

Caliendo, Marco; Rodriguez, Daniel

**Working Paper**

## Divergent Thinking and Post-Launch Entrepreneurial Outcomes: Non-Linearities and the Moderating Role of Experience

IZA Discussion Papers, No. 16443

**Provided in Cooperation with:**

IZA – Institute of Labor Economics

*Suggested Citation:* Caliendo, Marco; Rodriguez, Daniel (2023) : Divergent Thinking and Post-Launch Entrepreneurial Outcomes: Non-Linearities and the Moderating Role of Experience, IZA Discussion Papers, No. 16443, Institute of Labor Economics (IZA), Bonn

This Version is available at:

<https://hdl.handle.net/10419/279141>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

DISCUSSION PAPER SERIES

IZA DP No. 16443

**Divergent Thinking and Post-Launch  
Entrepreneurial Outcomes: Non-Linearities  
and the Moderating Role of Experience**

Marco Caliendo  
Daniel Rodríguez

SEPTEMBER 2023

## DISCUSSION PAPER SERIES

IZA DP No. 16443

# Divergent Thinking and Post-Launch Entrepreneurial Outcomes: Non-Linearities and the Moderating Role of Experience

**Marco Caliendo**

*University of Potsdam, CEPA, IZA, BSE, DIW and IAB*

**Daniel Rodríguez**

*University of Potsdam and CEPA*

SEPTEMBER 2023

Any opinions expressed in this paper are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but IZA takes no institutional policy positions. The IZA research network is committed to the IZA Guiding Principles of Research Integrity.

The IZA Institute of Labor Economics is an independent economic research institute that conducts research in labor economics and offers evidence-based policy advice on labor market issues. Supported by the Deutsche Post Foundation, IZA runs the world's largest network of economists, whose research aims to provide answers to the global labor market challenges of our time. Our key objective is to build bridges between academic research, policymakers and society.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ISSN: 2365-9793

**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9  
53113 Bonn, Germany

Phone: +49-228-3894-0  
Email: [publications@iza.org](mailto:publications@iza.org)

[www.iza.org](http://www.iza.org)

## ABSTRACT

---

# Divergent Thinking and Post-Launch Entrepreneurial Outcomes: Non-Linearities and the Moderating Role of Experience\*

Divergent thinking is the ability to produce numerous and diverse responses to questions or tasks, and it is used as a predictor of creative achievement. It plays a significant role in the business organization's innovation process and the recognition of new business opportunities. Drawing upon the cumulative process model of creativity in entrepreneurship, we hypothesize that divergent thinking has a lasting effect on post-launch entrepreneurial outcomes related to innovation and growth, but that this relation might not always be linear. Additionally, we hypothesize that domain-specific experience has a moderating role in this relation. We test our hypotheses based on a representative longitudinal sample of 457 German business founders, which we observe up until 40 months after start-up. We find strong relative effects for innovation and growth outcomes. For survival we find conclusive evidence for non-linearities in the effects of divergent thinking. Additionally, we show that such effects are moderated by the type of domain-specific experience that entrepreneurs gathered pre-launch, as it shapes the individual's ideational abilities to fit into more sophisticated strategies regarding entrepreneurial creative achievement. Our findings have relevant policy implications in characterizing and identifying business start-ups with growth and innovation potential, allowing a more efficient allocation of public and private funds.

**JEL Classification:** L25, L26, M13, M51

**Keywords:** divergent thinking, entrepreneurial performance, survival, business expansion, innovation

**Corresponding author:**

Marco Caliendo  
University of Potsdam  
Chair of Empirical Economics  
August-Bebel-Str. 89  
14482 Potsdam  
Germany  
E-mail: [caliendo@uni-potsdam.de](mailto:caliendo@uni-potsdam.de)

---

\* The authors thank David Audretsch, Nicola Breugst, Alexander Kritikos, Simon Parker, Roy Thurik, Karl Wennberg, and Annelot Wismans for helpful discussions and valuable comments. We further thank the Institute of Employment Research (IAB) for cooperation and institutional support within the research project 1755 and gratefully acknowledge funding from the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG, project number: 407087322).

