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ABSTRACT

Entrepreneurship is thought to be a key driver of economic growth. While there are myriad forms of entrepreneurship, ranging from self-employment to small and medium size enterprises to technology-and innovation-driven startups, recent research provides evidence that the relationship between entrepreneurship and economic growth is driven not by overall quantity of new firm entry, but rather by a small subset of high-growth startups that are primarily categorized as innovation-driven. This paper provides a survey of the growing literature on the economics of such innovation-driven entrepreneurship. We begin by distinguishing between the various forms of entrepreneurship, which are often confounded in both theory and empirical work. We lay out the current state of knowledge, and describe the challenges faced by researchers in the field, particularly around measurement, data and identification. We conclude with an overview of the major open questions and directions for future research in the area.

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1. Introduction

"…the entrepreneur is the single most important player in a modern economy."

–Edward Lazear (2005)

Entrepreneurship is an area of study that is not new to the economics literature. The introduction of new ideas into the economy sits at the front and center of our current understanding of economic growth (Aghion and Howitt 1992; Romer 1990). These new ideas take many forms, ranging from brand-new discoveries to innovative recombinations of existing material and labor, and are limited only by the laws of nature (Weitzman 1998). A significant source of integration of new ideas into the economy are entrepreneurial firms. One of the first proponents of this role for entrepreneurs was Schumpeter (1942), who described them as engaging in a process of "creative destruction," constantly replacing current modes of production with more productive ones. Schumpeter's observations spawned a large theoretical literature examining the nature of entrepreneurial discovery (see e.g. Kirzner 1997), which has since been incorporated into a coherent equilibrium account of endogenous economic growth that stresses the role of entry by new firms (Aghion and Howitt 1992). These theoretical developments were followed by a raft of empirical studies that further emphasize the importance of new firm entry for economic growth (e.g. Davis and Haltiwanger 1992; Davis et al. 1998; Haltiwanger, Jarmin, and Miranda 2012; Decker et al. 2014).

These empirical studies have furthered the notion that economic growth is tied to business dynamics—the process of firm entry, expansion, contraction and exit (e.g. Jovanovic and MacDonald 1994). For example, studies using U.S. Census data show that job growth is disproportionately driven by new firms (Davis and Haltiwanger 1992; Davis et al. 1998; Haltiwanger, Jarmin, and Miranda 2012; Decker et al. 2014; Fairlie, Miranda, and Zolas 2019). These young firms, however, exhibit positive skewness in their growth rate distribution, suggesting that the relationship between entrepreneurship and economic growth is driven not by the overall quantity of new firm activity, but rather by smaller subset of high-growth, innovation-driven startups (Haltiwanger, Jarmin, and Miranda 2012; Decker et al. 2014)—not only in the U.S., but

also across many other developed countries (Bravo-Biosca et al. 2016).[1] These patterns are perhaps not surprising: studies of small business entrepreneurs emphasize the low growth prospects of the average self-employed individual (Hamilton 2000; Hurst and Pugsley 2011) and suggest that most small business owners are different from the Kirzner or Schumpeterian view of "innovation-driven" entrepreneurs—with little desire to grow, innovate, or bring new products to market. Further emphasizing this distinction between types of entrepreneurs, recent studies such as Guzman and Stern (2015, 2020) document substantial regional and intra-regional variation in the growth potential for startups, even within the same industry. Only a fraction of new firm starts exhibit high growth and contribute substantially to job creation, innovation, and productivity growth. The vast majority of new ventures have low growth potential from the outset (Schoar 2010; Hamilton 2000; Hurst and Pugsley 2011).

While this distinction between types of new ventures is not always straightforward to ascertain ex ante, it is of great importance to entrepreneurs, policy makers, and researchers. The drivers of discovery, founding, funding, growth, and success are likely to be heavily dependent on the type of entrepreneurship entered into. Yet both policy makers and researchers often treat entrepreneurs as a homogenous group (Hurst and Pugsley 2011). As an example, while population-level indices such as the Business Dynamics Statistics Database suggest a secular decline in the rate of business dynamism and new firm formation overall (Decker et al., 2016; Hathaway & Litan, 2014), research focused on venture capital and innovation-driven entrepreneurship documents a sizable increase in the funding of growth-oriented entrepreneurial businesses (Gornall & Strebulaev, 2015), and quality-adjusted measures of new business formation that capture the likelihood that a startup is innovation-driven appear to follow a cyclical pattern sensitive to economic and capital market conditions (Guzman & Stern, 2020). Put differently, different definitions of entrepreneurship lead to different conclusions about the rate of entrepreneurship activity in the economy.

As researchers increasingly turn their focus to the topic of entrepreneurial activity, it is ever more important that we distinguish between the varying types of entrepreneurial activity and their different dynamics and needs. This survey takes this as a starting point, emphasizing the known

[1] Consistent with these findings, related work by Acemoglu and Cao (2015) shows that in innovation intensive sectors, young firms are also the most innovation intensive.

and unknown regarding innovation-driven entrepreneurship, and where further study could shed critical light.

Much of the economics literature in entrepreneurship, however, confounds multiple of the above categories of entrepreneurial activity. As a result, we often know less than we think we do about the specific mechanisms at work in the entrepreneurial production function of each of these groups. This survey aims to solidify what we know regarding the innovation-driven entrepreneurship that is so critical to future economic growth, while highlighting gaps and areas of particular interest for future research.

2. Types of Entrepreneurship

We begin by describing the distinction between the various types of entrepreneurship that have been studied in the economics literature. Definitions of entrepreneurs in economic theory vary from individuals who take economic risks (Knight, 1921; Kihlstrom & Laffont, 1979), to those who innovate and render older technologies obsolete (Schumpeter 1942), to those who assemble human, physical and information resources in an efficient manner (Lazear 2004). Policy-makers and practitioners often define entrepreneurs as those who set up a business and take on financial risks in the hope of profit, consistent with the view of entrepreneurs as job creators and drivers of economic growth. In the popular press, the image of the entrepreneur is often tied to the process of technological innovation that drives economic growth.

Certainly, many activities can be reasonably labeled as entrepreneurship, from creation of a new product or service line to establishment of a new company to self-employment. The types of entrepreneurship studied in the economics literature can be broadly classified into four buckets. First, a larger literature, primarily in development economics, has explored what we label here as *subsistence entrepreneurs*. Subsistence entrepreneurship has primarily been studied in the context of developing countries but is more generally defined as poverty-driven individual entrepreneurship that provides services in a local community in a variety of manners. Typically, subsistence entrepreneurs are providing for themselves and their families, often at a minimal level, as a substitute for low-wage employment. The typical subsistence entrepreneur has limited alternative employment opportunities. While present in large numbers in many developing economies, such entrepreneurs often have limited spillovers outside their own households. A second category, common to both developed and developing economy, are the self-employed. In

the western world, this category typically includes consultants, ad hoc self-employed doing free-lancing or piece work jobs as a Schedule C activity, lawyers and doctors in private practice, and gig economy workers. Importantly, this category of self-employed typically is not organized for growth or for the purposes of employing others.

While both these categories of entrepreneurial activity are important and influential areas of research that deserve their own coverage, they are distinct from the process of creating an employer business. The remaining two buckets in the entrepreneurship literature, in contrast, study incorporated, employer-based businesses. Most commonly, in much of the entrepreneurship literature, these entrepreneurs are split in two categories: "traditional" business entrepreneurs (TBE), and innovation-driven entrepreneurs (IDE). The distinction between these categories is primarily driven by differences in the level of uncertainty surrounding the type of business being launched.

Entrepreneurs in the "traditional" business category are typically starting businesses that are based on traditional business models and approaches and in existing markets, where probability distributions for outcomes can be well-estimated, and risk profiles are known. These entrepreneurs may, in fact, be oriented towards growth (for example, an entrepreneur starting a chain of cross-fit gyms or Italian restaurants), but in contrast to innovation-driven entrepreneurs, they employ well-understood business models and operate in known markets where risk can be well-assessed. This category of new businesses may also involve incremental improvement on an existing model brought about through learning by doing.

In contrast, entrepreneurs in the final category—innovation-driven entrepreneurship—which this article will focus on, enter into new—often unknown or unproven—markets, and are characterized by high Knightian uncertainty. In other words, the markets, technologies and business models employed by these entrepreneurs are such that the nature and parameterization of the probability distribution of outcomes is entirely unknown. Thus, the definition of these different categories of entrepreneurs is organized around a characterization of risk versus uncertainty, rather than growth intentions. That said, innovation-driven startups, while relatively small in number, have significant potential to be transformative. Entrepreneurs in this category typically do have ambitions and capabilities aligned with scaling a dynamic and growing business, and usually have a strong intent to grow.

2.1. Concretizing the Concept of Innovation-Driven Entrepreneurship

William Gibson, a noted futurist and author, once quipped that "the future is here—it's just unevenly distributed." This aphorism concretizes the core theoretical constructs that have been used to explain innovation: exploration and recombination. Large technical or scientific discoveries are rare, and the full impact of these discoveries can take decades to fully manifest in the economy and society more broadly (Rosenberg 1982; Bresnahan and Trajtenberg 1995). This impact is realized through the creative recombination of these technologies with prior products, technologies, and business models. For example, the computer has existed since 1946; the creation of the internet dates back at least to the creation of TCP/IP in the 1970s; and the world wide web to 1990—yet it was not until 2011 that Marc Andreessen, the founder of Netscape and a well-known venture capitalist, proclaimed that "software is eating the world" (Andreessen 2011). Similarly, new business models or management practices often emerge in specific contexts and industries, only to slowly diffuse across other industries and applications as they are combined with other existing technologies or scientific advances. It is entrepreneurial activity that is based in this process of exploration and recombination that we term innovation-driven entrepreneurship.

Importantly, innovation-driven entrepreneurship does not necessarily require a new high-technological advance per se, but merely a new recombination that produces a new way of conducting a particular type of economic activity. For example, Chipotle Corporation began as a simple taqueria competing in the fast-food industry with a relatively undifferentiated menu of tacos and burritos. With their second store, however, Chipotle began innovating, inventing a novel (for the food industry) assembly line concept that allowed 65,000 unique customizations of their menu. This combinatorics-based assembly line approach allowed a seemingly customized eating experience that both enabled higher prices while also delivering food faster than competitors such as McDonalds or Burger King (Stock and Wong 2015). The assembly line and economies of scope that were critical to this innovative approach are not a new concept; their application in the context of the fast-food industry was the innovation. Chipotle's experiments ran contrary to the received wisdom in the fast food industry and enabled a new niche—fast casual—that straddled fast-food and casual dining (Yohn 2014). A similar story can be found in the application of the assembly line in automobile manufacturing. Ford managers adapted the assembly line operations they observed in the slaughterhouses of the meat-packing industry, realizing that step-wise disassembly of carcasses could be redesigned to enable step-wise assembly of automobiles (Sloan 1963).

Importantly, the nature of IDE startups leads to substantial differences relative to entrepreneurs in the traditional business category and self-employment and subsistence entrepreneurship. These differences manifest across a wide variety of aspects of the entrepreneur and venture, including entrepreneur characteristics, human capital, funding and growth opportunities, competitive dynamics, the nature of the intermediaries they deal with, and ecosystem and policy needs. These differences are often largest in areas where the differences between risk and uncertainty are most important (financing, incentives) and in human capital (innovation versus exploitation). The distinction between categories of entrepreneurs is thus of substantial import—it affects how policy, regulation and entrepreneur support programs should be designed, depending on the type of entrepreneurship the social planner wishes to encourage or support. Yet much of the economic literature to date does not distinguish between these very different types of entrepreneurship. As a result, any survey of the literature needs not only review extant scholarship that touches on entrepreneurship, but also highlight whether and to what extent such research is focused on or pertains to IDE, TBE, or both. This is particularly important as many key data sources, including private census data, do not make such a distinction.

3. Who Enters into Innovation-Driven Entrepreneurship?

The factors that drive entry into innovation-driven entrepreneurial activity are not truly understood as of yet.[2] Presumably, individuals should enter into entrepreneurship only if the utility of entry into entrepreneurship exceeds the utility for wage employment. Many factors may enter into this utility function: entry may happen when an individual expects to earn more from entrepreneurship than from wage employment, and/or when they highly value the non-wage aspects of entrepreneurship. Consistent with this, on the small business side, a substantial body of research argues that the mean entrepreneur earns less than a similar salaried worker (Borjas and Bronars 1989; Evans and Leighton 1989; Hamilton 2000). Other evidence suggest that the returns to entrepreneurial activity are insufficiently high to justify entry into entrepreneurship (Moskowitz

[2] Relatedly, there are still outstanding questions about the optimal-level of entry of innovation-driven firms for stimulating productivity growth and improving social welfare. Building off of canonical micro-founded dynamic macro models (Hopenhayn, 1992; Klette & Kortum, 2004; Lentz & Mortensen, 2008), a burgeoning literature in macro dynamics has begun to give us a deeper understanding of the interplay between industry structure and innovation on productivity growth (Acemoglu et al., 2018), tempering our largely positive view of the role of innovation-driven entrepreneurship on productivity growth and social welfare (Garcia- Macia et al., 2019). While these topics are connected to innovation-driven entrepreneurship, coverage of this large and fast-growing literature falls out of the scope of this review.

and Vissing-Jørgensen 2002; Hall and Woodward 2010), although more recent work has suggested that calculation of return on investment to entrepreneurship is sensitive to the time window used (Kartashova 2014).

As a result, researchers have argued that other elements must play into the decision to start one's own small business, such as non-pecuniary benefits, higher order risk-preferences, and so forth. Indeed, Hurst and Pugsley (2011) find that a large share of US business owners were originally motivated to enter into entrepreneurship for reasons other than money, such as wanting flexible work hours, to be their own boss, or to pursue a passion. Only 32.2% entered because they felt they had a good business idea, and a further 2.2% enter because of lack of other job options. In contrast, Manso (2016) argues that research on the costs of entrepreneurial entry fail to account for the option value of experimenting with new ideas: entering into entrepreneurship may be equivalent to buying a lottery ticket on high wage, and thus, across all ventures might be NPV positive even if most ventures fail and lead to wage reduction and drop out.

Many of the existing studies on entry, however, mix the different types of entrepreneurship, such as small business and innovation driven, and therefore are not straightforward to interpret. If higher risk-aversion is observed across the self-employed and small business owners, it does not necessarily follow that we will observe similar behavioral preferences in innovation-driven entrepreneurs, an incredibly small but important fraction of business owners. To understand who enters into innovation-driven entrepreneurship, in the below we discuss research along two dimensions: structural factors, such as policy and programs, and individual factors, such as behavioral traits and human capital. Although we use this line of demarcation for simplicity, structural and individual factors are highly related and dependent on one another.

3.1. Structural Factors

Knight (1921) argues that bearing risk is one of the essential characteristics of entrepreneurship, and therefore, entrepreneurs must finance themselves and bear the risk of failure. In contrast, (Schumpeter 1942) argues that the role of the entrepreneur is to identify arbitrage opportunities in the economy, and it is the role of the capital markets to find him an investor willing to bear the risks for them. For TBE, the majority of this financial risk is experienced by the entrepreneur. In contrast, for IDE, much of this financial risk is shared by investors. Thus, relaxing some constraints may motivate TBE while relaxing others will motivate IDE, or both. This is

another important reason for research to be explicit regarding the type of entrepreneurship their theory and analysis is informing, or else subsequent policy risks being misguided.

