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ABSTRACT

We review the extensive literature since 2000 on the personality traits of entrepreneurs. We first consider baseline personality traits like the Big-5 model, self-efficacy and innovativeness, locus of control, and the need for achievement. We then consider risk attitudes and goals and aspirations of entrepreneurs. Within each area, we separate studies by the type of entrepreneurial behavior considered: entry into entrepreneurship, performance outcomes, and exit from entrepreneurship. This literature shows common results and many points of disagreement, reflective of the heterogeneous nature of entrepreneurship. We label studies by the type of entrepreneurial population studied (e.g., Main Street vs. those backed by venture capital) to identify interesting and irreducible parts of this heterogeneity, while also identifying places where we anticipate future large-scale research and the growing depth of the field are likely to clarify matters. There are many areas, like how firm performance connects to entrepreneurial personality, that are woefully understudied and ripe for major advances if the appropriate cross-disciplinary ingredients are assembled.

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Introduction

Entrepreneurial firms and the founders behind these ventures are in vogue everywhere. Cities across the United States are sprouting new incubators and accelerators and introducing programs to attract innovative talent. Foreign countries are also quite active, with nations ranging from China to Chile experimenting in new ways to foster new firm formation. The fascination with entrepreneurs is not brand new, of course, and a literature dating to the 18th century explores what drives entrepreneurs and whether their traits matter for the outcomes of their ventures. This literature now spans many fields and has introduced multiple concepts and methods related to the analysis of entrepreneurial characteristics. In this review, we collect and organize the latest findings on the prevalence of various personality traits among the entrepreneurial population and their impact on venture performance. We cover academic work ranging from economics to psychology to management studies, with a focus on studies published after 2000.

Many studies consider the "traits of entrepreneurs" or the "traits that make entrepreneurs successful." As Åstebro et al. (2014) highlight, the publication in 1921 of Frank Knight's book *Risk, Uncertainty and Profit* marked a key launching point into rigorous and careful research on the personalities of entrepreneurs that set them apart from general business managers. In the decades that followed, research has continued to investigate specific individual traits that prompt people to become entrepreneurs, as well as personal motivations and preferences that keep entrepreneurs on their chosen path. These studies have often focused on high-growth settings or firms financed by venture capital (VC), where entrepreneurs face a high probability of their business failing, a very small probability of extremely positive outcomes, and a possibly low average return to the monetary and time investments made into their businesses. Standard economic theory must be augmented to explain such a pursuit, and many scholars have tried to understand the "homo entreprenaurus" (a moniker introduced by Uusitalo, 2001).

Yet, the term "entrepreneur" is also applied in academic research to many groups beyond the founders of Silicon Valley startups. The studies that we document in this review range in terms of their definitions of entrepreneurship to also include creators of "Main Street" small businesses or even young college students attending an entrepreneurship class. While these groups are all connected to entrepreneurial activity, recent work shows the remarkable degree to which these subpopulations behave differently (e.g., Hurst and Pugsley, 2011, Levine and Rubenstein, 2017), and the typical personality traits of individuals will vary greatly by form of entrepreneurial activity. In our review, we attempt to pay close attention to the group under the microscope of each study and note where subpopulations are generating different results.

We conduct this survey with an applied empirical researcher in mind, although we hope this review is useful for many others too. Applied researchers today have access to data for measuring entrepreneurship that was unthinkable a decade ago. Most noticeably, researchers can now utilize large-scale administrative datasets built on employer-employee data to model

entrepreneurial transitions. Taking the United States as one example, while cutting-edge work in the 2000s often used firm-level entry rates measured in datasets like the Census of Manufactures or Venture Xpert, we increasingly have researchers accessing comprehensive panel data on individuals like the Linked Employer-Household Database to model entrepreneurial transitions. Other countries further hold frontier administrative datasets that combine founding behavior with anything from the prescription drug histories of individuals to their stock portfolios. Beyond administrative datasets, researchers now build their own specialized datasets: tracking cohorts from entrepreneurial training programs; accessing gig economy transactions from a leading online platform; crafting from LinkedIn profiles of entrepreneurs receiving venture financing; conducting customized surveys of entrepreneurs in co-working spaces; and much more. This wealth of opportunity has led to a flowering of research that measures career histories and individual-level traits that predict entrepreneurship.

While these frontier datasets afford opportunities to ask exciting new questions, researchers must also confront new challenges. As one considers individual-level factors that promote entry, questions arise as to when and how the personalities of founders should be considered. Some are directly interested in the phenomenon, wanting to study for example the risk tolerance of founders of high-growth startups. For others, the research question lies elsewhere, but there is a worry about personality being an important omitted factor that biases empirical results. For yet others, personality could be the channel or mechanism through which some studied events produce short- and long-run effects. While some classic studies have looked at how personality traits impact transitions into self-employment, this new work covers a much broader and more heterogeneous terrain, ranging from the opening of small-scale service businesses to high-growth entrepreneurship. As the options continue to proliferate for modeling individual- and team-level entrepreneurship, it becomes more important to have a perspective of the personality traits associated with entrepreneurship and how they influence the research being conducted.

Three decades ago, in a very influential article, Gartner (1988) criticized the study of entrepreneurial personality traits, arguing instead for a focus on how organizations emerge. Gartner disapproved of the varying definitions being used for entrepreneurship, preferring to focus on a definition that emphasized the functional creation of new organizations. Gartner also questioned collecting traits of entrepreneurs using survey methodologies to discern an “ideal” personality for entrepreneurial performance. The shadow of this critique has been on the literature for a long time, and it is far from clear that these new efforts will overcome the challenges that Gartner (1988) outlined, as we re-surface many of these same challenges throughout this review. Yet, the better recognition of heterogeneity among entrepreneurs and powerful new data sources suggest it might be fruitful to reexamine some of these areas again, some 30 years later. After all, the focus for many is now on describing how personality may influence the creation of new organizations, addressing at least some of Gartner’s concern.

We focus our survey on three core themes: (1) the personality traits of entrepreneurs and how they compare to other groups; (2) the attitudes towards risk that entrepreneurs display; and (3) the overall goals and aspirations that entrepreneurs bring to their pursuits. These themes cover most of the main theoretical contributions to the entrepreneurial traits literature, which are quite diverse, while at the same time enabling the identification of common concerns across apparently separate research streams. There are some personality traits and cognitive biases that we spend less time on, such as over-confidence and how it differs from risk attitudes. This was not due to a prejudice against these traits, but mainly the literature-driven foundation of our inquiry that we describe in the next section. With a few exceptions, we concentrate on empirical studies and meta reviews of them to give a flavor of the recent applied work in this field, spending limited time on lab or experimental studies.

An appendix to our survey provides a short discussion of some major factors influencing entrepreneurial decisions beyond personality: demographics, household assets and financing constraints, measurable skills like work experience and education, and local environment. This auxiliary discussion is short and far from comprehensive, meant only to provide some background helpful for understanding the "soft data" covered in this review and how they interact. For those interested in measuring entrepreneurial risk attitudes and personality traits in their own work, an additional online appendix documents some of the survey instruments commonly utilized. This appendix also provides more detailed notes on the research papers that we review.

We do not pretend to uncover a once-and-for-all synthesis with this review, and nor do we pretend to resolve longstanding debates like whether entrepreneurs are "born or made." The heterogeneity across entrepreneurs within just Cambridge, Massachusetts suggests that a unique set of factors does not exist, much less the vast differences in entrepreneurial pursuits across countries, industries, and similar. Few applied researchers when confronted with massive empirical datasets would even contemplate such grandiose aims. Instead, we provide a unified discussion of the vast body of research related to these three key topics and embrace the heterogeneity where it exists. An accurate and unvarnished depiction of the variance in studies is important for contemplating how academic work can provide better empirical insights that inform entrepreneurship training programs, policy initiatives designed to bolster startup activity, and so on.

In our opinion, the state-of-the art study on entrepreneurial characteristics is one that (1) utilizes longitudinal data on a large and representative sample of individuals, (2) measures personality traits before entry decisions are made, and (3) carefully measures individual traits such as risk aversion and entrepreneurial self-efficacy. These conditions are necessary for statistically precise comparisons of entrepreneurs to other employee and managerial groups, better insight into differences across types of entrepreneurs (e.g., self-employed vs. growth-oriented employers), and in-depth analysis of subsequent startup performance. The literature is especially weak on this

performance dimension. These conditions are not sufficient for assigning causal roles for personality traits—a very daunting task—but they are probably necessary ingredients. Ahn (2010) and Levine and Rubenstein (2017) are examples of innovative and impressive studies that utilize the National Longitudinal Survey of Youth (NLSY), although the NLSY's small sample generates constraints. Hvide and Panos (2014) and Caliendo et al. (2014) also show frontier examples that build upon longitudinal administrative records and national surveys. Even with this gold standard in mind, the practical limits of building such platforms—especially the off-the-shelf tradeoff of using administrative records that provide universal employment histories but limited collection of personality traits—suggest that there is still much to gain from carefully conducted surveys that focus on narrow and clearly specified groups of interest and define a relevant comparison group that entrepreneurs are contrasted with.

We hope this survey provides a useful input into several complementary streams of work. There are often four-fold or larger differences in entrepreneurship rates across U.S. cities (e.g., Glaeser et al., 2015), and those for venture capital are even sharper (e.g., Samila and Sorenson, 2011). Moreover, the rate of new business formation is declining in the United States (e.g., Decker et al., 2014). Many business leaders and policy makers are looking to build better environments to support entrepreneurship, and this review highlights softer personality traits and risk attitudes that can be considered along with more typical factors like financing conditions. As Chatterji et al. (2014) describe, successful interventions to build the entrepreneurial base need to activate the local population, versus just relying on attracting entrepreneurs from afar, and research on these softer elements is of first-order importance in designing quality initiatives and policy experiments.

The findings related to personality characteristics and other attributes of entrepreneurs, as well as the correlation of those characteristics with business performance, also imply that there may be scope for including some personality development modules in entrepreneurship education. Many academic institutes have introduced entrepreneurship training, ranging from high schools to executive programs, but these programs have to date focused more on hard skills rather than personality mapping and softer preparations. While some personality traits are fixed, Rauch (2014) provides some examples of how, for example, self-efficacy and achievement motivation can be influenced with relatively simple interventions. A clearer understanding of the specific traits of entrepreneurs and their heterogeneity may help to better match potential entrepreneurs to settings that are most closely aligned with their strengths.

Finally, we hope to connect to future academic work. There are very few scholars in the diverse entrepreneurial literature that regularly read the full range of academic output described below, much less utilize it in shaping their own research (including ourselves). Yet, these interfaces are precisely where we need the most urgent attention. To give an example, the very sparse number of studies that connect firm performance outcomes to the personality traits of entrepreneurs are a significant limitation to our capacity to describe the quality margin of entrepreneurial ideas.

Applied microeconomics researchers that utilize administrative and longitudinal data have an excellent toolkit to model these startup outcomes, but they are among the least exposed to the latest perspectives on personality traits. A goal of this survey is to help close these information gaps and encourage more cross-disciplinary work in this area.

1. Personality traits

Research on the personality traits of entrepreneurs took off in the mid-20th century, unifying approaches from economics, psychology, sociology, and business management to answer the questions: Who is an entrepreneur? What drives them? What traits define them? The first few decades faced many conceptual challenges as researchers struggled to develop a solid theoretical framework and appropriate measurement tools. In 1971, economist Peter Kilby famously compared the entrepreneur to A.A. Milne's Heffalump, a fictional elephant that all investigators approached with improvised proxies from their disciplines, each asserting that they had discovered the ever-elusive creature's behavior.[1] In the 1980s, this discordance in the literature led some researchers to conclude that there was no correlation between personality and entrepreneurship (e.g., Brockhaus and Horwitz, 1986; Gartner, 1988).

However, since the start of the 21st century and with the notable rise of public and intellectual fascination with startup culture, the entrepreneurial personality literature has enjoyed a resurgence and convergence toward an increasingly consistent set of theoretical frameworks, with meaningful insights toward innovation policy and business education. The bulk of recent literature seeks to answer two main questions: (1) Do certain traits predict an individual's likelihood of becoming an entrepreneur, and (2) Do certain traits predict an entrepreneur's likelihood of achieving "successful" outcomes? These answers are pursued by investigating the prevalence of personality characteristics in entrepreneurs versus other populations, as well as by analyzing the correlation of these characteristics with entrepreneurial performance factors such as business survival and growth (e.g., Baron, 2004).