## 1 Introduction

Understanding which factors influence entrepreneurial development is crucial to the design of entrepreneurship public policies, as such interventions can influence entrepreneurial performance, and overall the size of the entrepreneurial sector in the economy (Parker, 2018). This understanding is also valuable for investors (especially inexperienced ones), who might place weight on product attributes or founders' motivation in their decision-making process, given the complex and technical investment information that they need to analyze (Shafi, 2021). There are different factors influencing entrepreneurial development. Macroeconomic conditions like GDP and unemployment rates influence entrepreneurship entry and exit rates (Koellinger and Thurik, 2012; Fritsch and Kritikos, 2016; Sedláček and Sterk, 2017), and human capital contributes to exploiting new opportunities, and accumulating relevant new knowledge, as well as facilitating finding financial resources (Unger *et al.*, 2011a; Marvel *et al.*, 2016). Likewise, creativity plays a significant role. Creativity and entrepreneurship are closely connected, as the exploration and exploitation of business opportunities require creative thinking (Zhou, 2008), and both concepts can be understood as processes (Lex and Gielnik, 2017). Creative achievement within an organization is the result of a combination of cognitive style (e.g. divergent thinking), personality (e.g. locus of control), motivation, domain-specific skills, and resources at different stages of the creative process (Amabile, 1988; Woodman *et al.*, 1993; Baer, 2012; Amabile and Pratt, 2016). Similarly, instead of considering entrepreneurship as an isolated event, it can be understood as a continuous process in which different factors are at play during three distinct phases, namely the pre-launch, launch and post-launch of a business venture (Baron, 2007). According to Lex and Gielnik (2017), the predominance of the cognitive ability divergent thinking in the creative process will fluctuate across the different phases of entrepreneurship. In the third phase in particular, entrepreneurs will seek business survival through continuous innovation and growth (Lex and Gielnik, 2017). The aim of this paper is to analyze the role of divergent thinking in the post-launch phase of the entrepreneurial process by examining its relation with survival, innova-

tion and growth outcomes, as well as focusing on potential non-linearities in these relations, and the potential moderating effect of types of domain-specific experience.

The concept of divergent thinking was first introduced by Guilford (1967), and it refers to the ability to generate diverse and numerous ideas to solve tasks. When facing a challenge, divergent thinkers consider different approaches that do not necessarily rely on previous knowledge or routines. Divergent thinkers explore different answers to a question in an unsystematic fashion, whereas convergent thinkers look for one correct answer in an analytical way. Moreover, even though it cannot be understood as creativity itself (Runco, 2008), divergent thinking is described as a psychometric measure of creative problem-solving abilities and an indicator of potential for creative thinking and future creative performance (Kuhn and Holling, 2009a; Runco and Acar, 2012). As divergent thinking abilities can be transferred to specific domains (Clapham *et al.*, 2005; Chen *et al.*, 2006), the channel through which divergent thinking influences entrepreneurial outcomes is the transfer of ideational abilities to a specific domain of business, whereby business owners use their divergent thinking skills to generate business ideas that enhance their performance (Gielnik *et al.*, 2012).

Creativity is fundamental to the innovation process, as it helps to recognize new business opportunities or needs, and generate ideas to tackle them (Amabile, 1988; Scott and Bruce, 1994; Fillis and Rentschler, 2010; Shane and Nicolaou, 2015; Castillo-Vergara *et al.*, 2018). Furthermore, creativity and creative problem-solving skills are relevant to organizations facing changing business environments. Small-scale firms and start-ups face scenarios that require quick and flexible responses, given their low financial capital basis and highly segmented markets (Rauch and Frese, 2000). The ability to respond to those complex challenges in an innovative fashion strongly depends on creativity or creative problem-solving skills, such as ideation (Basadur and Hausdorf, 1996). Williams (2004) argues that organizations require a divergent thinking approach to solve heuristic problems. Given that the solutions to those problems are unknown, an optimal decision-making process should involve the identifying alternatives and a divergent search for possible answers. Entrepreneurs are confronted

with those challenges in all three phases of the entrepreneurial process. In the post-launch, in particular, entrepreneurs' main objective is to guarantee the survival of the business through continuous growth and innovation (Lex and Gielnik, 2017).