Several leading theories posit that liquidity constraints limit entry into entrepreneurship (see Bernanke and Gertler 1989; Kiyotaki and Moore 1997; Cagetti and De Nardi 2006; Evans and Jovanovic 1989). Consistent with this, considerable research suggests that wealth in general shapes entry into self-employment (Bellon et al. 2020; Evans and Jovanovic 1989; Evans and Leighton 1989; Holtz-Eakin, Joulfaian, and Rosen 1994; Fairlie 1999) and that housing wealth in particular influences both entry into self-employment (Black, Meza, and Jeffreys 1996; Fairlie and Krashinsky 2012; Fort et al. 2013; Corradin and Popov 2015; Schmalz, Sraer, and Thesmar 2017) and employment in small firms (Adelino, Schoar, and Severino 2015). For small and traditional businesses, however, Hurst and Lusardi (2004) show that the propensity to become a business owner is a nonlinear function of wealth: the relationship between wealth and entry into entrepreneurship is essentially flat over the majority of the wealth distribution, and it is only at the top of the wealth distribution—after the ninety-fifth percentile—that a positive relationship can be found. In terms of debt, Krishnan and Wang (2018) find that students loan debt decreases the likelihood of entrepreneurship—$10,000 of student debt lowers rate of entrepreneurship by 7 percent relative to $0 of debt—with the largest effect for IDE.

In a similar manner, declining costs of becoming an entrepreneur may also motivate entrepreneurial entry. A significant barrier to entry for IDE relates to the increased cost of material and labor. From a material perspective, Ewens, Nanda, and Rhodes-Kropf (2018) document that the costs of starting a new software business have fallen dramatically due to cloud computing, and that, as a result, resource requirements to assess market receptivity have been reduced significantly. Relatedly there has been a robust line of work analyzing entrepreneurship subsidies around the world: Baumgartner and Caliendo (2008), Caliendo and Kritikos (2010), and Pfeiffer and Reize (2000), for Germany; Wadensjö and Andersson (2007), for Sweden; Monte and Scalera (2001), for Italy; Meager, Bates, and Cowling (2003), for UK; Cueto and Mato (2006), for Spain; and Ejrnaes and Hochguertel (2008), for Denmark.

Researchers have recently taken advantage of policy changes at the firm and government level to better identify the role of general wealth effects on entrepreneurship, with Lerner (2020) providing a review of government incentives in entrepreneurship. Jensen, Leth-Petersen, and Nanda (2014) find that mortgage reform in Denmark leads to a small increase in the number of

individuals who become entrepreneurs. Here, a $30,000 increase in credit led to a 4 percent increase in the number of entrepreneurs; however, these firms are lower quality. Ferreira et al. (2020) find that a program in Portugal, which allows those on unemployment to collect benefits to start a business, increases entrepreneurship (see also Hombert et al., 2020 for another example of unemployment insurance and entrepreneurship). At the university level, a change in ownership rights—decreasing founder compensation—in Norway led to a significant decrease in the rates of entrepreneurial entry and venture quality (Hvide and Jones 2018). Again, it is prudent to highlight that many of these wealth effects may motivate TBE but not IDE. For example, most founders of IDE would enjoy a $30,000 increase in credit, however, for ventures that rely on millions of dollars of funding this is unlikely to be enough impetus.

In terms of indirect wealth effects, Fairlie, Kapur, and Gates (2011) find that a friction to entrepreneurial entry is employer-provided health insurance. Individuals without health insurance from their spouse are less likely to become entrepreneurs. Further consistent with "entrepreneurship lock," Fairlie, Kapur, and Gates (2011) show that business ownership rates are higher for individuals just over age 65 (who are eligible for Medicare) relative to individuals just under age 65. Other studies in the literature find mixed results, with some estimating that health insurance reduces transitions into self-employed business ownership by as much as 25% and others finding no evidence that health insurance reduces business creation (Holtz-Eakin, Penrod, and Rosen 1996; Currie and Madrian 1999; Bruce, Hotlz-Eakin, and Quinn 2000; Wellington 2001; DeCicca 2007).

Apart from financial factors, researchers have highlighted the role of other structural factors in motivating entrepreneurship, such as economic environment, training programs, peer effects, and employer dynamics. Fairlie (2013) shows that local labor market conditions are a major determinant of entrepreneurship, pooling all types of entrepreneurship. Higher local unemployment rates are found to increase the probability that individuals start businesses. Home ownership and local home values for homeowners are also found to have positive effects on business creation, but these effects are noticeably smaller. Individuals who are initially not employed respond more to high local unemployment rates by starting businesses than wage/salary workers. The results point to a consistent picture – the positive influences of slack in labor markets outweigh the negative influences, resulting in higher levels of business creation.

Relatedly, the availability of career risk protection or a safety net has been found to spur entrepreneurial activity. Gottlieb, Townsend, and Xu (2016) find that extended job-protected maternity leave increased the likelihood of entrepreneurship by 1.9 percentage points across various industries. Barrios, Hochberg, and Yi (2020) show that income fallbacks help encourage entry, using the staggered entry of the gig economy. Here, entrepreneurs are motivated to realize the risk of entrepreneurship knowing that they have another avenue by which to earn an income. Although this has been studied more generally, there is reason to believe that such security could be helpful for both TBE and IDE.

IDE entrepreneurs might also weigh entry based on the competitive dynamics of the industry they might enter. Acquirer market concentration appears affects the propensity to become an entrepreneur, with more fragmented markets leading to more entrepreneurial entry, but of lower quality (Wang 2018). Similarly, platform strategies, which allow incumbents to subsidize competition in one industry with customers in another, lead to substantially reduced entry in the subsidized industry (where prices often are approaching or at zero) (Kamepalli, Rajan, and Zingales 2020). For entrepreneurs entering with patents or other intellectual property rights, conditional on entry, the quality of the patents in more competitive industries are higher (Wang 2020) but the ability of IPR to forestall competition or facilitate acquisition varies substantially across industries (Cohen, Nelson and Walsh 2000; Gans, Hsu, and Stern 2002). Overall, evidence suggests that the greater the ability of incumbents to compete with the potential startup, the less entry is observed, but that the firms that do enter seem more oriented towards acquisition by incumbents.

In terms of entrepreneurship programs, Lyons and Zhang (2017) find that exposure to entrepreneurship training increases the likelihood of subsequent IDE entry. They find that this training is less impactful for individuals who have prior IDE experience and who have access to important resources (e.g., social network). Accelerators play a similar role in helping entrepreneurs learn about the viability of their venture thus resolving the aforementioned Knightian uncertainty (Knight 1921). Supporting this point, Yu (2019) finds that accelerators lead to expedited failure whereby accelerator companies close down earlier and raise less money conditional on closing.

Exposure to peers with entrepreneurial experience has an effect on tendencies to engage in entrepreneurial activity. Using an educational setting, Lerner and Malmendier (2013) find having peers in one's MBA section decreases the rate of subsequent entrepreneurial entry. However,

evidence suggests that this decrease is due to the filtering out of lower quality entrepreneurship ventures. Exposure to workplace peers also has an entry effect. Nanda and Sorensen (2009) find that having co-workers who were entrepreneurs increases the likelihood of subsequent entrepreneurial entry. Hacamo and Kleiner (2019) find in an educational setting that exposure to peers confident in their entrepreneurial ability increases the likelihood of pursuing entrepreneurial entry. This is also the case for children of entrepreneurs, who are more likely to start their own firm (Lindquist, Sol, and Van Praag 2015).

More broad research suggests that social networks are a key resource for entrepreneurial entry and performance. Using Danish registry data, Dahl and Sorenson (2012) show that entrepreneurs—across venture type and industry—that locate in their home region outperform generate more profit and survive longer than entrepreneurs who do not. They contribute some of this outperformance to superior opportunity recognition in an individual's home region (see also Giannetti and Simonov 2009).

The role of firm-level characteristics has also been highlighted. Employees from innovation-driven firms that have spawned more entrepreneurs in the past are more likely to spawn subsequent IDE in the future (Babina 2020; Habib, Hege, and Mella-Barral 2013); these ventures are more likely to get financing (Burton, Sørensen, and Beckman 2002). Gompers, Lerner, and Scharfstein (2005) explore entrepreneurial spawning of innovation-driven ventures from established corporations and find that venture-backed firms are the most likely to spawn entrepreneurs (Babina & Howell 2018) and among these firms that undiversified firms spawn the most subsequent firms.

3.2. Individual Factors

Much of what motivates an individual to enter entrepreneurship has been tied to individual factors from their behavioral traits to the human capital they possess. Behavioral traits and characteristics such as time preferences, risk preferences, risk aversion and ambiguity aversion, are thought to be key contributors to the choice to enter (or not enter) into entrepreneurial activity. (Knight 1921) was the first to focus attention on the specific individuals that engage in entrepreneurial activity and on an understanding of what makes them distinct from non-entrepreneurs. Understanding the traits and preferences that drive entry are important because they provide the basic building blocks that allow us to further expand theory in this area. This is particularly important in light of the ever-growing findings that for most entrepreneurial activity,

individuals who choose to enter do so despite the fact that can expect to earn low risk-adjusted returns (Astebro et al. 2014; Hamilton 2000). In terms of overview, Kerr, Kerr, and Xu (2018) provide an extensive review of research in economics, psychology, and sociology literature on the personality traits that entrepreneurs possess and how some differ from non-entrepreneurs (see also Sauermann 2017 for an example of employee motivates in IDE versus established firms).

Much of the literature to date focuses on small business entrepreneurs. Levine and Rubinstein (2017) document that smart and illicit (risk-taking) tendencies as youth predict entry into self-employment/small business. Puri and Robinson (2013) use data from the Survey of Consumer Finance to measure and isolate the enjoyment of private benefits, attitudes toward risk, and optimism for these groups. They find that small business entrepreneurs are more optimistic and enjoy the nonpecuniary benefits of work more than wage earners. Small business entrepreneurs embrace risk, but perhaps less so than commonly believed, as their risk-bearing is tempered by longer planning horizons. Guiso and Paiella (2008) use household data to construct measures of risk aversion and find that moving from the 10th to the 90th percentile of the distribution of risk aversion lowers the probability of being self-employed by 19% of the sample mean, and that of being an entrepreneur by 13%. Andersen and Nielsen (2012) show in sample of Danish entrepreneurs that small business entrepreneurs are no more or less risk averse than the general population, but that they have an S-shaped probability weighting function: they overweight the probability of big success and underweight the probability of big failure. Moskowitz and Vissing-Jørgensen (2002) posit that higher order risk preferences may provide one (of many) possible explanation for their private equity premium puzzle—entrepreneurs may have a preference for skewness.

Other traits that have been less explored in the context of entrepreneurial entry are ambiguity aversion and overconfidence (Bernardo & Welch, 2001; Camerer & Lovallo, 1999; Galasso & Simcoe, 2011; Landier & Thesmar, 2009; Malmendier & Tate, 2005). Astebro et al. (2014) provide an excellent survey on the topic of behavioral inputs into the decision to engage in entrepreneurial activity. They present three candidate explanations for understanding the empirical facts related to entry into entrepreneurial activity. None, however, can completely account for the patterns of low returns observed by prior studies. As Astebro et al. (2014) note, understanding whether the pattern of entry we observe are driven by behavioral biases versus preferences we can easily model is important for the social planner when considering policies to promote entrepreneurial activity.

Research has also shown how behavioral traits can be at odds for founders and the implications of this. For example, Wasserman (2017) details the "rich versus king" trade-off that entrepreneurs must make and the implications of these desires being at odds. Founders can strive towards increasing value at all costs, such as allowing themselves to be replaced on the leadership team (rich) or strive towards cementing their position as a leader at the firm at the expenses of value creation (king). However, fully maximizing both dimensions is often too difficult.

While behavioral traits are likely to be a factor in entry for both traditional business and innovation-driven entrepreneurship, human capital may play a particularly strong role in entry into entrepreneurship. Self-employed individuals are similar to wage employees in terms of general skills and educational attainment (Fairlie 2002) however, entrepreneurs seemingly have a wide breadth of human capital (Lazear 2004). Several leading theories emphasize that entrepreneurs have unique human capital traits—including creativity, analytical skills, education, and managerial acumen (Schumpeter, 1942; Lucas, 1978; Hvide & Oyer, 2018; Kihlstrom & Laffont, 1979; Evans & Jovanovic, 1989; Baumol, 1968; Murphy et al., 1991; Gennaioli et al., 2013). Entrepreneurs are highly remunerated for these scarce skills and for the additional risks associated with entrepreneurial endeavors (Lucas 1978; Kihlstrom and Laffont 1979).

This has led to an influential discussion that entrepreneurs must be "jacks-of-all-trades," possessing a wide breadth of human capital, instead of specialists whose skills are more narrowly focused (Lazear 2004). Accordingly, and in terms of IDE, Åstebro and Thompson (2011) find that inventor entrepreneurs have more varied work experience. More generally, Levine and Rubinstein (2017) show that incorporated businesses perform activities that demand strong non-routine cognitive skills, such as creativity, analytical flexibility, and generalized problem solving (see also Bernstein et al. 2018). Moreover, incorporated businesses utilize complex interpersonal communications that are associated with managing and persuading. Burton, Sørensen, and Beckman (2002) that those with jobs that are less innovative (sales, finance) are less likely to pursue an IDE. These findings contrast starkly with the activities of non-incorporated self-employed individuals, who tend to engage in activities that require relatively low levels of cognitive skills (Levine and Rubinstein 2017). The incorporated small business owner tends to be more educated and scored higher on learning aptitude tests as a teenager. When IDE entrepreneurs are involved, education is even more important: Burton, Sørensen, and Beckman (2002) find that individuals with advanced degrees are more likely to pursue IDE startups.

More generally, this link between human capital and entry into entrepreneurship has been well established (e.g., Campbell et al. 2012; Dobrev and Barnett 2005; Elfenbein, Hamilton, and Zenger 2010; Groysberg and Lee 2009; Hurst and Lusardi 2004; Nanda and Sorensen 2009). Along these lines researchers have demonstrated that extracting rents from superior human capital can motivate entrepreneurship. Carnahan et al. (2012) find that in the legal profession high performers are the least to leave their firm; however, conditional on leaving the highest performers are the most likely to enter entrepreneurship (see also Groysberg and Lee (2009). In addition to general human capital, entrepreneurs can bring ideas and intellectual property that are unused or underutilized in incumbent firms into their new ventures, a phenomenon commonly referred to as spin-outs or spinoffs (Klepper 2007; Klepper & Sleeper 2005). The human capital needed also differs depending on the type of entrepreneurship. Levine and Rubinstein (2017) show that business owners from incorporated businesses perform activities that demand strong non-routine cognitive skills, such as generalized problem solving, utilize complex interpersonal communications that are associated with managing and persuading, and are more educated relative to the business owners of unincorporated businesses.