While personality theory remains rife with its own set of contentions, researchers have primarily gravitated over the last few decades to the Big-5 factor personality model. Several additional traits have been fused into the Big-5 for entrepreneurial work, including self-efficacy, innovativeness, locus of control, and risk attitudes (which we reserve for individual discussion in the second part of this literature review). Researchers often mix and match these traits to describe a multidimensional "entrepreneurial orientation." In this literature review, we mostly focus our discussion on literature published after 2000 to detail the newest wave of personality research and the cutting-edge questions. Rauch et al. (2009), Rauch (2014) and Patterson and Kerrin (2014) provide reviews of some of the seminal contributions that came earlier.

[1] Kilby (1971) and A.A. Milne, *Winnie the Pooh* (1926) and *The House at Pooh Corner* (1928).

1.1 Prevalence of personality traits in entrepreneurs vs. other populations

Many researchers compare the traits of entrepreneurs to employed workers or the general population to identify characteristics that define entrepreneurs as a group. It may seem a foolish or unnecessary task to compare Steve Jobs or Elon Musk to the average person, and many books describe the special biographies and personalities of these great entrepreneurs. Here, however, the literature has a very different focus. For every Jobs or Musk, we have thousands of entrepreneurs seeking growth-oriented businesses and many more seeking to build a business for themselves as self-employed proprietors. The collective impact of these individuals on our economy is enormous, even if they don't start Apple or SpaceX. This literature is concerned with investigating and defining the regularities and differences in the personalities of these entrepreneurs.

For this review, we combed through hundreds of studies on J-Stor, Econstor, and the on-line journal databases available at Harvard Business School and Wellesley College, covering journal articles and dissertations spanning economics, psychology, and management studies. We restricted our focus to articles published after 2000, as a resurgence of interest into entrepreneurial behavior generated a new crop of studies that had not been meaningfully summarized. Data used in the studies came from the United States, Canada, Australia, New Zealand, Germany, France, Italy and other European economies. We considered articles with various definitions of entrepreneurs, most commonly self-employed individuals or business owner-managers. We excluded studies looking solely at subsistence entrepreneurship, partially because these studies are so sparse. Many of the personality questionnaires were conducted with business-track university students, while other studies used national data sets including all fields and industries of employment. While Frese (2009) highlights how entrepreneurial action extends to efforts beyond for-profit firm creation (e.g., social activism), we focus this survey on the venture creation process in the private sector. We purposefully spend less time on the variations of overconfidence, optimism, and risk taking given the detailed recent review of Åstebro et al. (2014) on these issues.

Studies on risk attitudes were searched using the keywords "risk preference," "risk propensity," "risk aversion," and "risk tolerance." We included risk measures of various kinds, including self-reported answers in longitudinal surveys, hypothetical gambling situations, and investment history metrics. Studies on personality traits were searched using keywords such as "personality," "traits," and "orientation," as well as the specific trait names covered in this survey. We included the most commonly used personality concepts (Big-5, need for achievement, internal locus of control, innovativeness, and self-efficacy). In a few studies that used composite measures of "entrepreneurial orientation," we turned to the reported underlying data for disaggregation of individual variables. We excluded personality traits for which there was too little literature to summarize meaningfully: need for autonomy, stress/uncertainty tolerance, tenacity, self-esteem, discipline, delay of gratification, and so on.

After combing through research databases for the relevant and academically rigorous articles, we compiled them into a set of tables (contained in the online appendix). The first series of tables list studies by risk attitudes (28 studies). The second series list studies by personality traits: Big-5 (10), need for achievement (12), locus of control (13), self-efficacy/proactivity (11), innovativeness (12), stress/uncertainty tolerance (4) and need for autonomy (4). The third series list studies by the stage of business they apply to: career choice/business creation (14), survival/success (14), and exit (1). The final series list studies by other types of comparisons: comparing demographics (11) and comparing with environmental factors (6). These tables form the starting point of our summary of each subset of literature, as well as comparisons on the methodologies, conceptual tools, findings, and efficacy of each approach.

Before reviewing these studies, it is important to identify broad caveats and limitations to this literature stream. First, many studies lack the preferred structure outlined in the Introduction, with the unfortunate result that it is often unclear as to whether individuals with a given set of personality traits selected into entrepreneurship, or whether the traits were developed endogenously by individuals after becoming entrepreneurs. This reverse causality concern is especially prominent for cross-sectional surveys and data tabulations. Additionally, even when the measurement of personality traits does precede entrepreneurial choices, this does not guarantee that this trait was the causal factor. For example, individuals from wealthy families may score high on risk tolerance levels because they have the security of their family's money, and perhaps availability of financial resources is the true factor that prompts entrepreneurship, independent of risk tolerance. Without observing and measuring the wealth of individuals, we are liable to mismeasure the role of risk tolerance for decisions. This concern over omitted variable bias is true for individual studies, and it is compounded when comparing studies drawn from countries and settings that have differing cultural factors that are also known to influence personality traits, such as entrepreneurial motivation and achievement orientation (Stewart and Roth, 2007). Finally, survey-based analyses often have small sample sizes, which may explain some of the variation in results seen across studies.

Understanding these caveats, we proceed with a summary of the main personality-related results. The online appendix to this review contains additional details for most of the papers mentioned. The collected information includes country of coverage, personality traits and demographics considered, measurement approach, data sources and sample size, outcomes and findings (including reference group), and the population of entrepreneurs considered. While first developed for our own use, we hope this is a useful resource for those wishing to dig deeper on these diffuse literatures.

1.1.1 Big-5 model

The Big-5 model is a multidimensional approach towards defining personality, through measuring openness, conscientiousness, extraversion, agreeableness, and neuroticism. It has been the predominant model for personality traits since the 1980s, and the Big-5 traits have been found to influence career choice and work performance (e.g., Costa and McCrae, 1992; Digman, 1990; Goldberg, 1990; John et al., 2008; Rauch, 2014). The five "macro traits" cover a distinct set of characteristics, as described in John et al. (2008, p. 138):

- *Openness to experience*: describes the breadth, depth, originality, and complexity of an individual's mental and experimental life
- *Conscientiousness*: describes socially prescribed impulse control that facilitates task- and goal-orientated behavior
- *Extraversion*: implies an energetic approach toward the social and material world and includes traits such as sociability, activity, assertiveness, and positive emotionality
- *Agreeableness*: contrasts a prosocial and communal orientation toward others with antagonism and includes traits such as altruism, tender-mindedness, trust, and modesty
- *Neuroticism*: contrasts emotional stability and even-temperedness with negative emotionality, such as feeling anxious, nervous, sad, and tense

Differences between entrepreneurs and managers

The bulk of the existing studies comparing the prevalence of Big-5 traits between populations of entrepreneurs and managers occurred between 1960 and 2000. Managers are frequently used as a comparison point for entrepreneurs given the potential need of both groups to direct workers and manage multiple tasks. In a meta-analysis of 23 studies conducted from 1970 to 2002 in a variety of countries and reported in English-language journals, Zhao and Seibert (2006) find entrepreneurs to be more open to experience, more conscientious, similar for extraversion, less agreeable, and less neurotic (or in the Big-5 lingo, O+, C+, E, A-, N-). Many individual studies, of course, show deviations from this pattern. For example, in a survey by Envick and Langford (2000) of 218 entrepreneurs and managers in a large Canadian city, the authors find entrepreneurs to be significantly less conscientious and agreeable than managers and less extraverted (O+, C-, E-, A-, N-), while confirming the other patterns observed in the meta study.

These characteristic differences between entrepreneurs and the average employed person are often theoretically ascribed to the "attraction-selection-attrition model" (Schneider, 1987). According to this model, workers are attracted to jobs whose demands and opportunities match their talents, motives, and personality traits; employers or financiers then select applicants whose aptitudes and motives fit their criteria; and workers then stay in their occupational group when

they find their professional situation more rewarding than alternative positions. We review next each of these five traits as they would be presented in this model.

Entrepreneurs are consistently found to be more open to experience than managers (O+). Researchers hypothesize that in the context of a business venture, an entrepreneur is likely to be attracted to constantly changing environments and the novelty of new challenges. Individuals who thrive on challenges and novel environments are those who present creative solutions, business models, and products, and the openness of entrepreneurs may aid these functions. Meanwhile, managers are often selected by their superiors for their ability to execute and deliver high-quality and low-variance results for a given set of directions rather than seek out original solutions. Thus, researchers theorize that both the environment and job requirements of an entrepreneur select for individuals who are more open to experience.

Zhao and Seibert (2006) suggest that higher conscientiousness is the most significant difference between entrepreneurs and managers (C+). Conscientiousness is a composite of achievement motivation and dependability. Zhao and Seibert (2006) find that entrepreneurs and managers are similar in dependability, but entrepreneurs score significantly higher than managers in the achievement facet. In a meta-analysis of 41 studies, Collins et al. (2004) also conclude that individuals who pursue entrepreneurial careers are significantly higher in achievement motivation than individuals who pursue other types of careers, and Stewart and Roth (2007) similarly conclude that entrepreneurs are more achievement-oriented than managers. It is frequently hypothesized that those with high achievement motivation are drawn to environments in which success is more closely attributed to their own efforts, rather than a larger institutional setting in which business success or failure is less a function of one's individual efforts.

There is a lack of consensus on whether entrepreneurs score higher than managers on extraversion (E). This trait measures the extent to which one is dominant, energetic, active, talkative, and enthusiastic (Costa and McCrae, 1992). Some researchers hypothesize that extraversion could be more important for entrepreneurs than managers since entrepreneurs act as salespeople for their ideas to investors, partners, employees, and customers. Zhao and Seibert (2006) conclude, however, that no reliable difference emerges in the literature. Envick and Langford (2000), who found that entrepreneurs were less extraverted than managers, suggested that many entrepreneurs may run small businesses from their homes to be away from large bureaucracies that demand one to be relentlessly sociable. This is an area where the definition of "entrepreneur" matters greatly: self-employed persons and growth-oriented founders tend to exhibit very different characteristics.

Finally, entrepreneurs are often found to have modestly smaller amounts of agreeableness and neuroticism (A-, N-) but these differences measured are quite small between entrepreneurs and managers. Some researchers hypothesize that, because most entrepreneurs eventually become the CEOs of their own ventures, they do not need to worry about pleasing other people around

them, whereas managers must at least please their own bosses. Zhao and Seibert (2006) find entrepreneurs to be less neurotic than managers, suggesting that this is because entrepreneurs require exceptional self-confidence to take on the risks of starting a venture. Overall, however, there is not a strong pattern of significant results in the current literature on these two dimensions.

Differences across entrepreneurial populations

Recent work seeks to measure these traits across different types of entrepreneurs or different levels of intent, and these variations are as exciting and policy relevant as the macro-level depiction of entrepreneurs versus the average person. Antoncic et al. (2015) conduct 62 face-to-face interviews at firms and 501 questionnaires at educational institutions in Slovenia, classifying people into four groups: practicing entrepreneurs who already own a firm (30.2% of responses); potential entrepreneurs who intend to establish their own firm in the following three years (9.9%); maybe-entrepreneurs who might establish their own firm sometime in the future (46.7%); or non-entrepreneurs who never intend to set up their own firm (13.2%). The study finds variations that mirror the meta-survey results for openness: practicing entrepreneurs are the most open to experience, potential entrepreneurs slightly less open, maybe-entrepreneurs even less open, and non-entrepreneurs the least open. The surveyed entrepreneurs are also less agreeable, but the patterns in meta-analyses are not reflected for conscientiousness and neuroticism (in total, O+, C, E+, A-, N). Antoncic et al. (2015) corroborates the broad consensus that entrepreneurs tend to be more open to experience than the general population, while the other traits are harder to determine.

What lies behind this latter uncertainty? Much of the variation across individual studies can be attributed to the small sample sizes, which usually only capture a few hundred respondents (Envick and Langford, 2000; Antoncic et al., 2015). But small sample sizes are unlikely to be the only answer, as the patterns in meta-analyses like Zhao and Seibert (2006) and Zhao et al. (2010) overlap but are also not fully congruous. This limitation for meta-analyses may in part reflect the influence of environment on each entrepreneurial population's traits, such that generalizations across populations, industry, and culture are an impossible task. Necessity- versus opportunity-driven entrepreneurs certainly bring different personality traits, and even the opportunity-driven entrepreneurs in New York City might be different from those in Silicon Valley. Perhaps as more studies are conducted, we will become better equipped to separate the noise of small samples from the actual differences in personality traits for entrepreneurship across environments, which would be a major accomplishment.