The relationship between creativity and entrepreneurial performance has been tested empirically multiple times (Sarooghi *et al.*, 2015). However, even though divergent thinking and creativity are closely connected, the relationship between divergent thinking and entrepreneurship might not be as straightforward. Higher levels of divergent thinking might involve paradoxes (Acar and Runco, 2015). The diversity of the ideas might lead entrepreneurs to think in opposites or find contradictions, which could hinder their performance. Similarly, when facing a problem, entrepreneurs with high divergent thinking might consider multiple creative solutions but find it difficult to choose which is the more efficient or optimal. Accordingly, it is relevant to question whether the relation between divergent thinking and entrepreneurial performance is always positive. Furthermore, creative ideas might not translate directly into creative achievement, as this requires other factors such as motivation and network abilities (Baer, 2012; Acar and Runco, 2019). Most theoretical models concerned with creativity and entrepreneurship highlight that creative achievement is a combination of not only cognitive styles (convergent and divergent thinking) but their interaction with motivation, experience, domain-specific skills and entrepreneurial context (Woodman *et al.*, 1993; Vincent *et al.*, 2002; Amabile and Pratt, 2016; Lex and Gielnik, 2017).

Drawing upon the cumulative process model of creativity in entrepreneurship (Lex and Gielnik, 2017), we hypothesize that divergent thinking has a lasting effect on entrepreneurial outcomes up until 40 months after start-up, and that this relation is not always linear: higher levels of divergent thinking might be counter-productive during a phase in which both divergent and convergent thinking are necessary. Additionally, from an interactionist perspective (Zhou, 2008; Gielnik *et al.*, 2012) in a post-hoc analysis, we argue that experience acts as a moderating contextual factor of the effect of divergent thinking on entrepreneurial performance, as it endows entrepreneurs with a different cogni-

tive framework that allows them to recognize business opportunities more efficiently, and it controls the individual's ideational abilities to update and sophisticate strategies to achieve creativity in a specific working environment (Baron and Ensley, 2006; Agnoli *et al.*, 2019). We estimate the relation between divergent thinking with business survival, patents or trademark protection applications, job creation, business field expansions, and regional expansions, as well as with dynamic outcomes such as having hired employees in the last 20 months, and the realization of business fields expansion plans.

Considering all of the variables that are at play within the creative and entrepreneurial processes, we control for a comprehensive set of possible confounders including socio-demographic variables, human capital, intergenerational transmission, labor market history, local macroeconomic conditions, business-related characteristics, and other personality characteristics, like the Big Five and locus of control, and cognition based on two numeracy tests and a memory test. Taking into account Lex and Gielnik's (2017) suggestion, that a longitudinal approach should be considered to test the main assumptions of the model, our data set combines survey data with administrative data from the Federal Employment Agency in Germany. It comprises a unique representative longitudinal sample of 457 entrepreneurs who started their business in the first quarter of 2009 and were surveyed twice, 19 and 40 months after business formation. Based on the Runco Ideational Behavior Scale (RIBS) developed by Runco *et al.* (2001), we construct a divergent thinking measure using a six-item battery of statements and aggregating them by factor analysis into one divergent thinking factor index to estimate its influence on the mentioned outcomes. We follow Podsakoff *et al.* (2003), and solve potential common method biases by using a temporal separation of about 20 months between our divergent thinking measure and the outcomes of interest.

Our results show a long-term effect of divergent thinking on post-launch innovation and growth outcomes. An increase in divergent thinking translates into a higher probability of entrepreneurs applying for patents or trademark protection, having employees, exploring new business fields, and



expanding into new regions 40 months after business foundation. Besides, an increase in divergent thinking increases the probability of hiring employees and realizing field expansion plans between the two interviews. The relative effects of divergent thinking on these outcomes are economically relevant and range from about 16% to 38% (for a one standard deviation increase) with respect to the mean. Additionally, we find strong evidence of non-linearities in the relation of divergent thinking with business survival. There is also evidence for non-linear effects of divergent thinking on exploratory innovations, and job creation, as well as suggestive evidence for expansion outcomes. We show that the relation between divergent thinking and innovation outcomes is always positive (in line with previous literature Sarooghi *et al.*, 2015), with increasing marginal returns. Whereas, for job creation outcomes such as hiring or having employees, we show that the relation follows an inverse U-shape, indicating decreasing marginal returns. The results for other outcomes are partially inconclusive but suggestive of potential non-linearities. Finally, contributing to the interactionist perspective literature on the interplay of contextual factors with divergent thinking, we find that domain-specific experience from self-employment has a different interaction effect compared to experience from regular employment. While the latter positively affects the probability of business fields and regional expansions, the former hinders innovation and job creation. Thus, experience from regular employment is likely to follow Lex and Gielnik's (2017) logic in which divergent thinking affects entrepreneurs' success through the opportunity identification, whereas experience from self-employment might put entrepreneurs in a *functional fixedness* mindset that hinders innovation.