In terms of other individual characteristics, researchers have focused on the relationship between age and entrepreneurial entry leading to some conflicting results. In terms of entrepreneurial entry favoring younger individuals, researchers have put forth models related to occupational choice which imply that individuals will try riskier occupations, such as entrepreneurship when they are younger (Johnson, 1978; Jovanovic 1979; Miller 1984). Consistent with this, Liang, Wang, and Lazear (2018) document that a standard deviation decrease in the average age of a country leads to 2.5 percentage points more entrepreneurship.[3] These papers contrast with empirical findings by Evans and Leighton (1989), who show that the hazard of entry into self-employment is constant in age. In terms of entrepreneurial entry favoring the older individuals, Azoulay et al. (2020) study data from the U.S. Census, and in terms of general entrepreneurship they find that founders tend to be older. Among the fastest growing companies the average founder age is 45 years old. Finally, although serial entrepreneurship has received little

[3] The aging of the U.S. population may in fact be a driver of the documented secular decline in new business formation.

attention, especially for IDE, there is some broad evidence that prior entrepreneurship experience is correlated with subsequent entrepreneurial activity (Lafontaine and Shaw 2016).

4. Strategic Choices

The canonical entry models for entrepreneurship (e.g. Blanchflower and Oswald 1998; Evans and Jovanovic 1989; Evans and Leighton 1989; Hamilton 2000; Hurst and Lusardi 2004; Levine and Rubinstein 2017; Sørensen 2007) posit that an entrepreneur is endowed with a new idea for a given industry and a certain level of productivity that enables her to successfully sustain competition (or not) in this industry. These benchmark models of entry raise a number of questions about the strategies chosen by entrepreneurs in their quest to enter into an industry and attempt to grow and thrive: How do entrepreneurs choose the industry or location they will enter? What is the relationship between new firms and incumbents? And how do new firms acquire the resources they require to compete? Further complicating these strategic choices is the fact that entrepreneurs have imperfect information and limited resources to use in order to discern which choice is "correct" (Gans, Stern, and Agrawal 2020).

One of the most parsimonious definitions of entrepreneurship is "the pursuit of opportunity in advance of resources" (Stevenson and Jarillo 1990), and new IDE ventures are typically resource-constrained. Given these constraints, "the central strategic challenge for an entrepreneur is how to choose" (Gans, Stern, and Wu 2019). The choices faced by entrepreneurs encompass many key areas, including with whom and in what manner they will compete and collaborate, how the product (or service) will be commercialized, which customers will be served, and where to locate the firm. These strategic choices are critical to an entrepreneur's ability to create value, as a high-quality idea that is commercialized inefficiently or targeted to the wrong customer will underperform. Resolving the uncertainties associated with these strategic choices can help an entrepreneur maximize their likelihood of success (Knight, 1921; Kihlstrom & Laffont, 1979; O'Brien et al., 2003).

4.1. Competition versus Collaboration

As new ideas and technical capabilities are created across the economy through research and development from companies and universities, the applicability of these new-to-the-world recipes and awareness of them varies across firms depending on their position in the economy (Griliches

1992; Bloom, Schankerman, and Van Reenen 2013). Spillovers from these R&D processes create new opportunities for new entrants: incumbent firms do not take advantage of all the new opportunities that arise (Henderson 1993), and their capacity to do so seems to vary by the size of the firm (Aghion et al. 2014; Akcigit and Kerr 2018). While firms can contract over ideas through intellectual property rights (IPR), which allows cooperation between incumbents and entrants, as an alternative to creative destruction (Arora and Gambardella 2010), this does not diminish the role of new entry in these accounts. Rather, a nuanced view of the role of entrepreneurs suggests that there can be excess entry and excess creative destruction, yielding not only productivity growth, but also dissipation of resources through duplication of effort (Aghion et al. 2005).

There is a clear distinction between TBE and IDE in the relationship between an entrepreneur and incumbents. For TBE, incumbents pose a direct threat of competition. Take for example, a founder that is starting a new pizza restaurant or patent advising firm. Other proximate incumbents—pizza restaurants or patent attorneys—pose a direct competitive threat to the founder. It is difficult to envision a scenario where these proximate incumbents would offer a direct benefit to these founders. On the other hand, while many IDE founders may view incumbents as direct competition, incumbents can also offer benefits to IDE, and vice versa: new entrants provide both a source of competition and a potential source of value for incumbents through cooperation (Anton and Yao 1995; Christensen 1997; Gans and Stern 2000; Gans and Stern 2003; Hsu 2006; Katz and Shapiro 1987; Lerner 1997; Reinganum 1983; Teece 1986).

One key benefit of cooperation is increasing immediate returns. Botelho (2018) provides evidence that in the face of costs related to loss of competitive advantage, investment professionals act entrepreneurially by cooperating with their competition. Specifically, they engage in detailed knowledge sharing in an effort to solve their own resource constraints, which leads to performance increases. Another benefit of cooperation is that it delays the costs of competition (Gans et al. 2002). Navis and Glynn (2010) in their study of Sirius and XM in the US satellite radio market, find that both the new entrant (Sirius) and the incumbent (XM) focused their efforts on legitimizing the new industry rather than directly competing. It was not until the market matured that the firms engaged in direct competition and between-firm differentiation. Hsu (2006) finds that stakeholders can also increase the likelihood of cooperation, with VC-backed startups engaging in more cooperative behavior than startups that were not VC-backed. Startups may also engage in a multifaceted strategy with regards to cooperating with incumbents, choosing to first compete

against incumbents and then subsequently cooperate once costs and uncertainty have decreased (Marx, Gans, and Hsu 2014).

The choice to compete or cooperate with incumbents can exist even for the same underlying product or service. Gans, Scott, and Stern (2018) discuss the innovation of online groceries through the case of Peapod versus Webvan. From the consumer standpoint, both companies offered the same service: online grocery shopping, delivered to the home. Peapod chose the strategic path of treating online groceries as a way to enhance the value of the existing assets of grocery store incumbents (e.g., physical retail space, lower cost labor), offering a value-added service that allowed grocery stores to service online clients through delivery. Webvan, in contrast, viewed online groceries as a disruptive innovation which would upend incumbents (Christensen 1997), and positioned themselves as an integrated substitute for the grocery store value chain, building their own supply chain and warehouses to service online orders, with the intention of competing directly against incumbent brick and mortar retailers. Both startups leveraged the internet to create value for their customers, but in very different manner. The example underscores the power of recombination for economic growth (Weitzman 1998). Each strategic direction had its merits, but in the short-term, Peapod's strategic choice was superior. While Webvan failed, a significant amount of its IP and automation knowhow was sold to Amazon, and has underlined much of Amazon's innovative capacity (Barr 2013). Amazon has recently successfully implemented Webvan's concept of online grocery delivery, underscoring the importance of timing.

The role of hard to reproduce complementary assets appears to structure the degree to which new entrants pose an immediate threat to incumbents in a particular market (Teece 1986). For many incumbents, the control of sales channels, critical IP, and key inputs ensures that they are able to protect their most profitable products (and often customers) from new entrants. Depending upon the existing assets of the incumbent firm versus the startup, and the incentive effects of ownership to the startup founders, an innovative idea might be worth more to an incumbent firm than to a startup (Teece 1986; Aghion and Tirole 1994). This creates the potential for bargaining between incumbents and new entrants in the form of investment, partnerships, alliances, etc. This can be seen most strongly in industries such as pharmaceuticals, where the required regulatory infrastructure and expertise is costly (in time and money) to develop. In the face of limited patent life, new biotech firms often choose to license their IP to established players for clinical development. Gans, Hsu, and Stern (2008) discuss the uncertainty related to the scope and degree

of IP rights will facilitate cooperation and the sharing of knowledge within an industry (e.g. Hoberg et al. 2018).

A similar line of work that has been used to inform our thinking on competition versus collaborating is research on strategic alliances and joint ventures. Much of this work is in the field of management and discusses this tradeoff in a more general sense (e.g., Chesbrough 2003; Koza and Lewin 1998; Mowery, Oxley, and Silverman 1996; Schilling and Phelps 2007; Teece 1986). Much of the work described above would fit under the general umbrella of strategic alliances or joint ventures. However, our focus on this research is due to the subject matter being more directly related to the decision between competition and cooperation for new firms.

4.2. Product Markets versus the Market for Ideas

Related to the above decision between competing and cooperating, IDE entrepreneurs must choose whether to compete in the traditional product market, or whether to compete in the market for ideas (Teece 1986; Arora et al. 2001; Winter 1984). Whether an entrepreneur enters the product market versus the market for ideas appears to depend on many factors, such as competition in the market (Arora, Fosfuri, and Gambardella 2001), regulations (Chatterji and Fabrizio 2016), control of intellectual property (Gans et al. 2002; Gilbert and Newbery 1982; Salant 1984), and the ability to contract (Arora, Fosfuri, and Gambardella 2001; Arora and Gambardella 2010). Furthermore, this decision has the potential to affect other strategic choices, such as the human capital, team, and financing needed.

In the product market, an entrepreneur creates a product or a service with the goal of marketing and selling that product or service directly to a customer base. For example, consider Tesla, a company that is attempting to revolutionize the automobile industry. While their approach relies significantly on cutting edge technology and innovations, their end goal is to compete against incumbent automobile manufacturers in the product market. This is the modal strategic choice for both IDE and SBE. As a result, from a research perspective, much of the research on entrepreneurship is concerned with entrepreneurship in the product market.

In contrast, competing in the market for ideas consists of developing an idea, knowledge or technology, which is sold or licensed to an incumbent firm that then commercializes and sells that technology (Teece 1986; Arora, Fosfuri, and Gambardella 2001). Relative to the product market, entrepreneurship through the market for idea is less common (Gans and Stern 2010) . An example

of a startup entering the market for ideas is Qualcomm. In its early days, Qualcomm's strategy consisted primarily of conducting research and development that would then be licensed and used by other firms. Institutions, in particular those related to control of intellectual property, such as patents, play a key role in intermediation of relationships between startups and established firms in the market for ideas (Gans, Hsu, and Stern 2008). More broadly, intellectual property rights allow a broad range of relationships between IDE firms and incumbents ranging from competition, investment, and cooperation. Alliances and investment by incumbent firms into research intensive startups is common across many industries and has been especially well-studied in areas like biotechnology where intellectual property rights allow a more fulsome development of the marketplace for ideas (Cohen, Nelson, and Walsh 2000; Walsh, Cohen, and Cho 2007; Arora, Fosfuri, and Gambardella 2001; Arora and Gambardella 2010).

4.3. Location

Another key strategic choice an entrepreneur must make is where they will locate their new venture. The factors influencing and implications of this choice of new venture location has been of great interest to researchers. For TBE, this choice is usually predicated on the market or customer the entrepreneur wants to serve. TBE opportunities are often linked to a given location, such as a desire to serve a given region. TBE often found their business near where they live, which is usually close to where they were born (Michelacci and Silva 2007). In contrast, IDE entrepreneurs can often choose to locate anywhere, and still serve their intended market. As certain locales or ecosystems provide specific resources that can help entrepreneurs maximize their likelihood of success, location for IDE venture becomes an extremely salient strategic choice.

There has been considerable discussion in the literature regarding the benefits of ecosystem/location choices for entrepreneurs (Krugman 1991; Saxenian 1994; Carroll and Wade 1991; Hannan and Caroll 1992; Ingram and Inman 1996; Sorenson and Audia 2000; Ellison and Glaeser 1999). In this context, a large literature has focused on agglomeration and its benefits. To an extent, coordination among new ventures on location choices exists, often due to "natural advantages." Firms in the U.S. wine industry, for example, are mostly located in states where wine-quality grape growing is prevalent, due to the cost advantages of being located near raw materials (Ellison and Glaeser 1999). A substantial proportion of agglomeration of new ventures, however, cannot be explained by natural resource advantages of this sort (Ellison and Glaeser 1999). Rather,

the key resources provided to entrepreneurs by location include access to similar entrepreneurs for the purpose of knowledge sharing and social networks (Chinitz 1961; Sorenson and Audia 2000; Michelacci and Silva 2007; Dahl and Sorenson 2010), supply of capital (Sorenson and Stuart 2001; Hsu 2006), supply of specialized human capital (Florida 2005; Glaeser and Kerr 2010; Saxenian 1994; Jara-Figueroa et al. 2018), and research and development (Agrawal and Goldfarb 2008; Delgado, Porter, and Stern 2014).

While firms face stronger competition from their local competitors, leading to a higher likelihood of failure (Carroll and Wade 1991; Hannan and Caroll 1992; Ingram and Inman 1996), geographical agglomeration of similar firms is still quite common (Krugman 1991; Saxenian 1994). Entrepreneurs are often willing to incur these costs in order to extract benefits from agglomeration. These benefits, in fact, may extend beyond the entrepreneurs themselves to their founding teams and employees, who are more likely to remain in the industry in the startup fails if there are more geographically proximate competitors, thus preventing a brain drain from the industry (Botelho and Marx 2020)

The benefits of agglomeration differ across IDE and TBE. For many TBE, a proximate competitor is a key reason to avoid starting their company in that locale. For example, a corner grocery or consulting practice may benefit from being a unique offering in an area, as the availability of proximate substitutes may cannibalize the venture's revenue, and there are often little compensating benefits to proximity to similar ventures. In contrast, while IDE also face stronger competition from local competitors (Carroll and Wade 1991; Hannan and Caroll 1992; Ingram and Inman 1996), in many cases these benefits outweigh the costs.

A key question for researchers is whether locations truly offer entrepreneurs these benefits, or whether it is simply the case that specific locations spawn better entrepreneurs and new ventures. Here too, the evidence for IDE versus TBE differs. Research focused on employment, profit and survival has often found negative performance implications to migration of a business. These studies, conducted with European data (Italy, Denmark) that includes entrepreneurship of all types, find that firms created by those local to a region are more valuable (Michelacci and Silva 2007), and that home-based entrepreneurs outperform nonlocals. In contrast, Guzman (2019), using U.S. data, finds that IDE ventures that start in one location but migrate to Silicon Valley have superior outcomes, substantially increasing their likelihood of a high-growth outcome (IPO).

4.4. Ramifications of Strategic Choices

A natural question for entrepreneurs, particularly in times of underperformance, is whether they made the correct strategic choices. *Would the same venture have done better in a sparser locale relative to a denser locale? Would the entrepreneur have been better off selling idea versus implementing it?* This is a challenging question to answer given that it is particularly difficult to gather data on failed firms in order to understand which choices they made. While strategic choices appear to be consequential, affecting both the likelihood that an entrepreneur succeeds and the resources they pursue, these strategic choices can be changed over time. In fact, a popular viewpoint in the literature is that entrepreneurship is a type of experimentation (Alvarez, Barney, and Anderson 2012; Kerr, Nanda, and Rhodes-Kropf 2014; Gans, Stern, and Agrawal 2020). Experimentation is also a core feature of the popular Lean Startup methodology (Ries 2011). Research on pivoting or strategic switchbacks has demonstrated that many of these choices can be changed when entrepreneurs receive signals that their current strategic positioning is not working (Marx and Hsu 2015) . This work extends research that has focused on how the external environment affects an entrepreneur's commercialization strategy (e.g. Gans et al. 2002; Gans and Stern 2003) to show that factors internal to the firm also have consequences.