Another critique of the Big-5 framework is the overly general nature of these macro personality traits, such that they cannot easily predict situation-specific behaviors of entrepreneurs; also, an understanding of a person's Big-5 personality may not help in understanding the specific mechanisms through which personality impacts entrepreneurial attitudes and actions (e.g. Kanfer, 1992; Rauch, 2014). Frustrated by these limitations of the Big-5 framework to describe a coherent portrait of the entrepreneur, researchers have shifted toward creating a multidimensional

personality framework that incorporates other qualities like self-efficacy, innovativeness, locus of control, and need for achievement. We describe these next.

1.1.2 Self-efficacy and innovativeness

In the uncertain and competitive environment of new venture creation, many researchers hypothesize that entrepreneurs thrive on a strong sense of personal self-efficacy to execute their visions and a keen eye for innovation to identify new products and markets. Self-efficacy describes a person's "belief that he/she can perform tasks and fulfill roles, and is directly related to expectations, goals and motivation" (Cassar and Friedman, 2009). High self-efficacy correlates with work-related performance (Stajkovic and Luthans, 1998), small business growth (Baum and Locke, 2004), academic performance (Hacket and Betz, 1989; Luszczynska et al., 2005), and career choice (Lent and Hackett, 1987). Self-efficacy is measured on two levels of specificity, either as generalized self-efficacy or domain-specific Entrepreneurial Self-Efficacy (ESE). Most researchers focus on the more situation-relevant ESE measure.

Chen et al. (1998) define ESE as a composite of self-efficacy toward five tasks: innovation, risk-taking, marketing, management, and financial control. Surveying students in three business study programs, they find that entrepreneurship students have a higher ESE average in marketing, management, and financial control than did organizational psychology and management students. Perhaps entrepreneurship programs draw students who feel confident in many areas due to the diverse demands of being an entrepreneur, or it could be that study of entrepreneurship instills this ESE. Chen et al. (1998) also finds that business founders have a higher ESE in innovation and risk-taking than non-founders, even as the locus of control remains the same across the two populations. In addition, researchers hypothesize that entrepreneurial types may also simply be more confident, which would induce them to score themselves higher across the board in the subjective surveys typically used to collect data. We discuss evidence related to this point below. Rather than evaluating whether entrepreneurs have a greater ESE than other groups (which seems a somewhat tautological question), most researchers have focused on the effect of ESE on firm performance. This evidence will be considered in section 1.2.

Utsch and Rauch (2000) examine innovativeness and initiative as mediators of achievement orientation, which in this case is a composite measure of self-efficacy, higher-order need strength, need achievement, and internal locus of control. Their surveys and interviews capture 201 German entrepreneurs defined as founders, owners, and managers of a small business with less than 50 employees. Innovativeness is found to be a mediator, while initiative is not. (The psychology literature talks about "mediators," which for an economist roughly means a mechanism via which one thing impacts another.) Likewise, innovativeness correlates positively and significantly with the personality traits of self-efficacy, higher-order need strength, and need achievement, but not with internal locus of control.

In general, innovativeness refers to how individuals respond to new things (Goldsmith and Foxall, 2003). Innovativeness can be considered as a global or domain-specific personality trait, or as a behavioral concept such as the adoption of new products by consumers. Different ways to measure innovativeness have been suggested at least since the 1970s (Hurt et al., 1977), but no uniform measure exists across the studies reviewed here. In one study, Marcati et al. (2008) argue that domain-specific innovativeness of founders completely mediates their general innovativeness in a sample of 188 entrepreneurs of small- and medium-sized firms of various industries. Both forms of innovativeness display generally consistent correlations with Big-5 traits, not indicating major differences in their origins.

Kickul and Gundry (2002) analyze the relationship between 107 small-firm owner-managers' strategic orientation, personality, and innovation. They adopt the Miles and Snow strategic orientation typology, which divides business strategies into prospector, defender, analyzer, and reactor strategies.[2] Kickul and Gundry (2002) find that the prospector strategic orientation mediates proactive personality and three types of innovations: innovative targeting processes, innovative organizational systems, and innovative boundary supports. They likewise find that those with proactive personalities are more likely to both take on a prospector strategy orientation and innovate in their work, which is to be expected.

Given the vast number of Big-5 and risk attitude studies (the latter of which are discussed below in Section 2), it is quite surprising how little attention has been paid to the innovativeness of entrepreneurs as it relates to their personalities. This is a place where the biographies of Steve Jobs alone likely outnumber the formal academic studies! Nevertheless, scholars likely agree that entrepreneurs need to be able to tolerate some risk and to create or recognize new business opportunities, perhaps also innovating new products and concepts that can be brought to market. Related industry-level evidence certainly supports this, with industries showing high rates of entry by small firms also tending to have high rates of innovation and high productivity growth (Parker, 2009).

One explanation for this gap may be related to the measurement of "innovativeness": we simply do not have an agreed-upon set of survey questions to measure someone's innovativeness in the way that we can measure risk preferences or Big-5 traits. As such, the metrics used in the literature are scattered, and universal, domain-specific measures of entrepreneurial innovativeness remain elusive. Another explanation is that the identification of ESE traits is especially sensitive to the reverse causality and omitted variable bias concerns described earlier, raising the difficulty

[2] Barney and Griffin (1992): "A prospector strategy constantly seeks out new markets and opportunities; a defender strategy concentrates on protecting current markets and maintaining stable growth; an analyzer strategy both tries to maintain market share and seek out new market opportunities; a reactor strategy fails to anticipate or influence events in the environment."

in studying it or in interpreting results (Bandura, 1997; Forbes, 2005). Consequently, scholars may be reluctant to pursue it for fear of limited publication possibilities.[3]

Cassar and Friedman (2009) compare nascent entrepreneurs in the startup phase of new ventures with a control group drawn from the general working-age population. A nascent entrepreneur is defined by the Panel Study of Entrepreneurial Dynamics (PSED) as anyone who is currently trying to start a new business, expects to be an owner or part owner of the firm, and has been active in doing so for the past 12 months. Cassar and Friedman (2009) assert that their data, drawn from the PSED and interview and survey responses of 431 American nascent entrepreneurs, overcome inference challenges due to venture survivorship and recall bias. They present evidence that higher ESE increases the likelihood of being a nascent entrepreneur as well as the successful founding of an operating business.

To sum, theory and a limited dose of empirical evidence suggest that entrepreneurs possess higher self-efficacy than managers and non-entrepreneurs (Chen et al., 1998). This is perhaps partly due to proactive personalities being more likely to innovate (Kickul and Gundry, 2002). Innovativeness, in turn, can mediate one's achievement motivation in a way that mere initiative does not (Utsch and Rauch, 2000). In a longitudinal study, Cassar and Friedman (2009) confirm that those with high ESE are more likely to become nascent entrepreneurs and successful founders. However, the limits of this literature should not be downplayed. There is still a clear lack of studies successfully isolating the pre-founding characteristics of to-be entrepreneurs on these dimensions, as well as longitudinal studies that track characteristics of individuals over time. Given the high potential for endogenous ESE, this is a large caveat to be addressed.

1.1.3 Locus of control

An important trait in the entrepreneurship literature is locus of control (LOC). A person with an internal LOC conceptualizes that their own decisions control their lives, while those with an external LOC believe the true controlling factors are chance, fate, or environmental features that they cannot influence. Rotter's (1954) theory of social learning first introduced the LOC concept. Persons with internal LOC believe that they can influence outcomes through their own ability, effort, or skills, rather than external forces controlling these outcomes. Previous research has linked belief in internal control to the likelihood of engaging in entrepreneurial activity (e.g., Shapero, 1975; Brockhaus, 1982; Gartner, 1985; Perry, 1990; Shaver and Scott, 1991).

[3] Many studies instead focus on the "innovativeness" of the firm rather than on that of the founder, basing their analyses on patents, R&D efforts, reported product and process innovations, and similar measurable firm traits. We abstract away from those studies, which are obviously important in their own way, to maintain the survey focus on the personality findings. Hyytinen et al. (2015) provide a strong survey of this parallel literature and analyze Finnish survey data combined with official business register data. They find a positive correlation between the innovativeness of the firm and its survival, although a causal interpretation is not established. For risk-loving entrepreneurs, any positive impact of firm innovativeness turns negative.

Many researchers emphasize LOC in their work. Barrick and Mount (2005) claim that "specific 'traits rely on explicit description of entrepreneurial activities that may be situated in time, place and role,' which is why specific characteristics such as risk tolerance, need for achievement, or locus of control are more useful in predicting entrepreneurial performance than the Big Five." Caliendo et al. (2009) re-evaluate that assertion and, along with other researchers, suggest that traits such as LOC can be more directly extrapolated onto decision-making in the professional field.

Notably, LOC is considered to be a culturally dependent trait. Mueller and Thomas (2000) find that countries with more individualistic cultures (as opposed to collectivist cultures) show greater internal LOC, and that LOC and innovativeness are both learned traits.[4] This cultural variance is affirmed by Tajeddini and Mueller (2009), who find that LOC is higher in British entrepreneurial populations than Swiss entrepreneurial populations in the high-tech industry. The authors argue that the difference could be related to the Hofstede's (1980) defined variations in cultural characteristics such as individualism, uncertainty avoidance, and risk propensity.

Many researchers find internal LOC to be stronger in entrepreneurial populations than in other populations. Levine and Rubenstein (2017) find in NLSY longitudinal data that those who become a self-employed person running an incorporated business display a strong internal LOC prior to founding their firm than those who are employed by others or self-employed in unincorporated businesses. This echoes earlier findings by Evans and Leighton (1989), and many studies find parallel results. In a cross-sectional study, Korunka et al. (2003) measure that Austrian entrepreneurs (defined as "successful new owner-managers") have a strong internal LOC compared to "nascent entrepreneurs." Gürol and Atsan (2006) find that Turkish students who are more entrepreneurially inclined have a higher LOC. Caliendo et al. (2014) argue that internal LOC is among the personality traits that best predicts entrepreneurial entry and exit decisions. Hansemark (2003) finds in tracking Swedish entrepreneurship students over 11 years that LOC predicts entry into entrepreneurship for men but not for women.

Looking within entrepreneurial populations, a higher internal LOC is further associated with venture growth. Rauch and Frese (2007) find in their meta-analysis that an internal LOC has a significant correlation with business creation and eventual business success. Surveying 168 Chinese entrepreneurs in small and medium-sized enterprises in Singapore, Lee and Tsang (2001) find internal LOC positively correlates with venture size and growth rates. At the same time, Lee and Tsang (2001) note that personality traits are less important than industrial and managerial experience and skills in explaining firm growth in their sample. Overall, the LOC personality trait finds extensive support and is rather homogeneous across types of entrepreneurs.

[4] The Hofstede (1980) index places countries such as the United States, United Kingdom, Canada and Ireland to the individualist end of the spectrum, and countries such as China and Singapore to the collectivist end of the spectrum. See also Thomas and Mueller (2000).

1.1.4 Need for achievement

The need for achievement refers to an individual's desire for significant accomplishment, mastering of skills, and attaining challenging goals. Researchers hypothesize that entrepreneurs might hold a high need for achievement, as building a business from scratch demonstrates one's individual abilities in ways that are often hard to match when working within a system in which responsibility is diffuse. Along with LOC, this important role for need for achievement finds strong support in the literature along several dimensions.

Need for Achievement (nAch) is a concept based on McClelland (1985) "acquired-needs theory" and is one of the dominant needs affecting individual actions in a workplace context. The concept was first introduced by Murray (1938), and later developed and popularized by McClelland (1961, 1985). Many researchers have found that a high need for achievement predicts entry into entrepreneurship, although this finding is sometimes challenged in specific contexts. Among the settings discussed above, the higher need for achievement is evident in the studies of the Austrian entrepreneurs (Korunka et al., 2003) and the Turkish students (Gürol and Atsan, 2006), but not in the study of Swedish entrepreneurship students (Hansemark, 2003). Comparing four Austrian studies, Frank et al. (2007) conclude that the need for achievement selects individuals for entry into entrepreneurship. Turning to comparative analyses across countries, Stewart and Roth (2007) conclude from a meta-analysis of 18 studies and 3,272 subjects that entrepreneurs exhibit a higher achievement motivation than managers regardless of country or type of instrumentation ("projective" or "objective").[5] Further differences are also evident across sub-groups of venture founders. Mueller and Thomas (2000) find that Swiss entrepreneurs have a higher need for achievement than U.K. entrepreneurs, suggesting that the trait varies across cultures and countries.