Our study makes several contributions to the entrepreneurship literature. First, it provides new evidence on the link between divergent thinking and entrepreneurial performance by testing the theoretical framework on an ideal setting: we use the longitudinal nature of our data to test the effect of divergent thinking on post-launch entrepreneurial outcomes, namely, survival, innovation, and growth-related outcomes 40 months after business foundation. We show that divergent thinking has a long-term effect on innovation and growth entrepreneurial outcomes. This contributes to the creativ-

ity and entrepreneurship research stream, showing the relevance of divergent thinking as a significant explanatory variable for business success in yet another context. This understanding might facilitate the design of entrepreneurial training programs and allow public and private investors to characterize or identify businesses with growth and innovation potential at early stages. Second, we provide new evidence on the non-linearity of divergent thinking relation with survival, innovation, and job creation outcomes in the third phase of entrepreneurship, as well as suggestive evidence of potential non-linearities in the relation with expansion outcomes. This could spur a discussion on the optimal amount of divergent thinking in the post-launch phase. Third, it provides new empirical evidence of the role of domain-specific experience as a contextual factor, and shows that there are different interaction effects according to the type of experience gathered prior to business foundation. We show that experience from regular employment has a different interaction effect compared to experience from self-employment.

## **2 Theory and hypotheses development**

### **2.1 Divergent thinking**

Divergent thinking is defined as the ability to produce diverse and numerous responses to questions or tasks. It is also a reliable indicator of the potential for creative thinking, as it often leads to originality, which is the central feature of creativity. Although the assessment of divergent thinking has dominated the creativity research to the point that some might use it as a direct measure of creativity, divergent thinking is only an underlying factor of the creative process (Vincent *et al.*, 2002; Kuhn and Holling, 2009a; Runco and Acar, 2012). Creative performance or creative achievement is a combination of both divergent and convergent thinking, as it is the result of an unrestricted search of ideas (divergent thinking) and their evaluation (convergent thinking) to perform a task or solve a problem (Brophy, 2001; Cropley, 2006; Runco, 2010).

Divergent thinking is also expected to be stable across time. According to McCrae *et al.* (1987), individual differences in divergent thinking are stable over a six-year window. Although there is a

decline after the age of 40 (except for ideational fluency, namely the number of ideas generated), individuals with high levels of divergent thinking are likely to maintain high levels relative to similar-age peers and in absolute terms. Additionally, more recent studies show that there are no significant differences between age groups, declines in divergent thinking scores are not age-related, and – regardless of an expected cognitive decline – divergent thinking can be preserved in elderly ages (Roskos-Ewoldsen *et al.*, 2008; Palmiero *et al.*, 2014, 2017).

There are several divergent thinking tests.<sup>1</sup> Unlike classical intelligence tests – which might fail to distinguish between creative and non-creative individuals (Kim, 2008; Hass, 2015) – divergent thinking tests often involve open-ended questions with no correct answers, and individuals are asked to provide as many original responses as possible. Runco *et al.* (2001) argue that this type of tests and their results are conditioned by the experimental setting (timing, number of people in the room, provided information, etc.) in which the tests are implemented and the subjective assessment of the answers by the evaluators, and therefore the creative achievement or performance on such experiments might be driven by different factors other than divergent thinking. The authors developed the RIBS to describe actual overt behavior in terms of ideation, which they claim to be the most relevant criterion when studying the predictive validity of divergent thinking tests. We rely on the validity of this scale to measure divergent thinking in our sample.

## **2.2 Divergent thinking and entrepreneurship**

The role of divergent thinking in entrepreneurship can be analyzed through the lens of creativity. Creativity is an indispensable component of entrepreneurship, as it promotes identifying business opportunities, as well as generating ideas for new products, services or processes (Zhou, 2008). Creativity and – most importantly – creative achievement are the results of combining different components within a creative process. Organizational creativity is an intersection of a creative process<sup>2</sup>,

---

<sup>1</sup>See Runco (2010); Kuhn and Holling (2009b); Hass (2015) and Acar and Runco (2019) for descriptions and scopes of different divergent thinking test batteries.