5. Teams, Incentives and Internal Organization

Another area whether IDE ventures differ from TBE is in the nature of the teams that found and manage the business. As IDE firms typically pursue ventures that differ intrinsically from TBE—as discussed above—it is no surprise that the teams that found and manage the business, and the internal structures set up to incentivize them, differ accordingly. Much of TBE ventures are sole proprietorships, having only one founder, or are partnerships who share common resources (e.g., law firms). Conversely, as Schumpeter (1942:132) noted, "technological progress is increasingly becoming the business of teams of trained specialists," and thus IDE ventures commonly have multiple founders. Founders of IDE versus TBE also typically differ in their skillsets and educational background.

Anecdotally, teams play a significant role in success, for example, in data collected on 1,100 tech companies and related to the causes of venture failure "not the right team" was listed as the number three most common reason for failure by 101 ventures that failed (CB Insights 2018). Venture capitalists report focusing on a venture's team and attribute a venture's failure and success more to the team than the business (Gompers et al. 2020). Earlier stage investors are particularly

focused on the founding team: Bernstein, Korteweg, and Laws (2017) execute a field experiment on AngelList where they measure investor interest in a venture and manipulated information related to a venture's current investors, founding teams, and market traction. They find that most significant focus of these investors were the founding team.

While the discussion of teams and team dynamics seems integral to the study of entrepreneurship, researchers have not dedicated extensive effort to studying the role of teams in entrepreneurship—broadly defined—and most research has been done outside of economics: in management, psychology, and sociology. This work has discussed that a benefit of teams (in and out of the entrepreneurship context) is joint problem solving, increased trust, and improved knowledge sharing (Ahuja 2000; Aldrich and Zimmer 1986; Uzzi 1997; Vedres and Stark 2010). A major roadblock to completing research on teams in the context of entrepreneurship is that founding team choice and composition is an endogenous process. Moreover, the lack of comprehensive or representative databases on founding teams, non-founder managers, and their backgrounds and demographics hamper empirical research outside the lab. Finally, we most often observe successful teams, as data on failed ventures is difficult to collect and analyze (cf. Botelho and Chang 2019; Botelho and Marx 2020).

5.1. Performance and Composition

A first-order question in the discussion of entrepreneurship and teams is whether teams lead to better entrepreneurial outcomes relative to ventures that are solo founded. An analysis from the 10 Year Project demonstrates that in their data of over 300 IDE companies, founding teams outperform solo founders by 163 percent and the seed valuations of solo founder ventures were 25 percent lower relative to ventures with more than one founder. In a study of IDE in Canada, Åstebro and Serrano (2015) find that after controlling for selection into teams having multiple founders doubles the likelihood of commercialization and increases expected revenue by 29 percent relative to having a solo founder. However, this team preference may not be constant for all types of entrepreneurship. In a study of crowdfunding, Greenberg and Mollick (2018) find that ventures from solo founders outperform team founders and survive longer. However, while some IDE ventures seek crowdfunding (e.g., Oculus VR), the modal venture on crowdfunding ventures would not be classified as such and would be more appropriately discussed as a TBE venture.

Conditional on a founding team being present, the next relevant question relates to the composition of founding teams. The success of innovation-driven ventures relies on members of the venture possessing a broad and balanced skillset. For example, the ability to assess and complete technical assignments, communicating with clients, managing diverse teams, promoting the venture's offering, and raising funds. Therefore, researchers have highlighted that a benefit of teams is the ability to combined complementary skills (Haeussler and Sauermann 2015; Roach and Sauermann 2015). Teams have been found to offer benefits: joint problem solving, increased trust, and improved knowledge sharing in research on entrepreneurial teams and innovation teams more generally (Ahuja 2000; Aldrich and Zimmer 1986). More generally, teams have been found to make better decisions than individuals. Charness and Sutter (2012) find in a laboratory setting that teams make less biased decisions than individuals and that teams are more cognitively sophisticated than individuals.

A benefit of larger founding teams is the ability to bring in complementary skill sets, larger stock of human and social capital, as well as share the workload (cf. Venugopal and Yerramilli 2019). All else equal we should expect a founding team of four members to have a larger social network and thus access to greater resources than if any one of these founders started a venture alone. Similarly, larger teams should have at least as much human capital as smaller teams. A broader set of skills has been tied to improved outcomes in the domain of crowdfunding (Jiang et al. 2020). However, these benefits may come at the cost of increasing coordination costs and accounting for heterogeneous preferences. For example, Eesley et al. (2014) show that the alignment between founding-team composition and commercialization strategy is consequential. Thus, as team size increases, we should expect diminishing return. Although there has not been much research in this area, Shrivastava and Tamvada (2011) examine this relationship and find an inverted-U shape between firm size and firm performance—with a peak at three founding team members—using data on 5,000 ventures from the Kauffman foundation.

A common characteristic related to the composition of founding teams is homophily along founder characteristics (Ruef, Aldrich, and Carter 2003; Gompers, Huang, and Wang 2017) . One key reason that homophily is common is that many founding teams are based on prior relationships. Specifically, friendship, work, or familial ties connect many members of a founding team. Using data from the Panel Study of Entrepreneurial Dynamics (PSED), which includes all types of entrepreneurship, Ruef (2010) finds that over half of ventures that have a team include a couple

that is either married or cohabitating. He further finds that around 15 percent of teams include other family members and 20 percent include other friends or associates. Although scholars have called for a better understanding of how these relationships, such as familial ties (Aldrich and Cliff 2003), affect entrepreneurship, to our knowledge no study presents a rigorous examination of how the prior relationships of founding team members affects entrepreneurial outcomes—for innovative-driven ventures or otherwise. In terms of performance, research in sociology has provided some evidence that founding team diversity increases firm performance (Beckman, Burton, and O'Reilly 2007; Ruef, Aldrich, and Carter 2003).

5.2. Incentives and Structure

An important area for studying entrepreneurial outcomes and for entrepreneurs is incentivizing founding team members. More generally, it is important to understand how to optimally structure a contract and expectations among founding team members. More practically, many founders enter into what is called a founders' agreements, which can vary from simple discussing the vesting schedule of founder equity, to complex outlining various provisions that every founder is legally bound to. For example, a founders' agreement may discuss "carry-along right," which specifies that majority shareholders can force minority shareholders to sell their shares when a fair offer for the venture is presented. (Hellmann and Thiele 2015) develop theory regarding various issues related to contracting among founders and Ewens, Nanda, and Stanton (2020) discuss contracting of founder-CEO compensation in VC-backed ventures (see also Aghion and Tirole 1994 for a discussion on contracting innovation as well as Gans and Stern 2000 and Gans et al. 2002).

Along these lines, a key area for discussion for all founding team members is the relative value they will extract from the firm, often formalized through splitting the venture's equity (Ashbrook 2000). There are no guidelines regarding how to split a venture's equity with founders agreeing to a "fair" split, making the process more of an art than a science. Although this decision is consequential, researchers have not spent much timing understanding what leads to observed equity splits or how these splits incentivize subsequent founder action affecting venture outcomes. One exception is Hellmann and Wasserman (2016) who model this process and test it using survey data. A difficulty of equity splits is an ability to correctly predict each founder's relative value; moreover, a split that does not allocate equal equity among all founders signifies that some founders may be more valuable than another founder (cf. Fehr and Schmidt 2006; Dawes et al.

2007). While this is rational and true in most cases, it may create issues within the team. For example, Breugst, Patzelt, and Rathgeber (2015) develop a case study of eight teams and find that there is substantial variation in the perceived distributive justice of equity splits across and within teams in their sample. In their survey data of innovation-driven ventures, Hellmann and Wasserman (2016) find that 32 percent of founding teams equally split venture equity and that 42 percent of teams decide on this split within one day. Furthermore, they find that this equal split is correlated with a lower likelihood of raising outside capital. However, the authors argue that these results are not causal and are instead driven by founder selection.

5.3. Succession and Evolution

A venture's founding team evolves over time, and changes to the team, such as a founder being replaced or a founder leaving, may have significant effects for the venture's future performance. There is some disagreement regarding the importance of founders altogether. Research has provided evidence that the venture's idea, especially once the business is more stable, is paramount (Kaplan, Sensoy, and Strömberg 2009; Kulchina and Gjerløv-Juel 2019; Wasserman 2017). Consistently, researchers have documented that founders, especially of IDE ventures, are often replaced (Wasserman 2003; Hellmann and Puri 2002; Chen and Thompson 2015). Hellmann and Puri (2002) document the increased likelihood of founder departure after VC investment. They discuss this effect as "professionalization" because it was associated with higher performance of teams. Furthermore, investors often replace founders. The reasoning for this replacement is varied; it may be due to disagreement on vision, the need for a different skill set, or valuing the idea more than the founder. Ewens and Marx (2017) find that about 20 percent of founders of VC-backed ventures are replaced. While replacement is more common when the venture is struggling, it does lead to better performance in their sample.

There is less evidence that founder replacement has an adverse effect on venture performance, most likely due to the fact that replacement is most logical in the face of underperformance. Bamford, Bruton, and Hinson (2006) offer an exception and in their study of newly formed banks they find that founder exit has a negative effect on subsequent performance. Supporting this adverse effect, some work has analyzed the effect of the unexpected departure of a founding team member (Becker and Hvide 2013; Choi et al. 2019) . Both of these papers analyze the effect of a founder's premature death on firm performance. These studies find that a founder's death has a

persistent effect on venture performance. Furthermore, this effect is consistent across IDE and TBE, and while the effect is stronger when team size is small, a decrease in performance is found when team size is large.

6. Financing

One of the most important issues facing entrepreneurial firms is their ability to access capital to fund their growth and operations. In raising startup capital, new ventures face two fundamental problems that form the basis for much of corporate finance theory: agency problems and information asymmetries. For entrepreneurial firms, however—and particularly for IDE ventures—the magnitude of these two problems is considerably larger than in the typical corporate finance setting. All firms face a menu of options for financing, ranging from non-dilutive debt to various types of equity financing, with standard pecking order theory arguing that debt is most preferable before equity. These seminal models, however, were developed to match the context of financing of traditional business, or larger, established corporations, where risk is relatively quantifiable, markets are known, and collateral can be offered.

For innovation-driven entrepreneurs, who are often commercializing unproven technologies and services, attracting external capital through debt channels can be exceedingly difficult (Leland and Pyle 1977; de Meza and Webb 1987). The market value of IDE start-up companies often rests on intangible assets that are hard to value ex ante and difficult to sell ex post and for which the value can vary substantially across different firms (Fresard, Hoberg, and Phillips 2015). As a result, collateralizing the loan is often impossible for IDE entrepreneurs. Information asymmetries are particularly acute in this setting, exacerbating frictions between lenders and debtors (Leland and Pyle 1977; Stiglitz and Weiss 1981). Even though loans would allow entrepreneurs to avoid costly dilution of ownership stakes, external debt is widely viewed as an unlikely way to fund risky projects in the absence of tangible assets or stable cash flows to secure the loan (Hall and Lerner 2010).

As a result, most IDE efforts are financed through equity. The most well-known type of equity financing provider for IDE startups is venture capital (VC), for which many thorough survey papers have been written (see e.g. Da Rin, Hellmann, and Puri 2013; Lerner and Nanda 2020), and the associated venture debt industry. Over the last decade, however, the price of early stage experimentation in certain types of IDE has fallen significantly (Kerr, Nanda, and Rhodes-Kropf

2014; Ewens, Nanda, and Rhodes-Kropf 2018). This falling cost of experimentation has shifted the allocation of financial and human capital towards smaller, faster, higher-risk projects, and has led to the emergence of new forms of financing and support programs. In financial economics, recent literature has drawn attention to the growing role of angel investors and equity crowdfunding, as well as reward-based crowdfunding platforms and initial coin offerings (ICOs). At the later stage, changes in securities laws and markets have led to the entry of non-traditional investors such as hedge funds and mutual funds, leading startups to raise larger sums of private capital and remain private longer (Gao, Ritter, and Zhu 2013; Ewens & Farre-Mensa 2020).

6.1. Venture Capital

The most prominent source of equity financing for IDE entrepreneurs is Venture Capital (VC). VCs specialize in investment in new ventures characterized by high risk and uncertainty, but also high growth potential (Sahlman 1990).[4] The VC industry plays an outsized role in the economy, with VC-backed firms constituting over 50% initial public offerings on U.S. stock markets (Kaplan and Lerner 2010). Kortum and Lerner (2000) demonstrate a strong association between increased VC funding and patenting, and Samila and Sorenson (2011) document a positive relationship between VC funding, employment and aggregate income. VC-backed startups grow larger and employ more people (Kerr, Nanda, and Rhodes-Kropf 2014; Puri and Zarutskie 2012) . There is an extensive literature on VC financing and on VC firms themselves. Many good surveys exist, so we will not try to be comprehensive, but instead focus on main issues.

VCs are equity investors who in addition to capital provide a range of value-added services to their investments (Sahlman 1990). There are a number of different types of VC organizations. These include independent, financially driven, VC firms, corporate VCs who represent the strategic interests and invest the capital of large corporations, and bank-affiliated VC firms. Much of the literature to date (with some notable exceptions) has focused on traditional independent VCs. VC funds are pools of capital provided primarily by institutional investors, who are typically referred to as Limited Partners (LPs). VC firms, who manage the funds, typically raised VC funds

[4] For a description of the origins of the VC industry and its institutionalization in the 1980s as a result of reductions in the capital gains tax rate and amendments to the Employee Retirement Income Security Act, see e.g. Gompers (1994).

as overlapping dedicated 10-12 year investment vehicles. These funds are typically organized as Limited Partnerships. The VCs who manage the funds are referred to as General Partners. The year in which each fund is raised is denoted its vintage year, and typically the fund has a 3-5 year investment period during which the GPs deploy the capital into a series of startup investments. As the investment period draws to a close, the GPs will typically begin fundraising for their next fund. The remaining years of each fund are spent nurturing the existing investments, funding follow-up rounds, and eventually, exiting the investments through sale or IPO and returning capital to the LPs.

VC firms, and the funds they raise, vary widely in both size and industry and geographic specialization (Gompers et al. 2008; Hochberg and Westerfield 2012; Hochberg, Mazzeo, and McDevitt 2015). Specialization and fund size appear to be substitutes: smaller funds tend to be specialized, while larger funds tend to be more generalist (Hochberg and Westerfield 2010), and specialization serves as a product differentiator for VC funds (Hochberg, Mazzeo, and McDevitt 2015). In addition to the wide variation in fund specialization and size, there is significant heterogeneity in fund returns, with an inter-quartile spread between managers that dwarfs that seen in other asset classes, such as mutual funds. Fund performance within a given VC firm appears to persist over time (Kaplan and Schoar 2005; Hochberg, Ljungqvist, and Vissing-Jørgensen 2013; Harris et al. 2020), suggesting VCs have skill, either in selection of which ventures to invest in, or in adding value to their portfolio companies.