Some researchers also identify a link between the need for achievement and business performance. For example, the meta-analysis of Collins et al. (2004) finds that both projective and self-reported measures of achievement motivation predict entrepreneurial intentions and performance. Rauch and Frese (2007) find similar results. However, Frank et al. (2007) argue that the need for achievement, along with other personality factors, is much less relevant than environmental resources and many "process configurations" (such as the set of management functions including planning, organization, and human resource practices) in explaining entrepreneurial performance.

[5] Projective instruments utilize unstructured stimuli to get respondents to reveal underlying or hidden emotions or internal conflicts (e.g., Holzman inkblot tests), whereas objective tests utilize comprehensive personality instruments.

1.2 Correlation of personality traits with venture phases

We noted in the Introduction that research has mostly investigated how personality characteristics correlate with probability of entry into and exit out of entrepreneurship, as well as with various measures of success as an entrepreneur (including venture creation, venture growth, and long-term venture survival). By contrast, academic work is only beginning to scratch the surface of how personality characteristics link to specific phases in the venture process or to consider narrower topics like industry-specific innovation or business plan quality.

1.2.1 Probability of entry into entrepreneurship

Entry into entrepreneurship is often defined as the act of starting a new business venture. The correlation between personality traits and probability of successful entry into entrepreneurship is typically measured in two ways. First, taking advantage of university settings, many researchers analyze student personalities in correlation with their current entrepreneurial intent, their perceived learning, perceived ability, and personal investment. Second, studies use national longitudinal panel datasets like the PSED or the German Socioeconomic Panel (GSOEP) to track whether measured personality traits in those large-scale surveys predicted later business founding.

Cross-sectional studies and meta-analyses

Research teams surveying student populations focus by necessity on future career intentions and early developmental views of entrepreneurship. For example, Singh and DeNoble (2003) examine the relationship between the Big-5 traits and entrepreneurial intent, perceived ability, and personal investment among 342 students at a large state university on the west coast of the United States. They find that openness is positively related to perceived ability and personal investment, whereas neuroticism negatively relates to intent and ability. They also test for variability between studies that had defined entrepreneurs as founders versus business leaders, finding no significant differentiation between the two categories. Synthesizing 60 studies describing the relationship between Big-5 traits and entrepreneurial intentions and performance, Zhao et al. (2010) find that entrepreneurial intentions are positively related to openness to experience, conscientiousness, extraversion, emotional stability, and risk propensity, and that only agreeableness was irrelevant in explaining entrepreneurial intentions (O+, C+, E+, A, N-). Among these, risk propensity garners the strongest support, followed by openness and emotional stability.

Looking to non-Big-5 traits, Korunka et al. (2003) survey 1,169 nascent entrepreneurs and new business owner-managers in Austria to study their action patterns. Of 627 new business owner-managers, 153 who meet success criteria also display a high need for achievement, high internal LOC, and medium risk-taking propensity. The study also considered three startup configurations for nascent entrepreneurs to combine analysis of personality traits with situational factors. The first configuration, “nascent entrepreneurs against their will,” consists of those with a

strong push factor and comparatively little social or network support. This group holds a comparatively low need for achievement, low internal LOC, and low personal initiative. The "would-be nascent entrepreneurs" have unfavorable financial situations but otherwise strong self-realization motives and internal LOC. Finally, "networking nascent entrepreneurs with risk-avoidance patterns" have supportive environments and strong resources, yet high risk-avoidance.

In a sample of 265 Master of Business Administration (MBA) students across five American universities, Zhao et al. (2005) find that individuals are most likely to form entrepreneurial intentions directly because they have high ESE, which in turn is influenced by learning and experience, and to a lesser degree, by risk propensity. However, even as gender was not related to ESE, women reported lower entrepreneurial career intentions, suggesting that the relationship of gender to entrepreneurial intentions is likely quite complex. As pointed out by Miao, Qian, and Ma (2016) in their meta-analysis of ESE, most other studies also find a positive relationship between ESE and entrepreneurial intentions and/or venture creation.[6]

To summarize these cross-sectional studies and meta-analyses, students who display certain Big-5 traits (i.e., more open to new experiences, more conscientious, more extraverted, and less neurotic) and higher levels of ESE, internal LOC, and need for achievement are the group most likely to enter entrepreneurship after graduating from university. These studies also highlight the environmental and gender factors that influence these choices.

Longitudinal studies

To move from entrepreneurial intentions to actual business formation, researchers need to track a group over time. For example, Hansemark (2003) tracks students from a Swedish entrepreneurship program over an 11-year period by matching psychological data with Swedish registries of new businesses. The author measures the predictive validity of initially measured personality characteristics toward becoming an entrepreneur at some point in the future, relative to a matched control group. Internal LOC has predictive validity for men but not for women; somewhat surprisingly the need for achievement is not predictive for either gender. These results are inconsistent with those of Korunka et al. (2003) and two studies discussed next.

Kessler et al. (2012) interview 227 Austrian business founders three times between 1998 and 2005. The authors find that personality traits of need for achievement, LOC, and risk taking predict early success, measured by first sales revenues, but not longer-term business survival. The relevance of internal LOC is also observed in the Caliendo et al. (2014) study of 10 waves of the GSOEP from 2000 through 2009. More broadly, the GSOEP study finds that some personality traits, such as openness to experience, extraversion, and risk tolerance, predict entry, but entirely different ones, such as agreeableness or other levels of risk tolerance, govern exit choices from

[6] In addition to studies already mentioned, see also Miner (2000), Müller and Gappisch (2005), Barbosa, Gerhardt, and Kickul (2007), and Wilson, Kickul, and Marlino (2007).

self-employment. Only internal LOC holds a similar influence on both the entry and exit decisions. Caliendo et al. (2014) report that these personality traits can explain 30% of the overall variance, with risk tolerance, LOC, and openness leading the way.

Two studies specifically consider the impact of ESE on various phases of the entrepreneurial process. First, Cassar and Friedman (2009) find in the PSED sample that ESE increases the likelihood of creating an operating business. Second, Brinckmann and Kim (2015) report that ESE facilitates the development of formal business plans, while entrepreneurial perseverance tends to promote engagement in business planning studies.

To summarize, recent literature mostly agrees that internal LOC and need for achievement are important predictors of entry into entrepreneurship. Risk-taking is also found to correlate with business founding but not necessarily with performance or exit. Finally, there also seems to be a link between ESE and business founding, as well as with specific related functions such as business planning skills.

1.2.2 Growth and success as an entrepreneur

Most researchers and policymakers are interested in not only what traits predict entry into entrepreneurship, but what traits contribute to successful venture performance measures such as growth, investment, long-term survival, and self-reported success. The literature becomes rather sparse and idiosyncratic over these various metrics, so we cycle quickly across them and provide some sample findings. (In addition, it is worth recalling that some studies would consider the innovativeness discussed above as a personality trait as a possible outcome metric.)

Firm growth is one of the most common measures of venture success. In their sample of 201 German founders, Utsch and Rauch (2000) find that measures of innovativeness predict employment growth and profit growth, while measures of initiative correlate only with profit growth. Additionally, they find a positive interaction effect between innovation and ESE.[7] Baum and Locke (2004) conduct a six-year longitudinal study of North American architectural woodwork firms. They find that situationally specific motivations of goals, self-efficacy, and communicated vision have direct effects on venture growth, mediating other traits like passion, tenacity, and new resource skill.

In some settings, researchers can study how personality traits correlate with firm investment. Cassar and Friedman (2009) find that ESE increases the amount of personal resources an entrepreneur invests into a venture, as measured by proportion of personal wealth invested in the venture and number of hours per week devoted to the venture. This type of personal investment

[7] Miao et al. (2016) synthesize 26 studies in their meta-analysis of ESE and firm performance to find a moderately-sized positive correlation (0.309) between these variables.

is also reflected at the student level, with Singh and DeNoble (2003) finding that personality could predict the amount of time students spent preparing for future business efforts.

Another popular measure is the long-term survival of the firm, as it can be readily measured through techniques as simple as business registers, web presence, or phone directories. Ciavarella et al. (2004) find that high conscientiousness is positively related to long-term venture survival (eight years or more), compared to a negative relationship for the entrepreneur's openness to experience and no relationship for the other Big-5 personality traits.

Many surveys ask entrepreneurs to rate their success. Different entrepreneurs may have very different views as to how successful their ventures are, and the typical proxies used by researchers (e.g., growth and survival) may not correlate very well with the self-defined success or performance. For example, Poon et al. (2006) assess performance among 96 Malaysian entrepreneurs by asking respondents to rate their company's growth, sales volume, market share, and profit using a scale ranging from 'very poor' (1) to 'very good' (5). Respondents rate these four performance criteria relative to that of competitors and their own expectations, yielding an 8-item performance scale. The study finds that internal LOC is positively connected to firm performance, but lesser support exists for ESE and achievement motivations.

Finally, researchers summarize the relationship between personality traits and successful venture performance through meta-analyses. For example, Rauch and Frese (2007) identify that the traits most significantly correlated with business success include the need for achievement (.30), innovativeness (.27), "proactive personality" (.27), generalized self-efficacy (.25), stress tolerance (.20), need for autonomy (.16), locus of control (.13), and risk-taking (.10). The authors note that these relationships are of moderate magnitude and that heterogeneity across the different studies allow the possibility of moderators, which could be included for future studies. Another meta-analysis by Zhao et al. (2010) finds that conscientiousness, openness to experience, emotional stability, and extraversion are positively related to entrepreneurial firm performance as measured by firm survival, growth, and profitability. While risk taking is positively related to business foundation, it does not correlate with eventual business growth and success.

Additional studies focus on how intelligence interacts with the personality traits. One example is the Baum and Bird (2010) field study of 143 U.S.-based founders of high-growth printing industry firms. The authors find that "successful intelligence," which is defined by them to consist of practical, analytical, and creative elements, combines with high ESE to promote venture growth over four years. Likewise, Hmieleski and Corbett (2008) find that improvisational behavior combined with high ESE has a positive relationship with sales growth. It is often difficult to bring much conceptual order to these studies as they combine personality traits with different empirical constructs, and the results are sometimes counterintuitive. We worry most about studies where individuals define whether they are successful, and such statements are very subjective and can only be evaluated against initial goals for the business, which vary substantially.

1.2.3 Probability of exiting entrepreneurship

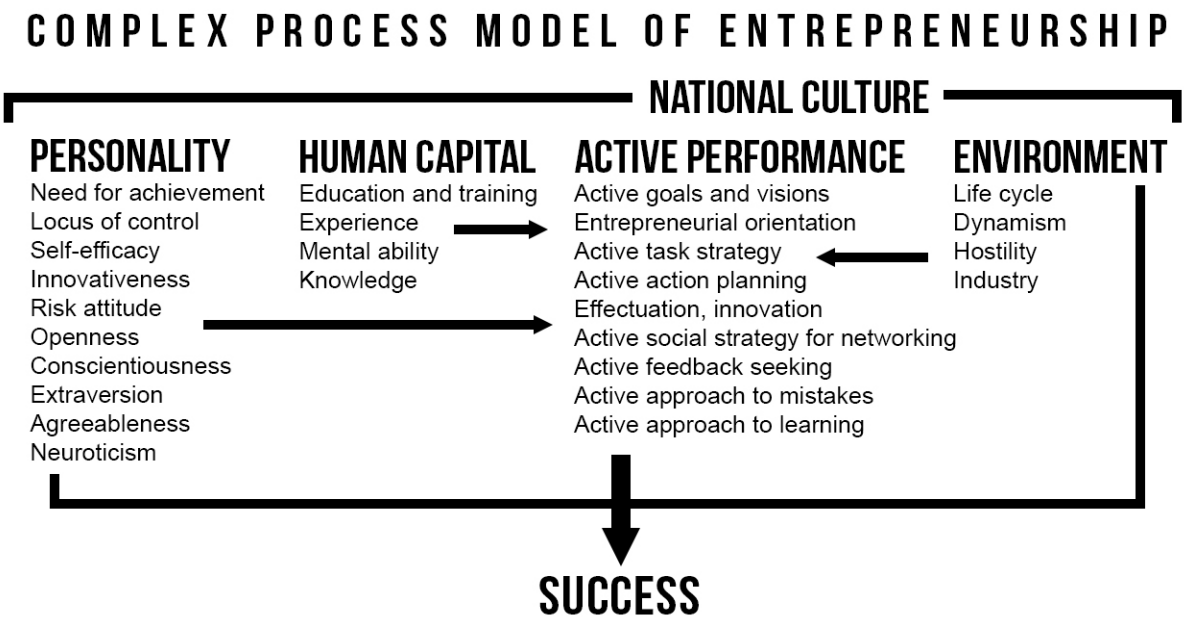
While many researchers scrutinize the decision to start a firm, very few consider how personality characteristics relate to decisions to exit from entrepreneurship. As a rare exception, Caliendo et al. (2014) find using the GSOEP panel dataset that agreeableness increases the likelihood of exit from entrepreneurship, and an internal LOC makes exits less likely. The authors note that risk tolerance also had a non-monotonic relationship with the exit decision.