<sup>2</sup>Here, creative process refers to specific processes within the organization, e.g. how resources are combined or managed, rather than the creativity process.

creative person, creative product, and creative situation (Woodman *et al.*, 1993). At the individual level, creativity is the result of experience (e.g. biographical variables), cognitive style (e.g. divergent thinking), personality (e.g. self-esteem), relevant knowledge, motivation, and social and contextual influences (e.g. social facilitation or time constraints, Woodman *et al.*, 1993). These components are combined at different stages of the creative process, as Amabile (1988) and Amabile and Pratt (2016) describe. Amabile (1988) developed a model of organizational creativity and innovation based on the premises that individual creativity feeds innovation within organizations, and domain-relevant skills like knowledge, talent or technical skills are not sufficient for an individual to produce creative work. Amabile and Pratt (2016) present an updated version of this model, which focuses on the individual-level psychological process involved in creativity. According to their model, the individual creative process is influenced by skills in creative thinking, besides motivation and domain-specific skills. Assuming that an individual has skills and incentives to engage in creative performance, the authors argue that a cognitive style that enhances taking new perspectives on problems is a fundamental skill in the production of creative work, as it combines the former two *raw materials* in new ways to generate innovative products. Ultimately, this cognitive factor will be combination of both divergent and convergent thinking, as diverse and original ideas need to be explored but also assessed and evaluated at some point during the process (Brophy, 2001; Cropley, 2006; Runco, 2010).

Like creativity, entrepreneurship can also be understood as a process. Instead of considering it an isolated event or a sequence of isolated events, entrepreneurship can be described as a continuous, evolving process (Baron, 2007). Lex and Gielnik (2017) argue that in order to understand the relationship between creativity and entrepreneurship, it is necessary to consider their nature as processes comprising different components and phases. Thus, they develop the cumulative process model of creativity in entrepreneurship. As theorized by Baron (2007), the entrepreneurship process has three major phases, namely the pre-launch, the launch, and the post-launch of a business venture. In each phase, different outcomes have predominance and the relative importance of some variables might

fluctuate (Shane, 2003; Baron, 2007). Lex and Gielnik (2017) disentangle creativity into divergent and convergent thinking, and argue that both are at play during the three entrepreneurial phases. However, the relative importance or predominance of each cognitive style depends on the phase in which entrepreneurs find themselves.

The first phase of the entrepreneurial process is the pre-launch. This phase is characterized by the exploration and identification of viable business opportunities (Ardichvili *et al.*, 2003; Baron, 2007; Dimov, 2007). At this stage, in order to generate a high number of novel and original business ideas, divergent thinking must have predominance over convergent thinking (Lex and Gielnik, 2017). In turn, convergent thinking plays a role in assessing the viability of those ideas (Cropley, 2006). However, while both styles are necessary at this stage, divergent thinking should play the major role (Gielnik *et al.*, 2014; Lex and Gielnik, 2017), given that the process of identifying business opportunities is vital at a pre-launch stage, and this process strongly depends on creating novel combinations of ideas (Eckhardt and Shane, 2003; Gielnik *et al.*, 2014). On the other hand, the second phase of the entrepreneurial process – the business launch – challenges entrepreneurs' capacities for planning, assembling financial resources, building and leveraging from social networking and human capital, etc. (Madsen *et al.*, 2003; Shane and Delmar, 2004; Baron, 2007; Lange *et al.*, 2007; Unger *et al.*, 2011b; Lex and Gielnik, 2017). At this stage, entrepreneurs once again require both divergent and convergent thinking. For instance, they need to generate novel and attractive ideas to appeal potential investors, and persuade them during negotiations (Ward, 2004; Chen *et al.*, 2009; Lex and Gielnik, 2017), whereby coming up with those ideas would require a divergent thinking style (Cropley, 2006). Meanwhile, entrepreneurs need to design a business plan for their new venture (Baron, 2007; Honig and Samuelsson, 2014). Evidence shows that business planning has an influence on venture creation and development (Delmar and Shane, 2003, 2004; Honig and Samuelsson, 2014). This task involves a rigorous search and evaluation of relevant information (Chen *et al.*, 2009; Honig and Samuelsson, 2014), which requires entrepreneurs to use a convergent thinking cognitive style (Cropley, 2006).