Because innovative technologies and business models suffer from fundamental uncertainty about their commercialization possibilities and chances of success, understanding the potential of IDE ventures requires a sequence of experiments over time, each reducing the risk and uncertainty associated with the venture (Nanda and Rhodes-Kropf 2016; Ewens, Nanda, and Rhodes-Kropf 2018). As a result, investment in IDE ventures is typically done through staged capital commitment, in the form of sequential rounds of financing meant to help the startup company achieve milestones that reduce the riskiness of the venture. If the startup does not achieve the milestones, investors do not need to follow good money with bad. This process is particularly valuable in the IDE setting, where most ventures fail completely (Hall and Woodward 2010). Investing in stages allows the VC investor to learn more about the venture's chances of success and preserve the real option to abandon the venture (Gompers 1995; Cornelli and Yosha 2003; Bergemann and Hege 2005; Fluck and Garrison 2006; Tian 2011).

The terms and contract structures used in venture capital align themselves to the uncertain nature of IDE startups and the staged investment process (Kaplan and Strömberg 2003, 2004). Agency and hold-up problems appear to be important in the design of VC contracts with entrepreneurs, while risk sharing is not (Kaplan and Strömberg 2004). VC financings separately allocate cash flow rights, board right, voting rights, and other control rights, and incorporate contingent contracting features that allocate increased control to the VC investor in the event of poor performance, and to the entrepreneur in the event of good performance (Hellmann 1998; Kaplan and Strömberg 2003). VC contracts further include non-compete and vesting provisions that make it more expensive for the entrepreneur to leave the firm, thus mitigating potential hold-up problems between the entrepreneur and the investor. More generally, VC contracts are structured in a manner that upholds many of the central theories of financial contracting between an investor and an entrepreneur (e.g. Hölmstrom 1979; Lazear 1986; Grossman and Hart 1986; Hart and Moore 1990; Aghion and Bolton 1992; Dewatripont and Tirole 1994; Ewens, Gorbenko, and Korteweg 2019).

Importantly, unlike the arms-length transactions often modeled in the finance literature, VC investors are widely believe to offer more than just capital: VCs are active investors (Bottazzi, Da Rin, and Hellmann 2008) and have been shown to offer value-add in the form of professionalization of startup teams (Hellmann and Puri 2002), time to product market (Hellmann and Puri 2000), monitoring of behavior (Bernstein, Giroud, and Townsend 2016; Tian, Udell, and Yu 2016), board involvement (Lerner 1995; Gompers et al. 2020), improvement of firm governance structures (Hochberg 2011), and active matchmaking between portfolio companies to create strategic alliances (Lindsey 2008). VC's understanding of the uncertain nature of IDE startups and their tolerance for failure allows their portfolio companies to pursue innovation more successfully (Tian and Wang 2011).

Hsu (2004) demonstrates that entrepreneurs are aware of the value-added aspect of VC, and are willing to accept lower valuations in order to have a higher value-added VC, and Nahata (2008) reinforces these findings with evidence that startups backed by higher reputation VCs are more likely to go public. (Sørensen 2007) estimates that approximately 40% of the performance differential between VC and non-VC backed firms is attributable to added value services.

Hochberg, Ljungqvist, and Lu (2007) demonstrate that VCs with better networks are able to add more value to their portfolio companies, with better-networked VCs exhibiting higher

performance both for individual portfolio companies and their overall funds. Hochberg, Ljungqvist, and Lu, however, show that these network benefits also come with costs: regions with strong networks of VCs act as a barrier to entry by new investors, and startups in these areas receive lower valuations in their financing rounds. Networking in VC is important not only for the venture capitalists themselves, however, but also for entrepreneurs, and recent research suggests that some gender differences in VC financing may be driven by differences between male and female entrepreneurs in their proactive networking with VCs (Howell & Nanda 2019).

Networks between venture capital partners and firms are often built through their syndication practices. Rather than investing alone, VCs typically invest in portfolio companies in syndicates, pooling expertise and capital in pursuit of better investment performance (Admati and Pfleiderer 1994; Lerner 1995; Brander, Amit, and Antweiler 2002; Hellmann 2007; Tian 2011; Hochberg, Lindsey, and Westerfield 2015) . In addition to syndication that stems from the desire to combine or trade scarce resources and skills (Hochberg, Lindsey, and Westerfield 2015), other factors also drive syndication patterns, such as educational ties between VCs and ethnic similarity (Bhagwat 2013; Gompers, Mukharlyamov, and Xuan 2016). Factors such as co-ethnicity also drive selection of startups to invest in (Hegde and Tumlinson 2014; Bengtsson and Hsu 2015).

The VC market, much like the equity market itself, is cyclical, and affected by macroeconomic factors (Gompers and Lerner 1998). Hot markets, with large influxes of capital into VC funds, are characterized by "money chasing deals" (Gompers and Lerner 2000). Companies of lower quality can be funded during these hot periods, and valuations rise. The pro-cyclicality of early stage VC investment has implications for innovation more generally, with VC-backed firms producing lower quality innovation during recessions (Howell et al. 2020) In recent years, the large influx of capital into the VC industry, particularly into VC funds that invest in later stage startups, has led to relatively larger investments in a smaller number of firms, as VC firms struggle to scale. This has filtered down and affected the decisions of early stage investors, who have responded by reducing funding to firms that show less early promise (Bernstein et al. 2020).

In addition to private, independent VCs, many large corporations also maintain VC investment arms, to mixed results (Gompers and Lerner 2000; Masulis and Nahata 2009; Chemmanur, Loutskina, and Tian 2014). Corporate VCs often have strategic goals in addition to (or instead of) financial goals, and are frequently acquired by the corporate venture capitalist's parent corporation (Benson and Ziedonis 2010) .

6.2. Venture Debt

While IDE firms generally rely on equity financing, and are often unable to utilize debt markets, there are a few exceptions to the "no debt" rule. The first and foremost of these exceptions is venture debt. Venture loans are typically arm's-length (formal) loans supplied by banks and other for-profit financial institutions to science and technology start-ups. Although technology start-ups and outside debt seem poorly suited for one another in theory, evidence suggests that the venture lending market is surprisingly large and active. Robb and Robinson (2014) report surprisingly high debt reliance by start-ups with external equity owners. Ibrahim (2009) estimates that venture lenders supply roughly $5 billion to start-ups annually. Hochberg, Serrano, and Ziedonis (2018) provide evidence of a large market for venture debt for innovation-driven startups, with venture debt financing tied to the liquidity of the secondary market for the venture's patent portfolio, firm-specificity of the patents, and the presence of existing equity investors, consistent with Holmstrom and Tirole (1997). Venture debt is often used by entrepreneurs to "extend the runway" and delay the need for further equity financing rounds (Hochberg, Serrano, and Ziedonis 2018; Davis et al. 2020).

6.3. Angel Investors and Friends and Family Financing

The second exception to the "no debt" rule is Angel investors and family and friends, who bridge debt and equity and often invest in startup ventures using convertible debt notes that convert to equity upon achievement of certain milestones, such as raising of a significant equity capital round from institutional investors. Angel financing appears to play an important role as a source of entrepreneurial financing (Lindsey & Stein 2019). The literature on angel and friends and family financing is less robust than that for VC, primarily due to relative difficulty in obtaining large representative datasets for analysis. Lee and Persson (2016) provide one of the few treatments of friends and family financing, suggesting that family finance is a poor source of risk capital for entrepreneurs. (Wong 2006; Wong, Bhatia, and Freeman 2009) provides one of the first empirical looks at angel financing. Hellmann and Thiele (2015) examine the interplay between angel and venture financing. Kerr, Lerner, and Schoar (2011) use regression discontinuity methods to assess the effects of angel financing on startups, while Lerner et al. (2017) examine the globalization of angel investing and complementarities between table setting policies and angel investment.

Finally, Bernstein, Korteweg, and Laws (2017) show that angel investors respond most strongly to information about the founding team, rather than product or traction.

6.4. Crowdfunding

Finally, a newer source of financing for IDE entrepreneurs is crowdfunding. Crowdfunding (CF) generally refers to the use of online platforms or intermediaries to solicit funding from a large number of smaller investors, either through pre-sales of product—typically referred to as rewards-based crowdfunding—or through sale of equity stakes. While pre-sale of products has always been allowed, rewards-based CF platforms have made this process simpler, and as a result, rewards-based CF has become almost ubiquitous for startups offering a consumer-based physical product. Kickstarter, IndieGogo and other platforms with open APIs have provided a laboratory for exploring CF in some detail. For consumer-based startups, the attraction of CF lies both in the raising of funds and in the ability to obtain market validation of demand for their product or service, thus mitigating the uncertainty associated with entry into new markets or with new technologies (Tu, Anh, and Thu 2018; Chemla and Tinn, 2019).

Agrawal, Catalini, and Goldfarb (2013) provide an overview of the economics of rewards-based crowdfunding, Mollick (2013) suggests that entrepreneurial quality is assessed in similar manner by both VCs and crowdfunders on rewards-based platforms; these findings are bolstered by those in Mollick and Nanda (2015), who present a random sample of arts projects featured on Kickstarter to a panel of 30 domain experts, finding that CF platforms are at least as good in finding and funding quality projects. Mollick (2013) also finds that the geographic and gender biases exhibited by VCs are somewhat alleviated in rewards-based crowdfunding. Only a small percentage of the projects that utilize rewards-based crowdfunding platforms, however, are IDE startups.

More recently, new legislation has opened the door to equity crowdfunding (also referred to as securities-based CF), which has emerged as an alternative financing vehicle, with mixed success. The SEC promulgated rules for equity CF in 2015; fundraising under regulation CF began in May 2016. In equity CF, startups sell equity stakes in their companies to investors, much as they might to an angel investor or angel syndicate. Brown and Davies (2020) provide a theory model of equity CF. Abrams (2017) explores the relationship between pricing on equity crowdfunding platforms and economic fundamentals, while Ivanov and Knyazeva (2017) explore the roles of

hard and soft information in this market. Agrawal, Galasso, and Oettl (2016), Catalini and Hui (2017), Itenberg and Smith (2017) examine syndicates in equity crowdfunding, and Hellmann, Mostipan , and Vulkan (2019) examine crowdfunding fundraising strategies.

A final form of crowdfunding that has taken form in the last few years with the emergence of blockchain technologies is the initial coin offering (ICO). An ICO enables a blockchain-based startup to raise funds through the sale of cryptographically secured tokens which will in future be used as the sole form of payment for the startup's products or services. An emerging literature on this topic provides descriptive evidence on the nature and scale of the ICO market (Howell, Niessner, and Yermack 2019; Lyandres, Palazzo, and Rabetti 2019), retention of tokens by entrepreneurs (Davydiuk, Rosen, and Gupta 2020), and exploration of the theoretical underpinnings (Lee and Parlour 2019; Bakos and Halaburda 2020).

6.5. Grants and Other Non-Dilutive Financing

In addition to source of private investment capital, IDE entrepreneurs may also access certain source of non-dilutive funding specifically designated to promote innovation and economic growth. Governments across the globe dedicate funding for innovation-driven small businesses. In the U.S., Federal Agencies annually allocate funding to both the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. The SBIR and STTR programs award non-dilutive funding to startups and small businesses across a large range of technology areas, markets, and risk levels (Link and Scott 2010) with the goal of stimulating technological innovation, meeting Federal research and development (R&D) needs, and increasing commercialization of R&D into private sector impact. State-specific noncompetitive matching programs offer some awardees additional funds regardless of their project's quality or content (Lanahan and Feldman 2018). An emerging body of research suggests that the SBIR/STTR awards lead to faster growth (Lerner 2020) and enable the production of new citation-weighted patents by awardee firms (Howell 2017), though the positive performance of awardees appears to be concentrated in regions and industry segments that also exhibit high volumes of venture capital investment (Lerner 2000; Gans and Stern 2003).

A final form of non-dilutive funding for IDE entrepreneurs comes in the form of prizes awarded through venture competitions. In these competitions, early stage startup founders pitch their startup businesses to a panel of expert judges, whose scores determine which ventures will

win monetary (and, sometimes, non-monetary) prizes. In an emerging market setting with random assignment of awards, (McKenzie 2017) finds that that winning leads to greater firm entry, more survival, higher profits and sales, and higher employment. In the U.S. context, Howell (2020) demonstrates that competitions, through certification, can help resolve the very large information problems that exist in new venture finance. Science-based startups appear to be the predominant beneficiaries of such certification (de Rassenfosse and van den Heuvel 2020).

6.6. Late Stage Capital

Finally, one recent emerging trend in IDE entrepreneurial finance has been the emergence of hedge funds, pension funds, mutual funds, sovereign wealth funds, and other non-VC investors as late stage investors in private, venture-backed companies (Kwon, Lowry, and Qian 2019; Ewens & Farre-Mensa, 2020; Chernenko, Lerner, and Zeng 2021). The entry of these financiers, who traditionally did not fund uncertain private growth stage startups, has allowed venture-backed startups to remain privately-owned for longer, and to raise significantly more private capital. This trend, combined with the emergence of global markets, the move towards software and mobile, and the rise in importance of economies-of-scope in winner-take-all global markets (Gao, Ritter, and Zhu 2013), have led to a significant drop in IPO activity in the U.S. and abroad.

7. Fostering Regional Entrepreneurial Activity through Policies and Programs

The final set of literature we discuss relates to the question of how policy makers can act to encourage and support entrepreneurial activity in their local area. Certainly, some regions seem more capable of creating new firms and fostering their growth into high impact companies. The spatial distribution of IDEs with the potential for high growth shows a high degree of concentration. Firms in Silicon Valley account for 48.1% of venture capital allocated in the United States and 18.4% of patents, leading the world in both venture capital investment and the number of "unicorn companies" (Kerr and Robert-Nicoud, 2020) .[5] Even within the Silicon Valley region, high growth firms are remarkably clustered (Kerr and Kominers 2014; Guzman and Stern 2015) and this clustering seems to have a dramatic impact on the productivity of inventive labor (Moretti

[5] A "unicorn" company is an informal designation for a company that has been valued at least at $1 billion dollars by investors.

2019). Interestingly, though many believe that Silicon Valley had high rates of entrepreneurship with its emergence, this remains a matter of debate in the literature, with some work suggesting that rates of entrepreneurship were relatively low at the time Silicon Valley began to emerge (Fairlie and Chatterji 2013).

Silicon Valley and other certain geographic clusters in the U.S. are major engines of economic growth for their states and for the United States more broadly. Increases in venture capital, a key marker for IDE activity in a region, have been shown to increase both employment and aggregate income in a region (Samila and Sorenson 2011). This in part because VC-backed firms grow larger and employ more people on average (Kerr, Nanda, and Rhodes-Kropf 2014; Puri and Zarutskie 2012) and in part due to the existence of wage multipliers for workers in other sectors of the economy in regions with robust IDE-driven growth (Moretti and Thulin 2013). It is not surprising, therefore, that many regions within the United States, as well as governments around the world, have attempted to institute policies and programs to increase the rates of IDEs in an attempt to foster a self-sustaining startup hub. Despite their supposed ex ante promise, however, the success of most government programs has been limited at best (Lerner 2013, 2020).