1.3 Moderating traits and environmental factors

Personality characteristics correlate with each other, while at the same time being impacted and shaped by environmental forces. Researchers in all disciplines frequently describe how personality factors interact with or are moderated by other individual traits (e.g., gender, education) and external conditions (e.g., industry dynamics, city traits). For example, we noted earlier the Tajeddini and Mueller (2009) study that compares 133 Swiss entrepreneurs with 120 British entrepreneurs in the high-tech industry. U.K. techno-entrepreneurs scored higher on surveys in autonomy, risk propensity, and LOC, while Swiss techno-entrepreneurs scored higher on achievement need, tolerance for ambiguity, innovativeness, and confidence. Because the technology industries in both countries are quite similar in terms of development and institutional support, Tajeddini and Mueller (2009) attribute the variation to cultural differences rather than other environmental factors.

Similarly, Hmieleski and Baron (2008) examine a three-way interaction of ESE, dispositional optimism, and environmental dynamism on firm performance (e.g., revenue growth and employment growth). The researchers define environmental dynamism as the rate of unpredicted change occurring within a given industry, following approaches of Dess and Beard (1984) and Sharfman and Dean (1991). They find that high ESE improved firm performance in dynamic environments when combined with moderate optimism, but was detrimental when combined with high optimism. In stable environments, ESE's effects are weak and not moderated by optimism. Hmieleski and Baron (2008) conclude that high ESE is not always beneficial for entrepreneurs and that environment and industry difference may interact strongly with personality traits in terms of their impact for venture outcomes.

Researchers in some disciplines (but rarely economics) go further than the study of interactions to construct "a complex process model of the entrepreneur," in which the relationships among these variables are mapped out and ultimately govern venture success. The following diagram is adapted from Frese (2009) and Brandstätter (2011) to illustrate this process.



Entrepreneurship does not occur in a vacuum, and personality traits, human capital, and environment weave the context for each attempt to start and operate a new business. Regardless of discipline, this complex and integrated nature of entrepreneurship suggests that researchers must approach their setting carefully to reach reliable conclusions and be careful to consider how much the results of any one study can port across locations.

2. Risk attitudes

The world of business venturing is incredibly risky, especially for those seeking high-growth opportunities. Åstebro et al. (2014) report that over half of startups are no longer operating after six years, and 75% of entrepreneurs exit with no equity. What is it then that draws 400,000 individuals in the United States every year to start a firm with at least one employee? One prominent explanation is risk tolerance, which we explore in this section.

Discussions of risk and entrepreneurship date back to Knight (1921), who proposes that entrepreneurs are differentiated from others by their astuteness toward perceiving and acting on opportunity despite uncertainty and risk. Knight further separates risk, where the probability of future states of the world are knowable if beyond one's control, from uncertainty, where it is hard to even describe exactly what the future states might be. Pure risk can often be priced and diversified away, while Knight identifies entrepreneurs as those who can handle well this business

uncertainty. Despite the intuitive and important nature of this distinction, most subsequent work has continued to meld together risk and uncertainty.[8]

Khilstrom and Laffont (1979) develop a very popular theory model which predicts that the most risk-averse people will become employees while those with low risk aversion will become entrepreneurs; Feng and Rauch (2015) provide simpler forms and extensions of this very technical model. Åstebro et al. (2014, p. 55) summarize the standard expected utility model of risk preference as such: "Risk preferences are defined by the utility function over wealth in the standard expected utility framework. Most people have utility functions that imply risk aversion, and such people are more willing to take work with regular and less-variable pay. However, a smaller proportion of people—who exhibit less curvature in their utility functions over wealth, and thus less risk aversion—are more likely to be attracted to the possibility of large gains from highly risky ventures such as entrepreneurial activity. Thus, holding constant other factors such as entrepreneurial ability and financing constraints, the individual's preferences over risk can play a critical role in determining the entry decision."

Risk attitudes are described in the literature as risk preferences, risk tolerance, risk aversion, and risk propensity. All usages of the concept attempt to answer the question of whether something in an individual's personality predisposes them to take on the risky conditions of entrepreneurship and the impact of this personality trait on outcomes.

2.1 Methods of measuring risk attitudes

One approach toward measuring risk attitudes uses self-reported metrics. These questions vary on levels of specificity, as many are derived from longitudinal surveys that are not specifically tailored toward entrepreneurship. For example, the GSOEP used by Caliendo et al. (2009) includes the general risk-attitude question, "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" Ekelund et al. (2005), who use the Northern Finland 1966 Birth Cohort Study, study more indirect questions about general risk attitudes, such as "I usually feel tense and worried when I have to do something new and unfamiliar" and "Most of the time I would prefer to do something a little risky (like riding in an automobile over steep hills and sharp turns)—rather than having to stay quiet and inactive for a few hours." Block et al. (2015) use a self-scoring question that asks, "In your entrepreneurial decisions, are you prepared to take risks, or do you try to avoid taking risks?"

The most obvious criticism of self-reported risk-aversion measures is that incomplete knowledge of oneself may lead a respondent to see him/herself differently than he/she appears to

[8] In some sense, the portrait of the risk-taking entrepreneur can also be traced back to Schumpeter's (1935) notion that entrepreneurs take advantage of existing opportunities by converting a new idea or invention into a "successful innovation," which inherently sounds like a risky and uncertain activity. However, Schumpeter states that the risk is borne by the investor or the "capitalist," not the entrepreneur.

others. Entrepreneurs are frequently found to be overconfident (Åstebro et al., 2014), possibly skewing self-reported results. Additionally, general attitudes may not transfer to attitudes toward the startup process, as one's risk attitude toward driving a fast car could be unrelated to one's risk attitude toward one's career or finances. Some researchers address this by presenting hypothetical but business-specific scenarios (or "vignettes") to measure risk attitudes. Where possible, other researchers who worry about the self-confidence or self-knowledge gap turn to directly examining entrepreneurs' investment portfolios and indices of demonstrated action that could be indicative of their attitudes to risk.

Among hypothetical situational questions used to measure risk attitudes, there is variation between questions on general financial risk-taking and more entrepreneurship-specific settings. Some surveys present a question about career choices with an either/or answer. For example, the PSED asks: "Assuming you are the sole owner, which situation would you prefer? (1) A business that would provide a good living, but with little risk of failure, and little likelihood of making you a millionaire, or (2) A business that was much more likely to make you a millionaire but had a much higher chance of going bankrupt." The NLSY79 asks: "Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50–50 chance that it will double your (family) income and a 50–50 chance that it will cut your (family) income by a third. Would you take the new job?" These situational questions that directly engage one's disposition toward risk propensity in business venturing are more reliable than general risk-attitude questions.

Some risk-attitude questions allow a wider range of responses beyond an either/or dichotomy using a hypothetical lottery or investment opportunity. For example, the study by Block et al. (2015) asks: "Imagine you have won $100,000 in a lottery. After having received the money, you have the possibility to invest the money in an entrepreneurial activity. With a probability of 50%, you double the amount. With a probability of 50%, you would lose half the invested money. How much money obtained from the lottery would you invest?"

Finally, other studies circumvent the self-confidence and self-knowledge gap by looking directly at the demonstrated investment metrics of individuals and firms or other behaviors that would reveal risk preferences (e.g., Puri and Robinson, 2007; Brown et al., 2006; Uusitalo, 2001). On the individual level, Hvide and Panos (2014) measure risk preference through stock market participation, personal leverage, and the fraction of wealth invested in the stock market. Lazear (2005) uses the standard deviation of industry-wide earnings in the individual's first job to measure how willing the person is to tolerate earnings-related risk. At the firm level, Caggese (2012) uses R&D expenditure behavior to measure risk attitudes under the assumption that research for introducing new products is riskier than investing in improving existing products.

Although individual investment data are limited and do not represent the entire entrepreneurial population (e.g., a small convenience store owner may not have an extensive stock portfolio), it avoids the concern that people act differently than how they answer in hypothetical self-report surveys. Similarly, at the firm level, Hall and Woodward (2010) use a model-based approach to back out what the relative risk aversion of an entrepreneur has to be for a given wealth level and external guaranteed earnings option, given the wide distribution of exit outcomes (ranging from failure to highly successful sales and public offerings) for VC-backed companies.

2.2 Risk attitudes of entrepreneurs vs. other populations

Studies compare the risk attitudes of entrepreneurs to managers within the same industrial sectors, the general population, and other groups of entrepreneurs with varying levels of skills and different types of motivation. Lazear (2005) uses a large sample of over 5,000 Stanford GSB graduates for whom questionnaire data can be combined with student transcripts. The author's proxy measure for risk tolerance—the variation of industry-level earnings among first job selected—is positively correlated with the probability of later entering entrepreneurship (although for Lazear, this metric is a control variable given the study's focus on the breadth of skillsets important for entrepreneurship).

Using a very different approach, Hall and Woodward (2010) agree that entrepreneurs must have a relatively high risk tolerance. Their study uses proprietary data for many VC-backed companies, analyzes the realized distribution of exit outcomes, and then infers what the relative risk aversion of entrepreneurs involved in these businesses must be compared to asset levels and guaranteed employment options. For example, someone with a coefficient of relative risk aversion equal to two (a common assumed value) and with assets worth $188,949 would be indifferent between starting their own VC-backed firm versus being employed at market salary. Individuals with lower risk aversion and/or higher assets would value the entrepreneurial opportunity more than wage employment.

The most controversial findings relate to the risk attitudes of entrepreneurs versus business managers, and here the evidence has been inconclusive if not contradictory. While it is straightforward to understand why entrepreneurs may be more risk tolerant than managers, some argue that other attributes, like the high need for achievement that both groups possess, equalize or obscure the simplest predictions (e.g., Atkinson, 1957). In a meta-analysis of 14 studies, Stewart and Roth (2001) find that the risk propensity of entrepreneurs is greater than that of managers. This conclusion is challenged, for example, by Miner and Raju (2004), who present data from 14 other studies that used projective techniques to measure risk preferences rather than self-report measures. The latter study finds entrepreneurs appear more risk avoidant than managers and highlights the unsettled nature of these questions. See also the Stewart and Roth (2004) response.

Xu and Ruef (2004) further examine the "myth of the risk-tolerant entrepreneur." They compare the risk attitudes of American entrepreneurs to the general population, using PSED data to analyze the reactions of 1,261 nascent entrepreneurs and general population participants in a series of vignettes concerning business investment decisions. Within these vignettes, they utilize two models. One is a "strategic" model of risk tolerance based on investment choices, which captures situational risk tolerance in taking a specific strategy or executing a specific action. The other is a "non-strategic" model of risk tolerance based on information bias about business success, which captures pre-dispositional risk tolerance. The researchers conclude that the PSED entrepreneurs are significantly more risk-averse than the general population, proposing that risk-averse individuals enter highly risky endeavors mostly because they value "identity fulfillment" and their autonomy more highly than any pecuniary benefits.

Other researchers measure heterogeneity within entrepreneurial groups. Both Stewart and Roth (2001) and Miner and Raju (2004) find that there are large differences between entrepreneurs whose primary goal is venture growth versus those whose focus is on producing family income. Block et al. (2015) expand on these distinctions by comparing opportunity and necessity motivations among a sample of 1,526 German entrepreneurs via an email questionnaire, in which participants are asked to indicate their willingness to take risks with regards to startups and the amount they would invest in a hypothetical investment lottery. The study finds that opportunity entrepreneurs are more willing to take risks than necessity entrepreneurs, and those who are motivated by creativity are more risk tolerant than other entrepreneurs.

