies on Startup Firms, or Examining Subnational Regional Effects.

<table>
<thead>
<tr>
<th>External factors examined</th>
<th>Internal factors examined</th>
<th>Maturity of firms</th>
<th>Sample description</th>
<th>Dependent variable</th>
<th>Method used</th>
<th>Data source</th>
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<tbody>
<tr>
<td>Industry and year effects</td>
<td>Firm effects</td>
<td>Start-up firms (VC portfolio companies)</td>
<td>3,756 start-ups, 1,418 venture capital firms (USA)</td>
<td>Growth measured as increase in valuation in between two investment rounds</td>
<td>Simultaneous ANOVA</td>
<td>VentureXpert database from Thomson Financial</td>
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<tr>
<td>Industry and year effects</td>
<td>Firm effects</td>
<td>Start-up and established firms (post IPO)</td>
<td>308 start-ups (USA)</td>
<td>Post-IPO performance: employment, growth and ROA</td>
<td>Random coefficient modeling (hierarchical linear modeling)</td>
<td>SDC Platinum database from Thomson Financial</td>
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<td>Industry and year effects</td>
<td>Firm effects</td>
<td>Start-up and established firms (comparison)</td>
<td>7,256 start-ups, and 12,692 established firms in Sweden</td>
<td>Sales, sales growth, and survival of start-ups and established firms</td>
<td>Hierarchical linear modeling (random coefficients)</td>
<td>Swedish tax authority and Statistics Sweden</td>
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<td>Industry and year effects</td>
<td>Firm effects</td>
<td>Start-up and established firms (comparison)</td>
<td>5,183 foreign affiliates</td>
<td>Variance components (random effects)</td>
<td>Simultaneous ANOVA</td>
<td>METI Trend survey</td>
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<tr>
<td>Industry and year effects</td>
<td>Firm effects</td>
<td>Start-up and established firms (comparison)</td>
<td>1,843 parent firms (Japan), 4,951 foreign affiliates</td>
<td>Variance components (random effects)</td>
<td>Simultaneous ANOVA</td>
<td>METI Trend survey</td>
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<tr>
<td>Industry and year effects</td>
<td>Firm effects</td>
<td>Start-up and established firms (comparison)</td>
<td>228 parent firms (19 countries), 1,625 foreign subsidiaries</td>
<td>Variance components (random effects)</td>
<td>Simultaneous ANOVA</td>
<td>MOFCOM and NBS database</td>
</tr>
</tbody>
</table>

This study (first to examine region effects for startups) |

Subnational region (US) |
Subnational region (China), industry, country, and year effects |
Subnational region (US), industry, and year effects |
Owner (i.e. VC investor), firm, and development stage effects |
Start-up firms (VC portfolio companies) |
Growth measured as increase in valuation in between two investment rounds |
Simultaneous ANOVA |

Table 2. Results of Variance Decomposition Analysis*

<table>
<thead>
<tr>
<th>Category</th>
<th>Studies using VentureXpert data</th>
<th>Previous research examining subnational regional effects</th>
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<td>This study % of variance in inter-county valuation increase</td>
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</tr>
<tr>
<td>Development Stage</td>
<td>0.39 n.s.</td>
<td>0.22 n.s.</td>
</tr>
<tr>
<td>Region</td>
<td>2.03</td>
<td>-</td>
</tr>
<tr>
<td>Region X Industry</td>
<td>6.55</td>
<td>-</td>
</tr>
<tr>
<td>Region X Development Stage</td>
<td>5.56</td>
<td>-</td>
</tr>
<tr>
<td>Number of firms</td>
<td>3,893</td>
<td>3,756</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>7,813</td>
<td>6,490</td>
</tr>
</tbody>
</table>

*All effect sizes are significant at p<0.05 or higher, except for those marked n.s.

Owner effects refer to investors (i.e., venture capital firms) in our study and Fitzsim et al. (2009), and corporate parents in Chan et al. (2010) and Ma et al. (2013) respectively.

Firm effects refer to new ventures in our study and Fitzsim et al. (2009). They refer to foreign subsidiary (Chan et al., 2010) and affiliates (Ma et al., 2013) respectively.


A small negative effect is usually interpreted to be zero (McGahan & Porter, 2002).
Figure 1. Interaction Effects of Region with a) Firm Development Stage and b) Level of General Human Capital in Industry of Operation