Of course, Silicon Valley has a plethora of resources that underpin its regional IDE advantage (Kerr and Robert-Nicoud 2020). A natural question is thus what scale of resource accumulation is needed for regional advantages to take hold in a manner similar to Silicon Valley, and whether virtuous cycles can be created at smaller scale through the judicious use of programs and policies to catalyze IDE entry and success. The last two decades have witnessed an explosion of innovative programs, from startup accelerators to pitch competitions and hackathons, that have attempted to intervene in the entrepreneurial process in ways that might impact the rate, direction and success of IDE entrepreneurship (Cohen et al. 2019). Among practitioners, some view these programs as the key to a radical improvement of entrepreneurial ecosystems (Feld 2012) while others doubt that the unique cluster of factors that allow Silicon Valley to flourish can be replicated anywhere else (Graham 2006). We next discuss a number of literatures that explore elements related to the entry of new ideas into the local economy and the formation of entrepreneurial clusters.

7.1. Intellectual Property Policy

Often, IDE serves as the channel through which new ideas and discoveries enter into markets and the economy. New IDE clusters can emerge because of technical or scientific discovery in a

region that can confer upon it a new technological trajectory from which the region can gain an advantage. Examples of this include the pursuit of integrated circuits in Silicon Valley, the assembly line production of automobiles in Detroit, the pursuit of the petrochemical revolution in Cleveland, and the pursuit of biotechnology in San Diego and Boston (Bresnahan, Gambardella, and Saxenian 2001; Kerr and Robert-Nicoud 2020; Lamoreaux, Levenstein, and Sokoloff 2006; Zucker, Darby, and Brewer 1998). In many cases, these new discoveries emerge from research hubs such as universities. The subsequent innovation output from these research centers serves to attract private capital investment to the region to launch new IDE companies, igniting a virtuous cycle of innovation and capital (Hausman, Fehder, and Hochberg 2020; Kortum and Lerner 2000).

Large general-purpose discoveries such as integrated circuits or petrochemicals[6] which open up new technical trajectories are infrequent and difficult to forecast or predict. There are many technical discoveries that fall short of the general-purpose technology standard, however, that may also have dramatic economic impact if properly nurtured. Bringing such ideas out of the lab and into the economy, while a nontrivial task, can potentially be encouraged with appropriate programs and policies.

The literature provides a number of key insights for economists and policy makers as to the effectiveness of programs and policies, but also leaves certain areas less explored. One area that has received considerable attention is intellectual property policy. As much basic research is conducted in universities and research institutes, there has been considerable attention turned to university IP creation. The main channel for the creation of IP inside the university which can be transferred into the economy has been the Bayh-Dole act of 1989. Yet there are substantial variations in the structure of how innovators within universities are rewarded for their work which can impact how much IP is created and how it is leveraged. Moving property rights to universities seems to have a stimulating effect on both IP creation and innovative activity (Mowery et al 2001; Henderson, Jaffe, and Trajtenberg 1998; Sampat and Mowery 2004), although more direct allocation to the actual scientists could potentially reap even more economic rewards (Hvide and Jones 2018). Institutional differences in licensing policies and incentives to professors at the university-level seem to impact the rate of out-licensing and university spin-outs (Lockett and

[6] David (1990) and Brenahan and Trajtenberg (1995) provide early explorations of the concept of General Purpose Technologies. See Bresnahan (2010) for a more current literature review.

Wright 2005; Lach and Schankerman 2008; Belenzon and Schankerman 2009). Interconnections between local industries and universities mean that the location of universities and the nature of their ecosystems matter for their ability to transfer new ideas into the economy (Bikard and Marx 2020; Hausman 2012; Hausman, Fehder, and Hochberg 2020).

Empirically, it is clear that university-level differences in IP policies and location matter for the degree to which their research generates innovative output and intellectual property, but less is understood about translational programs that seek to accelerate the transfer of technology out of the university and into commercial application. Examples of such programs include science parks and the NSF iCorps program. Of these, the science park is the most pervasive type of entrepreneurship program connected to universities. The Stanford Research Park, established by Terman in 1951, is believed to have anchored the growth of Silicon Valley (Moore and Davis 2004). The overall evidence on the impact of these programs, however, is far more modest (Rothaermel and Thursby 2005a, 2005b; Link and Scott 2007). Far less is understood about other programs. The NSF's iCorp Program has received limited attention (Kearney 2019), for example.

7.2. Human Capital Accumulation

A second area that has been explored in the literature relates to the accumulation of human capital in a region. The creation of high growth IDEs has been shown to be systematically related to the accumulation of a specific set of human capital (Lazear 2004b; Baumol 2005). Exposure to certain opportunities during higher education seems to be important; this includes practical experience with engineers (Boudreau and Marx 2019) and introductions to current and former entrepreneurs (Lerner and Malmendier 2013; Eesley and Wang 2017). Some universities have formal programs where alumni entrepreneurs volunteer to provide each other support and guidance; this supply of interest and advice predicts the future success of the venture (Scott, Shu, and Lubynsky 2019). At other universities, this process may happen informally through the cohort structure of certain types of programs (Lerner and Malmendier 2013). Outside of educational institutions, pitch competitions and other programs provide important information to entrepreneurs about the quality of their idea and the potential to improve that idea (Howell 2020), while accelerators provide training, mentorship and support for new entrepreneurs (Cohen and Hochberg 2014; Hochberg 2016; Cohen et al. 2019).

Certain government policies and programs can increase the rate at which individuals with the appropriate human capital endowments can utilize their insights in the formation of new IDE. In particular, much attention has been payed to the role of non-competes in moderating new firm formation and the flow of information between firms more broadly. Qualitatively, Saxenian notes that individuals within Silicon Valley jumped from firm to firm quite promiscuously compared to other regions like route 128 in Boston where the shadow of Digital Equipment Corporation (DEC) loomed large (Saxenian 1996). Quantitative accounts of this effect have supported that the freeing up of technical talent through the non-enforcement of non-competes indeed seems intimately tied to the functioning of Silicon Valley (Fallick, Fleischman, and Rebitzer 2006; Jeffers 2020).

Having new firms that are pursuing new and valuable ideas does not guarantee that those firms will succeed in scaling to a sustainable level, however. Regions can be successful in stimulating the entry of new companies backed by new and innovative ideas and yet be unsuccessful at scaling these companies into large firms capable of fully competing in national and international markets (Guzman and Stern 2020). In innovation-driven entrepreneurship, the recombination of ideas to create potentially valuable economic experiments continues for some time after the initial idea phase. The impact of human capital accumulation is not only on initial entry but also on scaling and growth. The ability to scale, grow, and adapt to opportunities require a deep pool of human capital. For example, Google was founded in 1998 shortly after the creation of PageRank algorithm was invented, yet it was the combination of PageRank with keyword-based advertising through second-price auctions in 2002 that propelled Google's ultimate success, through chance meetings with a potential competitor, Overture, and input from prominent economists in the Silicon Valley (Batelle 2005). While the scale of human capital pooling has figured prominently in broader explanations of entrepreneurial agglomeration (Chatterji, Glaeser, and Kerr 2014) and features prominently in discussions about Silicon Valley's success, we have less understanding in how the depth, breadth and density of human capital in a region impacts the performance and growth of nascent ventures across regions.

Our understanding of the processes by which startups in IDE rich regions are able to leverage the human capital in the area to grow their firms is an area with limited research. There is reason to believe that these processes might look substantially different than those by which other types of entrepreneurial firms grow. Reflecting on the success of Silicon Valley, one of its founding fathers, Gordon Moore, wrote that in Silicon Valley, "scientists and engineers of this particular

economy learned to organize themselves and their businesses differently. . . learning to build firms and markets in ways unique to high-technology products" (Moore and Davis 2004). While qualitative research has suggested that there was an open exchange of ideas and approaches both inside and across firms inside Silicon Valley which stood at odds with other regions (Saxenian 1994; Powell et al. 2005), our ability to characterize these differences in a rigorous economic frame remains limited.

Google's story is but one of thousands in Silicon Valley that suggest that regional advantage is built upon the close proximity of many talented individuals in geographic and social space that allows the recombination of new ideas together into new economic experiments (Liebeskind et al. 1996; Storper and Venables 2004). Even within the broader Silicon Valley, there seem to be pockets of more intense interactions that seem to be driven by the commuting patterns and distribution of existing firms and their technological similarity (Kerr and Kominers 2014). Sociological studies suggest that networks and social capitals between individuals and firms in a region moderate the extent to which the random interactions enabled by regional density can be leveraged into successful startups even when other resources, like venture capital, is available (Powell et al. 1999, 2005; Samila and Sorenson 2017). Interestingly, the effect of targeted interventions like accelerators on their portfolio startups are moderated by the social capital and networks of the startup's founding geography, despite the fact that accelerators are intended to substitute in some ways for the informal and unplanned "collisions" within these entrepreneurial ecosystems (Fehder 2020). Questions remain for future work about the balance of these forces in fostering the types of collisions and cooperation that generate valuable experiments in the economy.

7.3. Incumbent Corporations

Universities are not the only source of new ideas in the economy. Corporations invest substantially in R&D and the knowledge produced from these efforts can lead to innovation within the company that benefits subsequent entrepreneurship in at least two ways. First working within companies at the vanguard of new technologies seems to yield a higher likelihood of starting a high impact firm (Gompers, Lerner, and Scharfstein 2005), and this relationship seems tightly tied to corporate R&D allocation (Babina & Howell 2018). Second, not all new product avenues and innovations are used by incumbents. Spinouts can leverage the ideas and intellectual property that

are unused or underutilized in incumbent corporations as a source of entrepreneurial entry, especially in the early stages of an industry's lifecycle (Klepper 1996; Klepper & Graddy 1990; Klepper & Sleeper 2005). Similarly, there is a strong empirical relationship between the industrial structure of a region in the past and the likelihood of new firm entry and employment in the current period (Glaeser et al. 2014; Hausman, 2020; Klepper 2007, 2010).

Despite these empirical findings, our understanding of the levers available to policy-makers that wish to capture the benefits of the industrial organization in their region or spawning firms is limited at best. Emerging work, however, has begun to explore policies designed to enhance positive relationships and spillovers between established and startup firms. For example, Economic Technological Development Zones in China appear to have produced measurable increases in both IDE and innovation in existing firms (Tian and Xu 2020). These zones and the incentives they provide are targeted toward the development of technology and IDE, and thus are substantially different from other special economic zones for which there are mixed evidence of efficacy (Busso, Gregory, and Kline 2013; Neumark and Kolko 2010). Similarly, for example, the attraction of large plants has been shown to increase regional productivity through spillovers (Greenstone, Hornbeck, and Moretti 2010). There has been limited systematic exploration of the effects of incentives such as tax credits to attract technology firms, however, a practice that has accelerated in recent year, and is perhaps best exemplified by the competition between cities over attracting Tesla's Gigafactory in 2014 and Amazon's HQ2 in 2019 (Soper, Day, and Goldman 2020).

7.4. Funding Availability

Once a discovery and an opportunity are recognized, whether inside a university, corporation or garage, it typically requires early-stage capital to reach the market. Unfortunately for originators of new ideas seeking to create new IDE, venture capitalists and other early-stage investors show a substantial preference for firms near to their headquarters (Chen et al. 2010). The geographic distribution of venture capital and other forms of investment for IDE is highly concentrated. In 2019, Silicon Valley firms received 39% of all U.S. VC allocation, the top three cities received 60%, and the top five received 69% (PwC MoneyTree 2019). Lack of access to capital to grow innovative new companies is frequently cited reason why regions might not have a well-

functioning IDE ecosystem and has been one of the most frequently targeted areas for intervention by policy makers.

One prominent example of such interventions is tax-credit schemes to encourage angel-investing. While these programs do appear to lead to the allocation of more early-stage capital, they do not lead to increases in employment, patenting, or other markers of IDE entrepreneurship (Lindsey & Stein 2019; Denes et al., 2020). The lackluster effect of angel investing programs might be found in the compliance issues surrounding the soliciting and acceptance of money from angel investors (Xu 2020). It also might create incentives for inexperienced investors to enter the early-stage market in ways that be inefficient for the allocation of capital to the best firms (Lerner 2009; Denes et al. 2020). Another avenue favored by policy makers are efforts to attract existing, experienced VC investors to invest in the local region. One of the few programs that has helped stimulate IDE in a region in this manner is the Yozma program in Israel. Yozma provided matching, non-dilutive funds for established venture capitalists that wanted to invest in Israeli high-tech companies, thereby increasing the attractiveness of investments in Israeli firms by increasing the marginal impact of each dollar invested by a VC without impacting their equity stake (Lerner 2009). Finally, other interventions aim to create local VC firms funded by economic development funds provided by the local government. Evidence on the role of government venture capital programs is scant, though programs which focus on joint investment with established venture capitalists appear to succeed in increasing performance of IDE startups in their region more than programs that "go it alone" (Brander, Du, and Hellmann 2015).

While policy makers have often focused on endowing the region exogenously with new sources of capital, more recent work suggests a more effective way to spur new funding availability in a region is to focus on spurring innovative activity itself. Shocks to innovative output in a region appear to spur venture investment and VC activity through the provision of new investment opportunities which draw private capital to the region (Hausman, Fehder, and Hochberg 2020). This can then ignite a virtuous cycle of innovation and capital that serves as a key input into the formation of entrepreneurial clusters (Hausman, Fehder, and Hochberg 2020).

Another path to increasing venture capital investment in a region appears to be the provision of non-dilutive financing grants at the earliest stage of an IDE's development to support translational research needed for successful commercialization and attraction of private market investment capital. In the U.S., grant programs such as the SBIR program have attempted to serve

this role, yet the impact of the SBIR program seems to be mixed. Due to vagaries in the design of the program, SBIR grants seem to be allocated more towards larger, more established small businesses (Wallsten 2000), leading to potential crowding out of some types of investment and to no large impact on employment. On the other hand, receiving an SBIR grant appears to improve the performance of firms, though much of the impact seems to have been isolated to regions with well-functioning venture capital pools (Lerner 2000). Grant programs such as the SBIR program might serve a role beyond simple allocation of capital, however. Because the evaluation panels of the SBIR program are staffed with top scientists, their evaluation of the technical merit of the applicants can provide a certification signal for the winners of the grant. Indeed, Howell (2017) finds that the impact of the SBIR grant program flows mostly through the certification signal itself rather than the total number of dollars allocated. Similarly, Zhao and Ziedonis (2020) find that the largest impact on an SBIR-like program in Michigan is in stimulating downstream investments in winning firms that hail from outside regions in Michigan where venture capital investment is common.