To sum up, while the literature on entrepreneurial risk attitudes is sizeable and growing, there is no uniform consensus as to how risk preferences should be elicited and how they differ between populations. Perhaps a new and more complete synthesis lurks around the corner, but progress to such an end is not evident in recent studies. More work could be done on narrowly defined populations to better understand the degree of risk aversion among entrepreneurs. We also need to continually bear in mind and explore differences between actual risk taken on by entrepreneurs and the perceptions of the risk they hold (e.g., Palich and Bagby, 1995). It is not entirely clear whether risk attitudes can be separated from over-optimism and over-confidence in measurement, a distinction that is meaningful theoretically (Parker, 2009).

2.3 Effect of risk attitudes in the startup process

2.3.1 Probability of entry into entrepreneurship

Not surprisingly, there is a large literature looking at the impact of entrepreneurial risk attitudes on the likelihood of starting a venture and on the eventual success of that venture. This section briefly summarizes some key recent studies. There is a considerable heterogeneity in the samples studied by different scholars, and our illustrations reflect this range.

Cramer et al. (2002) consider 1,500 individuals from the 1952, 1983, and 1993 Dutch Brabant surveys, allowing a long time span for entrepreneurial choices to come about.[9] While the study finds evidence that risk aversion reduces entrepreneurial entry, the researchers did not feel confident enough in the link to deem it a causal relationship. In a very different setting, Gürol and Atsan (2006) administer a 40-item questionnaire to a random sample of 400 fourth-year university students from two Turkish universities. The sample of students who intend to start their own business ventures show higher risk-taking propensity than non-inclined students. Similarly, using the income gamble questions asked in the two years of the NLSY79 panel, Ahn (2010) finds that relative risk tolerance has a large, positive, and statistically significant effect on the probability of entering self-employment. An individual whose level of risk tolerance is one standard deviation above the mean is 13% more likely to enter self-employment than is an otherwise identical person. The author notes that the estimated effect of risk tolerance is dramatically understated (by about 90%) if the measurement error is not considered.[10] In another U.S.-based study that utilizes 14,305 observations from the Panel Study of Income Dynamics, Brown et al. (2011) measure that willingness to take financial risk is positively associated with future self-employment. Other international studies include Ekelund et al. (2005), who analyze psychometric data from the Finnish 1966 Birth Cohort Study to examine "harm avoidance" as measure for risk aversion.[11] They find that harm avoidance carries a negative effect on the individual's probability of being self-employed. Caliendo et al. (2009) observe in the GSOEP that individuals with lower risk aversion are more likely to become self-employed if they are coming out of regular employment, but risk aversion does not explain entry for those coming out of unemployment or inactivity.

Across the studies, the weight of the evidence suggests individuals with greater risk tolerance are more likely to enter entrepreneurship. That said, much more work could be done using the same measures of risk aversion for different populations of potential entrepreneurs and comparison groups to improve our estimates of the relationship, which are more directional than quantitative in nature. The realities of business venturing (and subsequent rates of failure) make it quite reasonable that a would-be entrepreneur needs to be one who can tolerate a lot of risk, but it is very important to push onwards. For examples, when designing unemployment insurance benefits or future universal basic income schemes, it would aid policy makers to have an accurate understanding of the relative degrees of risk tolerance in their population. Individuals who are risk tolerant may be more likely to exit unemployment by starting their own business, versus looking for paid work, if getting small incentives from the government (e.g., Hombert et al., 2017).

[9] The Brabant survey covers 5,800 people who were interviewed and tested at the age of 12 in 1952, while attending the last grade level of elementary school in the Dutch province Noord-Brabant. In so far as they could be traced, they were subsequently re-interviewed in 1983 and 1993. The data cover a rich set of aptitude scores, parental background variables, and later labor market outcomes, including detailed information on entrepreneurship experiences.

[10] The lifetime gamble questions are asked in 1993, 2002, 2004, and 2006 waves of the NLSY79.

[11] Harm Avoidance is measured as one of the four subscales of the temperament dimension of the Temperament and Character Inventory (TCI), a 240-item, self-reported questionnaire. The other three subscales are Novelty Seeking, Reward Dependence, and Persistence. An example of a survey question from Ekelund et al. (2005) is "I usually stay calm and secure in situations that most people would find physically dangerous."

2.3.2 Growth and success as an entrepreneur

In contrast to the strong consensus among researchers that risk tolerance supports venture creation, it is unclear whether risk attitudes impact long-run business success. In a meta-analysis of 60 studies, Zhao et al. (2010) find that risk propensity is positively associated with early entrepreneurial intentions but does not relate to entrepreneurial performance, defined through study-level indications of firm survival, growth, and profitability. Similar results are found by Kessler et al. (2012) among Austrian founders for assessed venture success and business survival.

Hvide and Panos (2014) hypothesize that the businesses of risk-tolerant individuals might underperform over the long run, on average, because more of these individuals select into entrepreneurship (thus bringing more mediocre ideas) than among risk-averse individuals (who thus might only be tempted to start firms with the very best ideas). The authors assemble an impressive dataset that combines the investment data of 400,000 males in Norway who were fully employed in 1993-1994, and the researchers identified 6,300 who subsequently became entrepreneurs, defined as having a majority stake in a new firm incorporated between 2000 and 2007. Investment data show that common-stock investors, who are known to take on individual financial risks, are about 50% more likely to subsequently start a firm, but their firms have roughly 25% lower sales and 15% lower return on assets during the annual observation period between 2000 and 2010, supporting their hypothesis. This type of study represents an important frontier in this area of research.

Korunka et al. (2003) survey and compare 314 nascent entrepreneurs and 627 new business owner-managers in the European Union, mostly drawing from German-speaking countries, and find that those who become successful (self-assessed) displayed a medium risk-taking propensity. It is possible that while the high risk-takers are not the most successful, some degree of risk-taking propensity is helpful toward business success. This hypothesis of a non-monotonic relationship between risk tolerance and firm performance is worthy of study in larger samples.

Hyytinen et al. (2015) use an innovative approach that combines interview data from an early startup period with national business register data to track firm survival over time. Their main interest is in the innovativeness of the firm (rather than that of the entrepreneur) but they also ask about the risk attitudes of the entrepreneur. They find that risk-loving entrepreneurs that operate innovative firms are much less likely to have their firms survive over a three-year follow-up period compared to similarly risk-loving entrepreneurs running less innovative operations. The main effect for risk-attitude is not significant in the firm survival models without this business model (i.e., “innovativeness”) interaction, while the interacted model displays a positive partial correlation between entrepreneurial risk preference and firm survival.

In contrast, Cucculelli and Ermini (2013) find that firms run by risk-loving entrepreneurs tend to perform better in their sample of 178 entrepreneurs running Italian manufacturing firms in 2007. The authors compare firms that introduce new products with those without new product innovations. Risk attitudes are measured with a hypothetical lottery question, and are then matched with firm-level product portfolios and other financial data. A separate analysis of risk-averse versus risk-loving entrepreneurs reveals that the introduction of a new product affects firm growth positively (and significantly) only in the sample of firms owned by risk-loving individuals. The risk-loving entrepreneurs are also somewhat more likely to introduce new products in the first place, showing that they may indeed stimulate firm growth through innovation.

2.3.3 Probability of exiting entrepreneurship

Caliendo et al. (2010) measure in GSOEP datasets that risk attitudes have a non-monotonic relationship with entrepreneurial survival, as the exit rates of medium risk takers are 40 percent lower than those for low and high risk takers. While a positive relationship emerges from the literature regarding risk taking and initial entry into self-employment, there appears to be a more complex relationship between risk taking and growth/exit choices. These early results need further verification using data from other countries and different entrepreneurial populations.

2.4 Entrepreneurial self-efficacy, risk attitudes, and optimism

Many researchers investigate the relationship between ESE and risk propensity. For example, Zhao et al. (2005) find in a survey sample of 265 MBA students that the effects of risk propensity (as well as perceived learning from entrepreneurship-related courses and previous entrepreneurial experience) is fully mediated by an individual's ESE. Similarly, Densberger (2014) considers whether risk propensity is a side effect of high ESE. In 49 in-person interviews with entrepreneurs in three American cities, the author concludes that high ESE allows entrepreneurs to be comfortable taking risks. Barbosa et al. (2007) take a more complex approach by considering the roles of risk preference and cognitive style on four types of ESE and entrepreneurial intentions. Surveying 528 entrepreneurship program students in Russia, Norway, and Finland, they find that high risk-preference students hold higher levels of entrepreneurial intentions and opportunity identification efficacy. Meanwhile, individuals with low risk preference had higher levels of relationship efficacy and tolerance efficacy. These outcomes appear to support claims that higher risk preferences select for entrepreneurial qualities, while lower risk preferences select for managerial qualities.

Researchers also consider that entrepreneurs may enter the risky world of business venturing because they over-assess their likelihood of positive returns. In a comprehensive literature review of the topic, Åstebro et al. (2014) examine the relationship between optimism, overconfidence, and entrepreneurial activity. Optimism refers to a general disposition toward having unrealistic beliefs in good outcomes, while Åstebro et al. (2014) use Moore and Healy's

(2008) framework of overconfidence as expressions of overestimation and over-placement. Overestimation refers to estimating one's abilities to be greater than they really are, while over-placement refers to estimating one's abilities to be greater than they really are *relative* to another group. Both versions of overconfidence appear to encourage people to enter entrepreneurship at higher rates than average, and they may also encourage people to make riskier decisions. Åstebro et al. (2014) point out that while it is often difficult to distinguish between the effects of optimism, overestimation, and over-placement, the effects psychologically operate on different levels of specificity. Optimism applies to all situations, while overestimation applies to a set of situations that reference a specific skill, and over-placement applies in a specific situation that involves a specific reference group, such as a certain market. Because of these differences, Åstebro et al. (2014) assert that it is important to understand their distinctions for effective policymaking.[12]

Researchers measure the correlation between general optimism and entrepreneurial activity using various survey forecasting answers compared to later outcomes. For example, one research question is whether entrepreneurs are good at forecasting in general. Shane (2009) finds that entrepreneurs are generally overconfident in their performance estimates. Using data from the Global Entrepreneurship Monitor (GEM), Shane finds that U.S.-based entrepreneurs believe five times more often than occurs in reality that they will have at least $10 million in sales. In contrast, Bengtsson and Ekeblom (2014) examine monthly survey data of 153 Swedish entrepreneurs and non-entrepreneurs regarding their beliefs about future nationwide economic conditions that spans 13 years. Comparing forecasts to economic reality, these researchers find that entrepreneurs have higher optimism about the economy, but less forecasting error. However, the forecasting error component of this study may be inconclusive given the economic growth between 1996 and 2009 that generally exceeded expectations of the general public (apart from the very last year). Additionally, this study compares entrepreneurs to the general population, who may be less informed about economic trends than entrepreneurs whose very work requires them to consider economic conditions.

The general trend in this line of research appears to be that while optimistic people are more likely to enter into entrepreneurship, they make riskier entrepreneurial decisions and incur greater losses to income. Puri and Robinson (2007) compare self-estimates of life expectancy from the Survey of Consumer Finance with actuarial tables. Those who overestimate their lifespan are more likely to be entrepreneurs, and the most optimistic are more likely to make high-risk financial decisions. Landier and Thesmar (2009) compare French entrepreneurs' own expectations of future income with linked panel data, finding that overconfident entrepreneurs are more likely to use short-term debt financing. Perhaps due to riskier decision-making, the optimistic entrepreneurs earn less than pessimistic entrepreneurs. Dawson et al. (2014) compare earning expectations from

[12] Åstebro et al. (2014) also review the connected peer effects and entrepreneurship literature (e.g., Giannetti and Simonov, 2009; Nanda and Sorensen, 2011; Lerner and Malmendier, 2013). While we skip this literature in this review, it is important to note that peers influence some personality traits like perception of risk.

the British Household Panel Study 1991-2008 with future earnings as an entrepreneur. Controlling for ability and environmental factors, the researchers report that optimistic entrepreneurs earn less than pessimistic entrepreneurs, with the difference being highest at the top of the earning scale and insignificant at the bottom.