The role of government programs as certification signals for future venture capital investment shows the importance of investment frictions that exist for early-stage investors, most importantly time and attention. Venture capitalists are willing to invest in startups outside of their home region if the startup has a higher chance of creating a significant return (Chen et al. 2010). Investments that decrease the amount of time required for an investor to evaluate or monitor a startup in a region increases the venture capitalist's willingness to allocate capital there (Bernstein, Giroud, and Townsend 2016). Program design, therefore, may best focus on both improving the quality of startups in a region and certifying the best startups to receive attention from potential funders. An increasing number of programs appear to serve this latter role. Pitch competitions can provide go/no-go signals to entrepreneurs as to whether they should continue to pursue ideas, while also providing easier access to capital through certification (Howell 2020). Startup accelerators serve similar roles in helping to quickly shut down low-quality startups (Yu 2019). By helping to decrease the cost of experimentation, such programs can increase the entry of higher quality entrepreneurs who might face stronger trade-offs between entrepreneurship and their outside option in wage employment (Nanda and Rhodes-Kropf 2016; Manso 2016).

8. Wrapping Up: Future of the Field

Relative to other areas of research in economics, the study of innovation-driven entrepreneurship is a new development that has grown in importance across a number of fields of economics over the past few decades. The main goal of this review was to highlight the key areas of research in the economics of entrepreneurship, and innovation-driven entrepreneurship in particular, and highlight the need to distinguish between different types of entrepreneurship and how they vary along key economic constructs. While we distinguish between IDE, TBE, and self-employment and subsistence entrepreneurship early in our discussion, this review focused on IDE primarily due to its outsized potential for spurring economic growth.

While some areas of study in IDE entrepreneurs are particularly well-developed (e.g. the financing of IDE ventures), there remain many open questions for future research. In this section, we focus on important open questions and areas of research in the economics of IDE that not only may facilitate better understanding of the differences between TBE and IDE but also contribute to our understanding of critical factors that can foster higher rates of IDE and greater likelihood of success for IDE ventures.

8.1. Data

At a basic level, our understanding of IDE entrepreneurship is fundamentally limited by the availability of data. Areas of research such as entrepreneurial finance through VC are particularly well-developed simply because of the availability of relatively comprehensive data on new IDE venture financings through commercially available databases. In contrast, other areas of IDE remain black boxes primarily because no data is available for empirical exploration. More generally, the availability of data presents a clear constraint for progress in the field.

One of the most significant challenges for empirical research is the ability to produce data covering representative samples of IDE entrepreneurs. While certain databases, such as the Census LEHD present population-level samples of new firms that have reached a certain stage of development (at least one employee), the ability to distinguish between IDE and TBE entrepreneurs in such data is limited, and as a result analysis of these data often confound different types of entrepreneurship that may be influenced by different economic forces. While the LEHD allows researchers to restrict samples by industry or to match firms to USPTO data, both of these

methods provide imperfect identification of IDE startups. On the other end of the spectrum are data sources like Crunchbase and Pitchbook. These databases create datasets of early-stage entrepreneurs through both self-reporting and web presence, both of which require certain choices on the part of the entrepreneurs, and which limit the presence of stealth startups and early-exiting startups in the data. Importantly, these datasets also do not allow identification of failure at later stages.

The inability to clearly distinguish between IDE and TBE in the data sources that are the most representative on other dimensions means that some of the most fundamental empirical findings in the economics of entrepreneurship represent an average over TBE and IDE entrepreneurship. As mentioned in Section 3, basic questions such as those regarding the returns to entrepreneurship have largely been answered using datasets in which IDE entrepreneurs represent a relatively small portion (Moskowitz and Vissing-Jørgensen 2002; Hall and Woodward 2010). What are the differences in returns to IDE vs TBE? Under what conditions are the returns to IDE entrepreneurship are significantly higher? Answers to these questions are particularly important for regional and national level economic growth, but the literature to-date affords limited answers.

Currently available data sources also provide limited visibility into two key parts of the entrepreneurial process: entry and exit. The best available sample for entry processes comes from nationally representative samples of prospective entrepreneurs in surveys like the PSED but their focus on a nationally representative of individuals with entrepreneurial intentions sample results in a small number of IDE firms in the sample that precludes fine-grained analysis (Reynolds and Curtin 2008). Similarly, in most existing large-scale data sources, it is difficult to identify when firms have exited, particularly in downside cases. The ability to distinguish between "lifestyle" firms, "living dead" firms, and firms that have been disbanded, is substantially limited in many existing data sources either because reporting on the firms is periodic and does not require a yearly or quarterly update, or because data is sourced from web presence which often is not updated, nor removed immediately when the firm disbands. The lack of reliable data on entry and exit places bounds on the type questions researchers can inform.

Paradoxically, the data that is "best" in terms of population-level representation and clear indication of entry and exit, such as the LEHD, suffers from a separate key issue: lack of covariates about founders and founder backgrounds. Relatedly, it is often impossible to discern the role of an individual (e.g., founder versus early employee) from these data, or to gain an understanding of

key decisions, such as strategic tradeoffs made by the founders. Key theoretical issues around IDE entrepreneurship involve the relationship between the human capital investments of its founders and the performance of their ventures (Lazear 2004b, 2005a). Similarly, there remain many open questions regarding how individual-level differences in founder preferences and personality impact their decision making, and thus the performance of their ventures (Astebro et al. 2014; Kerr, Kerr and Dalton et al. 2019; Wasserman 2017). As we detail below, many key theories in entrepreneurship that speak to entry, persistence, and performance, suggest that individual-level differences at the founder level are key drivers of entrepreneurship, yet data constraints severely limit our ability to test these theories and the interconnections between them.

Development of new sources of detailed data on ventures and their founders remains a key need for further development of knowledge in the field. One opportunity for such data development lies in the conduct of more extensive field studies, which we discuss in more detail later in this section.

8.2. Non-IPO Exits and Venture Failure

While a large and substantive literature explores the notion of startup company exit via IPO, much less is known about exit through other modalities, and, in particular, about exit through venture failure. The vast majority of startups do not reach an IPO, but, rather, are either acquired or are liquidated. This decrease in the use of IPOs as an exit vehicles has accelerated in recent years, as IPOs themselves have declined in number.[7] Despite this, there has been limited research exploring failure of IDE startups or exit through acquisition. This is a target rich area for future research.

Entrepreneurship is rife with uncertainty, and an entrepreneur's identification and response to this uncertainty is a key starting point for much of the research conducted on entrepreneurship. The resolution of this uncertainty triangulates on one key question: Will the venture succeed? For the majority of ventures, the answer is no. This is especially true for IDE, where venture failure is a high probability event (e.g. Davis et al. 1998 for a general discussion). In a sample of over 30,000

[7] The decline in IPOs and its causes has been the subject of a number of recent research papers in the finance literature. See e.g. Gao et al. (2013), Doidge et al. (2013, 2017), Ewens & Farre-Mensa (2020). No consensus has been reached on the cause of this decline, suggesting room for future research in this area.

startups tracked by the Startup Genome project (Startup Genome 2019), approximately 11 out of 12 ventures fail. Ljungqvist and Richardson (2003), in a large sample of VC investments by a major limited partner, estimate the failure at 3 out of 4 companies. A venture's failure has a substantive impact on all stakeholders: founders, employees, investors, and suppliers, however, a venture's founders and employees often face the greatest consequences. Given the prevalence of failure and its significant impact, the phenomenon is deserving of more attention and research.

A primary reason for the lack of research on the general implications of entrepreneurial failure is a dearth of data. There is often a survivorship bias in the study of entrepreneurship, as ventures that succeed are the easiest to collect data on. It is challenging to collect data on new ventures in general, as many entrepreneurs will not officially register their business until they have reached a minimum level of derisking. Moreover, the low barrier to business registration may also result in the formation of many firms whose founder has no real plan to actually grow a business. Data availability on an IDE venture is often subject to the venture reaching a specific milestone, such as raising venture capital funds. This also leads to an over-selection on firms from the right tail of the quality distribution. Research with these data, much of which we have discussed in prior sections, offer important insights into entrepreneurship, however, we often lose sight of the modal founder, venture, and startup employee. While administrative data (e.g., US Census) casts a wider net with regards to venture quality, it frequently mixes IDE with TBE, and the nature of the data makes identifying mechanisms challenging. For example, administrative data does not allow for unpacking demand-side mechanisms from supply side mechanisms, as we only observe realized events, such as an employee leaving to join a new firm.

The economics literature does acknowledge the existence of significant failure rates. Manso (2016) uses general population survey data to suggest that the cost of failure at entrepreneurship may be overstated, given that important learning comes from an individual attempting entrepreneurship (see also Vereshchagina and Hopenhayn 2009; Dillon and Stanton 2017). By experimenting with entrepreneurship, individuals may, for example, be better able to understand their career and make appropriate choices. However, this cost may be higher for individuals with less experience to reply on subsequently. Would-be entrepreneurs may also learn from the experiences of former entrepreneurs with whom they interact. Lerner and Malmendier (2013) use a sample of Harvard Business School MBA students to understand the peer effects of having former founders as peers, finding that their presence decreases the rate of entrepreneurship due a

reduction in the launch of unsuccessful ventures—in other words, it lowers this failure rate. Similarly, Nanda and Sorensen (2009) find that having former entrepreneurs as co-workers increase the likelihood that an individual enters entrepreneurship. Failure (or even success) of general ventures (a mix of TBE and IDE) may thus have utility for former founders—by allowing them to experiment—and for potential founders, through peer effects.

Recent research in management and strategy provides some insight into the relationship between IDE failure and the subsequent careers of the founders and employees. Botelho and Chang (2019) use a field experiment to study how former founders are evaluated by recruiters when they attempt to enter the traditional labor market. They find that IDE founders receive fewer callbacks than otherwise identical non-founders, with formerly successful founders receiving fewer callbacks than former "failed" founders. This overall founder discount appears to be due to concerns on the part of hiring firms that former founders may be unable to fit into and remain committed to wage employment. Many important questions regarding the mechanisms that may affect how former IDE founders are perceived and evaluated in the labor market remain unanswered, however. For example, does substantial wage employment experience prior to founding a venture attenuate the founder "discount?" Does a founder's network help when attempting to (re)enter wage employment?

A related set of questions regard how startup experience affects the careers of employees, and especially the effect of a failed venture on its employees. Given that over 100,000 individuals join IDE ventures each year (Goldschlag and Miranda 2020; Botelho and Marx 2020), and that most IDE ventures fail, these questions are first order. In economics, most research on employee careers and firm failure relates to general displacement effects (Gibbons and Katz 1991; Jacobson, LaLonde, and Sullivan 1993). For entrepreneurial ventures, we know much less, with much of what is known coming from research outside of economics. Even here, many of these studies are restricted to particular industries; for example, in the Semiconductor industry, experience as an early employee, which includes founders, leads to a positive wage effect conditional on being hired (Campbell 2012). Some evidence mixing IDE and TBE ventures also exists, and suggests that startup employees who join other startups earn less than those startup employees who join more established firms (Sorenson et al. 2021). Research focused on IDE ventures is more limited, even in management. directly study the likelihood that employees of failed ventures exit the industry. Comparing over 100 firms in the innovation-driven Automated Speech Recognition Industry--

many of which are early-staged ventures—they find that exit rates for employees who voluntarily choose to leave their firm and those for employees from failed firms are similar. This similarity, however, is driven by employees with specialized human capital from failed firms being the most likely to remain in the industry, and if firm failure is associated with a scandal, those employees are the most likely to exit—regardless of their human capital.

Many questions regarding entrepreneurial failure and its effects on the subsequent careers of the venture's founders and employees remain fertile areas for future research. For example, who becomes an entrepreneur? There is reason to believe that work experience at an IDE venture may increase the likelihood that an individual enters entrepreneurship themselves, and that this rate may be moderated by whether the venture they worked out succeeded or failed. At the founder level, serial entrepreneurship and the effects of previous entrepreneurial experience, even at a failed venture, also remains relatively unexplored. Prior entrepreneurial experience, even or perhaps even particularly at a failed venture, may benefit the founder through learning-by-doing, and thus potential employees and investors may prefer founders with previous experience. Furthermore, there is much that remains to be understood regarding the causes of startup venture failure and the likelihood of a venture reaching particular milestones, and how they relate to the founding team or strategy.

Of course, even those ventures that do succeed do not always result in an IPO. Whereas 20 years ago IPOs were the majority of venture-backed startup exits, they now account for only 10% of exits for venture-backed startups (National Venture Capital Association (NCVA) 2020).The rest exit through acquisition. Despite this, acquisition as an exit strategy remains relatively unexplored in the literature. Researchers have recently begun to pick up on this gap in our understanding, with explorations of acquihires—acquisitions in which the startup is purchased as a way to hire its team for other purposes (Ng and Stuart 2019; Kim 2020), the role of the competitive landscape and competitor acquisitions (Conti, Guzman, and Rabi 2020), and exploration of killer acquisitions—acquisitions in which the incumbent purchaser buys the startup in order to dismantle it (Cunningham, Ederer, and Ma 2020; Callander and Matouschek 2020). While acquisitions appear to be a desired outcome for entrepreneurs, many open questions remain with regards to how these acquisitions affect the founders, employees, investors, and the acquirers themselves.

8.3. Individual Characteristics of Entrepreneurs

Much like data on other aspects of entrepreneurial firms, comprehensive data on the individual characteristics of IDE founders are typically unavailable. For example, the literature lacks a deep understanding of how founder gender and founder race affect the entrepreneurial process. The little evidence we have paints a stark picture regarding the founding rates of IDE by underrepresented individuals. In recent decades, women represent less than 10% of the entrepreneurial and venture capital labor pool, and Blacks represent less than 1% (Gompers and Wang 2017). While supply-side mechanisms may account for some of the discrepancy in founding rates, there are likely systematic demand-side barriers faced by underrepresented individuals who are attempting to found an IDE venture.

Demand-side biases for underrepresented individuals are well documented in economics research, especially from a labor market perspective (Bertrand and Mullainathan 2004; Goldin and Rouse 2000; Blau and Kahn 2000; see Cain 1986 and Neumark 2018 for reviews). This research joins a vast amount of work in psychology and sociology, which has also consistently documented that underrepresented individuals receive worse evaluations than comparable White men. While there is little research that analyzes the effect of ascriptive founder characteristics in the context of IDE, there is convincing evidence that demand-side biases are prevalent. In an experiment, (Brooks et al. 2014) find that investors prefer pitches presented by men relative to the identical pitches when presented by women. Similarly, Ewens and Townsend (2020) find that male investors express less interest in female entrepreneurs relative to male entrepreneurs, and that the male-led ventures they select underperform. These findings are especially important given that entrepreneurship is fraught with uncertainty, which increases observed bias in evaluation processes (Botelho and Abraham 2017). Furthermore, this bias is most likely cumulative, as entrepreneurs depend on positive evaluations in one area to assist in another. For example, if underrepresented founders face greater difficulty in attracting initial employees, and investors use founder characteristics, as well as employee quality, to base their decisions, then bias in one domain magnifies bias in another. Furthermore, the fact that underrepresented individuals may utilize their social networks differently in the IDE will increases the challenges faced by underrepresented founders (Howell & Nanda 2019).