However, it is more difficult to ascertain whether forecasts stem from general optimism or overconfidence within a more specific context or a market. Åstebro et al. (2007) attempt to tease apart the effects of optimism and overconfidence by comparing 820 inventor-entrepreneurs with non-entrepreneurs in Canada with two scales—the forecasting of one's score on a general knowledge test and a general belief that "good things will happen." Inventor-entrepreneurs tend to both overestimate their scores and be more optimistic in general. The researchers then compare measures of optimism and overconfidence with data from the Inventors' Assistance Program at the Canadian Innovation Centre that advised inventor-entrepreneurs to either terminate efforts or continue through with launch. While overestimation does not affect investment of time and money, optimism increases expenditures of time and money even when prospects are said to be limited.

Entrepreneurs may enter competitive markets with a small chance of venture success due to overestimation of their own abilities vis-à-vis competitors or because they simply enjoy competitive environments. Camerer and Lovallo (1999) present a scenario to university students in which pay depends on rank. When asked whether they would like to receive their rank randomly or based on performance on a trivia quiz, those with high estimations of their abilities are more likely to select the trivia quiz. Interestingly, Holm et al. (2013) use a similar approach and find that Chinese entrepreneurs are more likely to enter skill-based competitions even if they do not over-place themselves, suggesting that entrepreneurs may be more generally drawn to competition regardless of overconfidence. Bernardo and Welch (2001) describe herding behavior for entrepreneurship.

In conclusion, research provides clear hypotheses as to why entrepreneurs tend to be optimistic and overconfident, and at the same time, why these traits may be deleterious for entrepreneurial performance. Overall, while plenty of room remains for further inquiry and sharpening of results, this part of the literature is more developed and cohesive than many other areas of the entrepreneurial characteristics research.

3. Goals and aspirations

Most entrepreneurship scholars measure business success by looking at observable events in the firm history, such as firm survival, exit, and growth. Different entrepreneurs, however, hold very different goals and aspirations when starting and operating their firms, and this will impact many decisions made and outcomes experienced. Research on these topics is, however, surprisingly slim compared to other aspects that we have reviewed. One bright spot, if contentious, is the work to examine non-pecuniary motivations ("be my own boss") for starting businesses,

which has seen a surge of influential activity within the economics literature. We close this review with some recent work on this topic that parallels the personality literature. It is quite likely that the personality traits of entrepreneurs differ significantly by the goals and aspirations that entrepreneurs bring to the business, and future research can benefit by bringing tighter alignment of these two literature strands.

3.1 Reasons for deciding to start a business

One key source of longitudinal data on entrepreneurial motivations is the Panel Survey of Entrepreneurial Dynamics (PSED), which asks nascent entrepreneurs the open-ended question, "Why did you want to start this business?" Hurst and Pugsley (2011) organize the original 44 motivations into five categories: non-pecuniary reasons, to generate income, to realize a good business idea, lack of employment options, and other.[13] The authors find that the vast majority of small businesses do not intend to innovate or expand their operations, but are instead content to remain at their current size and scope. They further measure that non-pecuniary motivations are most frequent driver of new firm birth. Their classification is not standardized, and there are almost as many motivation typologies as there are studies. For example, Kuratko et al. (1997) use a four-factor structure of goal statements identified based on responses from 234 entrepreneurs: extrinsic rewards, independence/autonomy, intrinsic rewards, and family security. Nevertheless, the importance of non-pecuniary benefits is now well documented and robust in the literature.

There is a second version of this theme in the entrepreneurial finance literature. In a famous paper, Hamilton (2000) estimates that U.S. entrepreneurs have both lower initial earnings and lower earnings growth than in paid employment, with a median earnings differential of 35 percent for individuals in business for 10 years. This differential persists across three alternative measures of self-employment earnings and across industries, and cannot be explained by selection of low-ability employees into self-employment. Thus, Hamilton concludes that there must be substantial non-pecuniary benefits to self-employment. In parallel, Moskowitz and Vissing-Jorgensen (2002) examine entrepreneurial investment, finding that investment in U.S. private businesses is extremely concentrated and non-diversified, yet returns to private equity are no higher than the returns to public equity. The researchers conclude that households are willing to invest substantial amounts in single privately held firms with a seemingly far worse risk-return trade-off due to non-pecuniary benefits, a preference for skewness, or an overestimation of survival probability.

[13] In their scheme, non-pecuniary reasons include desire for autonomy, independence, flexibility, and various measures of self-fulfillment. Pecuniary reasons, by contrast, classify different motivations to earn money, whether to generate additional income or to leave wealth for one's children. Having a good business idea includes various urges to take advantage of a new opportunity, whether one is utilizing a new technology or building on one's talents or experiences. Lack of other employment options suggests that one is otherwise unemployed, disabled, or retired. Finally, other reasons may include belief in the value of the work, contributing to a community, or aiding in economic development.

These influential studies undergird the conventional wisdom that entrepreneurs sacrifice earnings to be entrepreneurs, indicating that non-pecuniary motivations must be also present. Over the last decade, however, a stream of work questions whether entrepreneurs actually earn less. The challenges include underreporting of income by entrepreneurs (e.g., Hurst et al., 2014; Sarada, 2016), failure to capture the option value of entrepreneurship and the returns present in future wage employment (e.g., Manso, 2016; Dillon and Stanton, 2016; Galina and Hopenhayn, 2009; Kerr et al., 2014), and the failure to separate entrepreneurship into types (e.g., Åstebro et al., 2011; Levine and Rubenstein, 2017; Hegde and Tumlinson, 2016). Kartashova (2014) likewise revisits the private equity premium puzzle and finds it sensitive to the time periods used by Moskowitz and Vissing-Jorgensen (2002). Thus, the entrepreneurial finance literature now questions whether entrepreneurs earn less than paid workers in expectation. However, this does not obscure the broader fact that non-pecuniary reasons, including desire for autonomy and self-fulfillment, are now accepted to be an integral part of many choices to create new businesses, and thus measures of venture returns or growth may mismeasure the true returns that these entrepreneurs experience. This will undoubtedly remain an important research topic for many years to come.

3.2 Entrepreneurial goals

Entrepreneurs driven by pecuniary versus non-pecuniary benefits often have drastically different goals for their companies. Hurst and Pugsley (2011) find that most entrepreneurs, being driven by non-pecuniary benefits, have little intention to innovate or expand their market share. Hurst and Pugsley (2011, 2016) argue that those who receive large non-pecuniary benefits naturally gravitate toward industries where the natural scale of production is small (e.g., accounting, plumbing). Bhide (2000) describes case studies of fast-growing firms that connect the actions and behaviors of founders to their firm growth, including some shifts in motivation with time and experience. Ardagna and Lusardi (2010) measure from the GEM survey that the average entrepreneurship rate is much higher in low- and middle-low income countries (14%) than high-income countries (6.7%); at the same time, two-thirds of entrepreneurs in poor countries are necessity-driven entrepreneurs, compared to 22% in high-income countries. Notably, opportunity-driven entrepreneurs provide greater economic growth.

Thus, the literature is increasingly categorizing two broad types of entrepreneurs: growth-driven entrepreneurs who seek opportunity and innovation and necessity-driven entrepreneurs that open new businesses when options are meager. Schoar (2010) further describes this partition in a review of the entrepreneurship and development literature. The recognition of this heterogeneity is important progress, as these distinctions of entrepreneurial heterogeneity are paramount to understanding entrepreneurial goals and their role in shaping the economy. On the other hand, researchers need to be diligent in remembering that entrepreneurial motivations are not so binary in nature. Just as the average performance of an entrepreneur is proving to be a poor conceptual target in earning estimations, these two sub-groups are likely still too aggregated for the best long-term foundation, even if they allow good progress today.

There is ample research looking at specific industries where non-pecuniary motivations define entrepreneurial goals. For example, Bergevoet (2005) finds that the goals and attitudes of entrepreneurs are determinants of strategic and entrepreneurial behavior in the Dutch dairy farming industry. Entrepreneurial competencies and instrumental goals (such as having a large and modern farm) correlate to self-scored success and larger farm size, and non-pecuniary goals explain much of the variation in job satisfaction. Santos-Requejo and Gonzalez-Benito (2000) conduct 85 in-depth interviews and learn that the objectives of subsistence businesses are highly influenced by socio-cultural attributions such as family values, goals, and motivation to stay in business. In a very different setting, Reijonen and Komppula (2007) show in two Finnish studies of micro-businesses in the craft and rural tourism industries how entrepreneurs measure their performance by non-pecuniary criteria and find success in job satisfaction and satisfied customers. Haber and Reichel (2005) identify similar performance measures of small ventures in the tourism industry of Israel. In their study, the most important subjective performance measures include the perceived customer satisfaction and the perceived profitability relative to competitors, while the key objective performance measures are related to firm growth (e.g., employment and revenue).

Some researchers consider the role of gender in entrepreneurial goals. Justo et al. (2006) draw data from 1,236 Spanish entrepreneurs in the 2005 GEM survey to compare gender and parental status on intrinsic and independence measures of success. Intrinsic measures of success are generally more valued by women, while independence measures of success are valued equally by men and women. However, the study finds that parental status alters women's notions of success, with independence measures of success overcoming intrinsic measures of success among women with dependent children. There is no such shift for men with dependent children. In interviews with 129 successful women entrepreneurs in the United States, Buttner and Moore (1997) distinguish between corporate climbers, who emphasize gaining managerial experience, from intentional entrepreneurs who emphasize the importance of technical competence.

While goals for entering entrepreneurship and starting a business are considered on a personal level, such as generating profit or retaining autonomy, there is little academic examination into self-defined measures of success for ventures. Large-scale surveys have not, to our knowledge, asked whether an entrepreneur's individual goal for the venture is to reach a public offering, grow the venture until acquisition by another firm, or to stay on as a Founder-CEO for the long term. At the same time, these entrepreneurial decisions shape the entrepreneurial landscape, and the alignment of founding teams and their investors on these goals is vital for venture success (e.g., Wasserman, 2011).

To sum up, much work remains to be done in this largely unexplored area, and much of the initial research needs to focus on data collection via surveys and interviews. Policymakers have much to gain from understanding the specific goals of growth-oriented entrepreneurs who disrupt and develop the broader economy. At the same time, most entrepreneurs have multiple non-

pecuniary goals, and policy makers need to understand and support this important part of the economy too. Efforts to bridge the literatures on entrepreneurial personality and motivations may prove very fruitful in the years to come.

4. Conclusion

The topic of personality/psychological traits of entrepreneurs is of great importance for the study of entrepreneurship in a multitude of contexts, including the examination of the determinants of occupational choice (entrepreneurship vs. paid employment), the predictors of entrepreneurial success, the evaluation of the effects of entrepreneurship policies, and the design and assessment of different approaches to entrepreneurship education. While many theories and empirical analyses have approached the concept, the literature remains arguably underdeveloped due to the conceptual and empirical challenges faced by researchers. Our review and assessment of recent work is built with an eye to catching up on the recent literature and the outline of future opportunities for applied researchers.

Entrepreneurs are a very heterogeneous bunch, and so it is not surprising that studies of their personalities are mixed. This review highlights places where empirical findings are consistent, while also embracing the heterogeneity where it is evident. Some of this variance appears due to small sample sizes and selected subgroups, and so bigger studies and meta-analyses will likely yield a clearer picture in the long-term. The multi-disciplinary nature of the entrepreneurial characteristics and personality literature also means that the terminology is not well standardized, and the research dialogue does not easily lend itself to learning from past research and making incremental progress as a field. The sheer number of journals publishing research related to entrepreneurial characteristics, as well as the large differences across them in terms of academic field and quality, also complicates the ability to have a linear, chronologically progressive research dialogue. This challenge too is likely to diminish with time, as the greater depth and specialization of the emerging field begins to provide returns to scale.

Other heterogeneity will be irreducible as it pertains to the type of venture created, and we have no reason to think the geeky personality of a 20-something tech founder will be tightly aligned with that of a 50-something immigrant founder that is opening a Main Street convenience store with her family members. We should, however, start to build the necessary language and taxonomy to better label these studies and their subpopulations, using the heterogeneity to our advantage. Accurate portraits of this heterogeneity will, in the long-term, prove truly valuable to understanding entrepreneurship: the differences between our two hypothetical founders above and their businesses can be every bit as informative as the comparison of them to people engaged in wage work. Our opinion is that future work in this regard is likely to be more productive than a one-size-fits-all portrait of the entrepreneur.

We believe a productive path forward exists utilizing universal administrative datasets that characterize new firm creation and identify the founders of ventures. These data allow researchers to model directly the heterogeneous types of firms created, ranging from self-employed nannies to VC-backed startups, and to measure performance and venture success in objective ways. Moreover, the data provide insight into the careers that founders have before starting their companies, ranging from past business success/failure to the peers who they work with, and they describe the founding team that comes together. Powerful tools are also capturing digital signals about the growth intentions of founders when they set out (e.g., Guzman and Stern, 2017). These data are already being matched with additional personal-level information ranging from stock portfolios to personality assessments.

It has been 30 years since the critique of Gartner (1988), and perhaps the next 30 years will also be unkind to progress on personality traits for entrepreneurship. Yet, the economics literature holds such a deep focus on the creation of ventures—the "doing" in Gartner's critique—that it may miss fruitful opportunities to learn from personality studies and contribute to them. Administrative data already afford much potential in terms of empirical assessment, and more data are continually coming online. Studies can combine these high-quality employer-employee filings with insight on personality traits that are measured before entrepreneurial spells commence, which would be an important first step for observing which traits are exogenous predictors versus endogenous outcomes. In more specialized settings, it may even be possible to build time-varying measures of personality traits by looking before and after interventions like enrollment in an entrepreneurial training program. It is hard to envision a setting where one will obtain widespread and exogenous variation in personality, but substantial progress can be made with pre-determined traits only.

This survey has repeatedly surfaced gaps between the theory of personality traits and how we can measure them, with our empirical tools frequently falling short of being able to disentangle complex and overlapping psychological traits to assign causal roles. Significant opportunities and challenges for research on entrepreneurial traits lie in developing theoretical approaches and constructs that can be empirically measured in a way that allows for the determination of causality between psychological traits and entrepreneurial outcomes. The literature is often unclear as to whether individuals with a given set of personality traits selected into entrepreneurship, or whether individuals developed the traits endogenously after becoming entrepreneurs. The increasing availability of detailed longitudinal information on demographic characteristics of entrepreneurs, including their human and financial capital endowments, as well as on entrepreneurial environments (regions and ecosystems) provides an opportunity to reduce both heterogeneity and endogeneity in studies of entrepreneurial traits. This requires the development of theoretical constructs and measurement procedures that align with detailed longitudinal coverage of people, but this task seems promising.

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Appendix 1: Other characteristics of entrepreneurs

A large literature investigates the non-personality traits of entrepreneurs. It is not possible to do full justice to that literature, especially in an international scope, within the confines of this review. We only seek here to provide a brief commentary that draws on mostly U.S.-based studies to afford a flavor of these findings. Parker (2009) provides a more extensive summary of these determinants of entrepreneurship.

A1.1 Demographics

Research tends to measure that entrepreneurship is more prevalent among men, younger people, non-minorities, and immigrants. These basic regularities are broadly consistent across sub-groups of entrepreneurs like self-employed individuals, the most documented case, and growth-oriented entrepreneurs, although the details certainly will differ by the domain studied.[14] We summarize the key studies making these conclusions. Importantly, with respect to this study's primary focus on personality traits, these demographic characterizations have been mostly developed in parallel and fruitful research can combine the streams (e.g., whether personality differences explain higher rates of entrepreneurship across some immigrant nationalities compared to others).

Contrary to popular perceptions, entrepreneurship is not just the domain of 20-somethings. Studies document that young people are more inclined towards entrepreneurship, but that the competing effects of better capabilities and resources to start new ventures (encouraging entry) with higher opportunity costs and family commitments (discouraging entry) tend to prevent major differences across age ranges in terms of entrepreneurship rates. Many studies that look for non-linear patterns document an inverted U-shaped relationship between age and rate of entrepreneurship, with perhaps a peak point in the range of age 45.[15] One's definition of entrepreneurship matters here. For example, many older, late-career individuals enter self-employment as a form of semi-retirement, but it is rarer that someone in the age range pursues high-growth VC investment, and Glaeser and Kerr (2009) highlight the spatial differences in these patterns. To contrast, Hsu et al. (2007) survey 45,000 MIT alumni since the 1930s and show that the average age of a founder has dropped from 40 (in the 1950s) to 30 (in the 1990s).

Women are less likely than men to enter entrepreneurship and this difference has remained quite persistent over the last several decades. Following the rise of female labor force participation, studies find mixed evidence for whether rates of female entrepreneurship are continuing to grow

[14] Globally, GEM-based measurements find opportunity-driven entrepreneurs to also be slightly younger, male, more educated, more confident in their skills and abilities, and less afraid of failure.

[15] Examples of work in this literature include Bates (1995), Cowling (2000), Reynolds et al. (2002), Blanchflower and Oswald (2009), Parker (2009), Bönte et al. (2009), and Liang et al. (2014). The Kauffman Index on startup activity indicates that slightly less than half of the new founders are aged under 45.

faster than those for men. Female entrepreneurs are highly represented in some sectors such as services and sales, while notably absent from other sectors such as construction.[16] Data from the Survey of Business Owners in 2007 suggest that female business owners are more prevalent in two-owner firms, with the implication that women are more likely to engage in entrepreneurship through a family business or cofounded venture rather than as the sole owner of a firm. An emerging area of research documents how women entrepreneurs tend to be more spatially isolated within local areas and less networked than male entrepreneurs, and consequently depend upon other female-owned firms more (e.g., Rosenthal and Strange, 2012; Ghani et al., 2013).[17]

Research finds that African Americans and Latinos are less likely to become entrepreneurs compared to whites (e.g., Fairlie and Meyer, 1996, 2000; Kauffman Index, 2016). A rare exception is the PSED-based study of Reynolds et al. (2004) that finds that minority groups are more likely to be "nascent entrepreneurs" than their white comparison groups. The rate for Asians seems to more closely track that of whites, although some studies suggest that Asian entrepreneurship rates now exceed those of whites (e.g., Fairlie and Robb, 2008; Kauffman Index, 2016).

Recent studies document that immigrants start a disproportionate number of firms in the United States, with about a quarter of entrepreneurs being immigrants compared to an overall immigrant workforce share of 15%. This difference moreover appears to be expanding in the last two decades (e.g., Fairlie, 2012; Kauffman Index, 2016; Kerr and Kerr, 2016). There are large differences across groups of immigrants in terms of their entrepreneurial inclinations, with Mexican and Latin American immigrants showing lower rates than many Asian groups.[18] This disproportionate contribution appears equally present for self-employed entrepreneurs as for high-tech entrepreneurs. For example, Indian and Chinese entrepreneurs are prevalent in the tech sector, while many of the Latino entrepreneurs can be found in the service sector. Moreover, this immigrant entrepreneurial behavior is often highly clustered at industry-level by ethnic group (e.g., Vietnamese nail care salons, Korean dry cleaners) as described in Kerr and Mandorff (2015), and it would be interesting to explore how this clustering influences personality factors like optimism and perceptions of risk. Fairlie and Lofstrom (2014) and Kerr and Kerr (2016) provide greater details.

[16] Examples of work in this literature include Bates (1995), Reynolds et al. (2004), Budig (2006), Wellington (2006), Greene et al. (2007), Parker (2009), and Kauffman Index (2016).

[17] Connected to optimism described before, there is also evidence that female entrepreneurship increases in developing economies as conditions improve, peer networks take root, and women observe inspiring examples (Ghani et al., 2014; Field et al., 2015).

[18] Examples of work in this literature include Fairlie and Meyer (1996), Clark and Drinkwater (1998), Bates (2006), Wadhwa et al. (2007), Parker (2009), Fairlie and Woodruff (2010), Fairlie (2012), and Hunt (2011). Some of these gaps can be explained by differing demographics, education levels, and wealth.

A1.2 Financial assets and wealth

The impact of wealth and financial assets on the probability of starting a business has been studied extensively, with influential early work by Evans and Jovanovic (1989) and Evans and Leighton (1989). There is clearly a positive correlation between wealth and entry, and the perceived wisdom for a long time was that substantial financial constraints exist for entrepreneurs, which holds very important policy implications. Subsequent work utilized unexpected changes in wealth (e.g., inheritances, home price increases, exchange rate fluctuations) that are arguably uncorrelated with individual-level abilities and wealth from previous entrepreneurship in an effort to establish a causal relationship (e.g., Blanchflower and Oswald, 1998), generally finding supporting evidence.

Recent work challenges this past wisdom following the contrarian finding of Hurst and Lusardi (2004). These authors first showed that entry rates are very non-linear over the wealth distribution, with the rate of entry only jumping up in the top 10% of wealth levels or higher. This poses problems for explaining differences in entrepreneurship across the broad workforce, and the businesses started by these very wealthy individuals are frequently of a low capital intensity such that the owners could have opened the business at lower wealth levels had they wanted to. Moreover, studies have shown that the seemingly solid instruments for wealth changes are often confounded (e.g., entry might rise upon the expectation of a windfall inheritance gain, well in advance of actual wealth increases). Since Hurst and Lusardi (2004), it is safe to conclude that the literature has been very mixed on the presence and importance of financing constraints.

Parker (2009) and Kerr and Nanda (2011) provide complete reviews of this work. We wish to mostly emphasize one point of connection to our present review. Attitudes towards risk, as well as the actual relative riskiness of a gamble, can change substantially with higher levels of individual wealth. Middle income families will often balk at a $25,000 business bet (e.g., the size of a typical angel investment into a startup), but that bet won't cause multi-millionaires to lose sleep. Kerr et al. (2015) describe these complex and ambiguous relationships in the context of home equity gains and entry behavior by home owners, with a critical point being that rising wealth levels can influence these personality traits in several ways: adjustments in risk perceptions consistent with growing wealth, adjustments in risk perceptions or other behavior that are more behavioral (i.e., playing with the "house money"), pursuit of entrepreneurship as a luxury good (i.e., the newly rich buy a Porsche and semi-retire into self-employed entrepreneurship), and so on. Separating these is very tricky, but substantial improvements in wealth data around the world foreshadow a productive decade ahead for researchers. Dunn and Holtz-Eakin (2000) contrast financial transfers over generations with those of human capital, which will certainly receive continued attention with data improvements.

A1.3 Industry experience and education

The skill distribution of entrepreneurs versus the general population is also important. Academic studies typically measure skills through formal education and work experience, although these are far from complete. Studies often measure a positive relationship between education and business ownership, but the evidence does not yield very strong relationships (e.g., van der Sluis et al., 2008). Parker (2009) estimates that about 60 percent of studies find a significant positive relationship between educational attainment and entrepreneurship. Lofstrom et al. (2014) postulate that this may be due to entrepreneurs sorting into industries based on entry barriers, as those with greater education levels are more likely to enter higher-barrier industries that also offer higher returns. Interestingly, Hunt (2011, 2015) shows that a good portion of the higher immigrant propensity towards entrepreneurship can be explained by educational attainments and field of study. The findings regarding work experience are similar. Parker (2009) discusses these studies in more detail, emphasizing the importance of separating types of prior experience: general work experience, industry expertise, prior startup experience, and so on. Prior studies also suggest that educated business owners run more successful businesses, generate more innovation, and grow their firms faster over time (e.g., Unger et al., 2011). While the traits are interesting in their own right, future research should target joint analysis with personality characteristics.

A1.4 Entrepreneurial regions

Recent work in the entrepreneurship literature considers why some places are endowed with a greater number of entrepreneurs than others. Chinitz (1961) first formulates this question in his attempt to explain why post-war New York was experiencing more economic success than post-war Pittsburgh. This literature strongly emphasizes how the past industrial legacies of cities can lead to lasting cultures that favor or hinder entrepreneurship.[19] These lasting legacies potentially impact industrial organization (e.g., Fallick et al., 2006; Audretsch and Feldman, 2012; Carlino and Kerr, 2015), and are reflected in the higher degree to which entrepreneurs operate in the regions of their birth than wage workers (e.g., Michelacci and Silva, 2007). At a broader level, work since Baumol (1990) and Murphy et al. (1991) highlights the degree to which a society's institutions, laws, and norms lead talented individuals to pursue productive or rent-seeking opportunities to maximize their returns under the given set of conditions. To date, there has been little attention given to how these powerful forces operate through the differing composition of personalities in places, exogenously or endogenously via migration, or are independent of them.

[19] Prominent examples include Saxenian (1994), Kenney (2000), Audretsch and Feldman (2003), and Florida (2004), and recent empirical work includes Falck et al. (2011), Audretsch et al. (2012), Glaeser et al. (2015), Stuetzer et al. (2015), Obschonka et al. (2015), and Sorenson (2017).