Many important questions also remain unanswered on how ascriptive founder characteristics, such as gender and race, affect their observed outcomes. Furthermore, there is a need for research in this area that goes beyond documenting bias and focuses on possible policy levers to reduce

such biases and improve outcomes. Since the demand-side preferences do not appear to be performance-based (Ewens and Townsend 2020), one potential avenue for future work is to explore the interaction between supply-side representation (e.g., investors) and demand-side evaluation of founders. Relatedly, future work should also focus on how improving a founder's initial resources can affect participation, given that both gender and race have been associated with more limited access to various resources (Robb, Consulting, and Rafael 2012), and that resource access appears to affect entry into entrepreneurship and subsequent performance. Similarly, female entrepreneurs are less likely to have a venture capitalist in their professional network (Brush et al. 2004) and, on average, have smaller professional networks than men (See Klyver and Terjesen 2007; Renzulli, Aldrich, and Moody 2000)

While substantial differences in outcomes are clear along ascriptive characteristics, there are other individual differences that can be explored and which might also yield substantial insight into the entrepreneurial process. Behavioral parameters, such as risk tolerance and overconfidence, have been connected theoretically to entrepreneurship in economics (Camerer & Lovallo, 1999; Kihlstrom & Laffont, 1979), and in psychology, a significant literature has developed connecting personality traits to entrepreneurial decision making and performance (Stewart and Roth 2001; Zhao et al. 2010; Zhao and Seibert 2006). Recently, there has been a growing interest in using personality traits identified in the psychology literature to understand individual differences in decision-making across a number of economic settings (Almlund et al. 2011; Borghans et al. 2008; Proto and Rustichini 2014), and in particular, in entrepreneurship (Kerr, Kerr, and Xu 2018). Empirical work has documented personality differences across founders and early employees of startups (Kerr, Kerr and Dalton 2019), has shown that personality traits are related to changes in risk aversion of IDE entrepreneurs in response to COVID-19 (Fehder et al. 2021), and are related to variation in how angel investors evaluate startups (Fehder et al. 2021).

The majority of this research has focused on the Big 5 personality inventory and its connection to entrepreneurial decision-making. While this focus is understandable given the Big 5's prominence in personality psychology, there are many other scales which might be systematically related to entrepreneurial behavior and which can be identified through further research. In addition, little attention has been paid to the interconnections between personality traits and behavioral preference parameters, like risk tolerance, that are central to our current theoretical account of entrepreneurship (Fehder et al. 2021). Further research that adds to the list of personality

traits connected to entrepreneurship and their own interrelatedness will help push forward our theoretical understanding of entrepreneurial activity.

8.4. International Aspects

Silicon Valley has been globally preeminent in fostering IDE entrepreneurship over the past 50 years. The remainder of the top areas for entrepreneurship activity were also in the United States. Yet it is unclear whether Silicon Valley, and the United States more generally, will be able to maintain its global advantage in IDE activity. Even within the U.S., other regions have seen sustained periods of innovation and IDE, only to quickly fade in prominence (Lamoreaux, Levenstein, and Sokoloff 2006). In fact, some theoretical models of agglomeration and innovation suggest that clusters such as Silicon Valley should eventually unravel (Duranton 2007; Duranton and Puga 2001). Three primary factors that have underpinned the United States' competitive advantage, but which face significant change in the coming decades, are (i) the battle for global talent, and (ii) global capital flows.

While Silicon Valley in particular and the United States in general has been a wellspring of IDE entrepreneurship over the past century, a substantial portion of that IDE entrepreneurship has been generated from the hard work of individuals born in other countries and attracted to the resources that Silicon Valley had to offer (for a review, see Kerr and Kerr 2020). In particular, Indian and Chinese-born individuals are disproportionately represented in the ranks of the STEM workforce and the roles of inventors in the United States (Kerr 2008; Kerr and Lincoln 2010). Foreign-born innovators have strong positive externalities for innovation in general, but especially for native-born inventors (Bernstein et al. 2018). They are also more likely to migrate to areas of new invention and technical opportunity (Kerr 2010). The emergence of this phenomenon has partial roots in the pre-eminence of U.S. universities in the post-WWII era that derived at least in part to the reallocation of scientific and engineering talent from Europe to the United States (Moser, Voena, and Waldinger 2014).

In addition to contributing substantially to inventive activity, immigrants are more likely to enter into entrepreneurship than similarly educated native-born workers (Hunt 2011). Interestingly, U.S. immigration policies thus provide a seed of instability for U.S. entrepreneurial activity. U.S. Permanent resident visas (green cards) are allocated on a per country basis that is not proportional to the educated population of the country based on the Immigration Act of 1990 as of

the writing of this article. As a result, immigrants from certain countries, even if educated in the U.S., face greater obstacles obtaining immigration status that allows for entrepreneurial activity (Azoulay et al. 2020; Kerr and Kerr 2020). The delay and uncertainty in obtaining permanent residence serves to drive immigrant STEM workers back to their home countries, an effect that is increasing in their home country's GDP (Kahn and MacGarvie 2020; Khosla 2018). To the extent that U.S. policies affect the flow of immigrant innovators into the U.S. and given that these immigrant innovators are more likely to enter into IDE, the effect on U.S. IDE activity and subsequent economic growth could be large, and IDE activity abroad may increase. Moreover, it is unlikely that U.S. citizens will be able to substantially substitute for the sheer quantity of immigrant STEM graduates demanded in Silicon Valley, or the U.S. more generally. If the deep human capital pools in Silicon Valley start to shallow, the competitive advantage of the region over others in the global economy will start to erode, potentially reshaping the geographic distribution of tech clusters globally. Beyond the obvious impacts on U.S. competitiveness, any declines in Silicon Valley may also have global effects, as there are substantial agglomerative effects to the productivity of innovators (Moretti 2019) and negative spillovers to being located outside of the U.S. for U.S.-educated foreign innovators (Kahn and MacGarvie 2016). Technology spillovers to other counties may also be affected. Foreign corporate investments in Silicon Valley firms serve as a channel for other countries' convergence to the global technological frontier (Akcigit et al. 2020). Finally, increasing nationalistic competition for supremacy in certain key technological areas like artificial intelligence may create an additional engine to spur technological development. All of these topics deserve considerable additional attention and research.

Beyond the ability to access global talent, a key contributor to Silicon Valley's rise was its early creation of a successful venture capital industry (Bresnahan and Gambardella 2004). The availability of early stage capital to fund risky new innovation-driven businesses attracted entrepreneurs from across to globe to Silicon Valley, contributing to an agglomeration of IDE ventures and talent. Changes to the geographic distribution of early stage capital and other financial institutions globally, however, may change the calculus for startup ventures and their decisions of where to locate. Recent increases in early stage investment in Chinese startups, as well as in the market capitalization of listed firms on Chinese stock exchanges are just one set of examples of new developments that could create worthy rivals to Silicon Valley abroad (Jiang et al. 2020). As funding availability and technology talent availability increase in new regions, founder location

decisions may shift. Economists have just begun to compare the efficacy of early-stage investors outside the United States to the benchmark of the American peers (Gompers and Wang 2017). Because the institutional details, policies and ecosystems of different countries can have a large impact on their ability to foster and sustain IDE (Lerner 2009), understanding the causal impact of these differences is key to understanding how the global distribution of entrepreneurial activity may shift going forward. For example, political control of economic decisions in China provides a useful window into the role of policy uncertainty in dampening IDE entry and performance (Cong and Howell 2018). The fast-changing landscape of global IDE, however, means that any emerging agenda in international entrepreneurial finance must remain responsive to changes in the phenomena on the ground.

Of course, the growth in IDE activity and financing globally has arisen in parallel to the reduction in geopolitical barriers and the opening of global markets to outside activity (Lane and Milesi-Ferretti 2008). The number of international markets that were once off limits due to geopolitical issues or high costs of entry is significantly smaller. The advent of the internet and mobile devices and their rapid adoption at both the consumer and enterprise level has facilitated access to these markets. As a result, startups today often sell their products into global markets from the get go (Hochberg 2017). Future research will need to look to the breadth of the global economy to capture these nuances.

8.5. Field Experiments

As noted, understanding some of the most important phenomena in IDE entrepreneurship is difficult to do with currently available datasets. These limitations result either because existing datasets lack sufficient information about individual entrepreneurs and companies or because they do not provide the researcher enough context regarding choice sets and decisions. One approach to circumventing these limitations is through the generation of new data via the execution of field studies and experiments. When designed properly, field experiments not only allow the researcher to generate data on otherwise opaque elements of the IDE phenomenon, but also have the benefit of isolating different causal channels which may impact decision making and outcomes. Field experiments may serve to increase our understanding of IDE entrepreneurship through two channels: evaluation of interventions that are prevalent in entrepreneurial communities and

construction of more nuanced models of entrepreneurial choices building on the foundations of behavioral economics (Astebro et al. 2014; Harrison and List 2004).

A common type of field experiment in economics is the randomized controlled trial (RCT). RCTs offer the opportunity to both test the efficacy of specific interventions as well as the opportunity to design exogenous treatments that allow us to test specific theories regarding entrepreneur choices and outcomes. To date, entrepreneurship-related experiments in the economics literature have largely sought to evaluate the impact of specific policies and programs. RCTs, however, offer the researcher the opportunity to think beyond program evaluation alone.

For example, recent studies suggest the existence of substantial gender inequity in IDE entrepreneurship, at both the population level (Guzman and Kacperczyk 2019) and in key resource allocation decisions such as angel funding choices (Ewens and Townsend 2020). While experimental evidence suggests that at least some of this inequity derives from statistical discrimination on the part of investors (Brooks et al. 2014), much of the discussion of this topic has revolved around the existence of specific bias on the part of overwhelmingly male investor base. Administrative data from entrepreneurship programs like venture competitions suggest that unequal outcomes in funding after the competition is at least in part due to behavioral differences between men and women entrepreneurs in the competition (Howell & Nanda, 2019). Identifying the most impactful channels for increasing female participation in IDE entrepreneurship and their success will come from a more detailed understanding of how observed differences in behavior tied to easily observed characteristics like gender might be related to deeper preference parameters. RCT can provide a valuable tool both for developing a better understanding and for influencing women's experience in IDE entrepreneurship, which may offer insight into interventions designed to improve the rates of female entry and success and to change evaluator preferences over the long run. Similar approaches have led to useful insights into the sources of observed wage premiums (Niederle and Vesterlund 2007; Gneezy, Leonard, and List 2009).

The role of gender in IDE entrepreneurship is just one of many examples where field experiments may help scholars rule in and out preferences and traits which help explain systematic differences in entrepreneurial or investor behavior. Researchers in entrepreneurship have long intuited that entrepreneurs are different from the general population in important ways. Some have emphasized differences in propensity to take risk (Kihlstrom and Laffont 1979), others have suggested that there are substantial human capital differences (Lazear 2004a, 2005b), and others

have suggested that there are other important behavioral parameters along which entrepreneurs vary from the standard population (Astebro et al. 2014). Similarly, studies have emphasized how differences in an individual's environment may significantly shift the likelihood of becoming an entrepreneur—whether through entrepreneurial parents (Hvide & Oyer, 2018), wealth endowments (Kerr and Nanda 2009), or workplace or educational peers with entrepreneurial intentions or backgrounds (Nanda and Sorensen,2009; Lerner and Malmendier 2013). While the literature provides some sense of how these individual differences might be related to entry (i.e. differences between entrepreneurs and non-entrepreneurs), we have less of an understanding of how these individual differences carry forward into entrepreneurial choices after entry which might impact entrepreneurial performance. For example, while it seems that entrepreneurs are more likely to have higher risk tolerance than the average non-entrepreneur in the population, do entrepreneurs with higher risk tolerance make different decisions regarding financing, contracts, or competition, among other things? If so, do these decisions to lead to better or worse performance for their ventures?

Recent studies conducted during the pandemic within larger entrepreneurial field experiments suggest important descriptive insights can be obtained from field-generated data that might otherwise lie uncovered (Bailey et al. 2020). While many of individual differences cannot be sources of experimental variation (we cannot assign individuals to have higher risk tolerance or have parents with entrepreneurial backgrounds), field experiments offer an opportunity to measure as many of these individual characteristics as possible, allowing for ex post exploration of patterns of treatment heterogeneity and connections between individual differences and individual choices. Recent work in machine learning provides methods that allow for disciplined ex post exploration of patterns of heterogeneity in the data without p-hacking (see e.g. Bailey et al. 2020). Use of such tools is likely to offer important insights from post hoc analysis, offering insight into previously unexplored areas of entrepreneurial behavior and outcomes.

Field experiments and RCTs, however, are not limited to providing insight solely on entrepreneurs. IDE startup success often involves multiple stakeholders outside of the startup. Field experiments can offer new insights into these stakeholders and their choices. For example, recent field experiments attempt to understand how investors perceive and rank opportunities (Bapna 2017; Bernstein, Korteweg, and Laws 2017; Brooks et al. 2014). Similarly, other recent randomized studies attempt to understand how entrepreneurs value and prioritize external

resources and stakeholder interactions (Fehder et al. 2019). Such studies should be expanded to explore how individual differences amongst investors and entrepreneurs may impact how they deviate from mean behavior.

Notably, a growing set of RCTs in mainstream and managerial economics have emphasized the possibility of influencing and improving the entrepreneurial process (Camuffo et al. 2019; Chatterji et al. 2019). Other studies suggest that entrepreneurs are harder to improve (Fairlie, Karlan, and Zinman 2015). These studies, however, utilize dramatically different study populations. Some focus on high human capital individuals primarily pursuing IDE entrepreneurship (Camuffo et al. 2019), while others focus on under-employed and educated individuals for whom entrepreneurship or self-employment might provide an avenue out of unemployment (Fairlie, Karlan, and Zinman 2015). Heterogeneity in the treatment effect for different populations for different types of interventions can be explored explicitly through trial design. As field experiments continue to grow in importance in the study of entrepreneurship, however, is as important that researchers explicitly recognize the differences between different types of entrepreneurship and between the different entrepreneurial populations they are studying. More careful consideration of these issues during initial trial design will then allow for deeper understanding of external validity of the results and which populations and entrepreneurship types they apply to.

8.6. Concluding Remarks

Research on innovation-driven entrepreneurial activity has come a long way since the initial thoughts of Kirzner and Schumpeter. We now know much more about the factors that determine entry into different types of entrepreneurship, the financing of these ventures, and factors that affect performance. We are beginning to scratch the surface of knowledge on how to build well-functioning environments to promote and support IDE activity. These insights have considerable policy implications. Yet there is still much to be learned. As we begin to properly differentiate between types of entrepreneurship and entrepreneurial activity, attention will need to be paid to revisiting our canonical models to adapt and update them to fit the varying entrepreneurial paths.

One area that deserves particular note on this dimension is the exploration of potential decline in entrepreneurial activity and business dynamism over time. Researchers approaching this issue from the viewpoint of different entrepreneur populations and types have arrived at vary

conclusions regarding the extent and nature of the decline. More exploration of this phenomena and how it differs along business type is warranted, given the importance of entrepreneurship as a key driver of economic growth.

Fortunately, recent years have seen a marked increase in the number of early career researchers participating in the field and in adjacent areas such as innovation and productivity. We look forward to seeing what the future holds.

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