Overall, at the second stage of the entrepreneurship process entrepreneurs will require more convergent thinking, as they need to focus on the opportunity that they chose in the previous phase to make it viable and feasible (Lex and Gielnik, 2017).

## **2.3 Deriving our hypotheses**

### **2.3.1 Divergent thinking in the post-launch phase**

The main focus of this study is the third phase of the entrepreneurship process, namely the post-launch, which entrepreneurs enter 12 to 18 months after start-up (Baron, 2007). In this phase, entrepreneurs need to secure business survival, i.e. guaranteeing the new venture is as a viable, lasting and growing business (Lex and Gielnik, 2017). For this purpose, entrepreneurs need to guarantee continuous innovation and growth in the form of creating new products, services or processes, conducting negotiations, attracting and retaining high-quality workers, and developing strategies for promoting, among others (Baron, 2007; Lex and Gielnik, 2017). Those activities require both divergent and convergent thinking.

There are two types of innovations that require different levels of divergent and convergent thinking, namely exploratory and exploitative innovations. Exploratory innovations – also known as radical innovations – refer to the inclusion of completely new products, services, or processes, particularly designed to meet the needs of potential new costumers (Raisch and Birkinshaw, 2008). This type of innovation focuses on originality and novelty and refrains from relying on existing knowledge (Benner and Tushman, 2003; Jansen *et al.*, 2006). By contrast, exploitative or incremental innovations refer to changes that aim to extend or improve existing processes, products, or services, and therefore rely on existing knowledge to build upon. They are designed to meet the needs of existing clients (Raisch and Birkinshaw, 2008; Jansen *et al.*, 2006). Thus, divergent thinking plays a more relevant role in generating exploratory innovations, and convergent thinking is more suitable for exploitative ones (Lex and Gielnik, 2017).

In terms of growth, when it comes to job creation, entrepreneurs need to use divergent thinking

to develop novel and creative working environments that attract high-quality workers, allow them to exploit their creativity, and keep them motivated (Williams, 2004; Matthew, 2009). However, at the same time, those working environments need to be stable, with well-defined standard operating procedures, for which entrepreneurs need to use a convergent thinking cognitive style (Lex and Gielnik, 2017). When it comes to other types of growth such as dabbling in new business fields, or expanding the business into new areas or regions, entrepreneurs' divergent thinking helps them to develop alertness to new ideas and information (Tang *et al.*, 2012; Gielnik *et al.*, 2014). Higher alertness increases the likelihood of identifying business opportunities (Ardichvili *et al.*, 2003). Furthermore, the process of business and regional expansions requires assessing those potentially useful new business opportunities, negotiation skills, and planning, for which entrepreneurs require convergent thinking.

Empirical evidence shows that there is a positive relation between creativity and innovation outcomes, although the strength of the relationship depends on contextual factors (Sarooghi *et al.*, 2015). Likewise, evidence suggest that a firm's innovativeness has a significant relation with the venture's growth (Roper, 1997; Thornhill, 2006; Audretsch *et al.*, 2014). When looking at divergent thinking specifically, Ames and Runco (2005) show the positive correlation between divergent thinking (measured as ideational behavior using the RIBS) and the number of businesses that the entrepreneurs have started. Additionally, Gielnik *et al.* (2012) show that divergent thinking influences entrepreneurship growth through business idea generation, under the assumption that divergent thinking is a general cognitive ability that can be applied to specific domains (Clapham *et al.*, 2005; Chen *et al.*, 2006; Baer, 2010)<sup>3</sup>. Overall, several scholars have focused on the effect of creativity and/or divergent thinking on entrepreneurial outcomes (see inter alia Vincent *et al.*, 2002; Ames and Runco, 2005; Gielnik *et al.*, 2012, 2014; Reid *et al.*, 2014; Chen *et al.*, 2015). However, as Lex and Gielnik (2017) point out, very few have analyzed this relationship specifically for the post-launch phase, and evidence is

---

<sup>3</sup>As discussed in Sternberg (2005) and Baer (2010), different levels of domain-general and domain-specific elements contribute to creativity. Models like Amabile and Pratt's (2016) account for this by incorporating in their model domain- and creative-relevant skills separately. We consider such potential confounders of the effect of divergent thinking on entrepreneurial outcomes by controlling for a comprehensive set of covariates.

mixed as the effects are not always significant. For instance, Baron and Tang (2011) find a significant positive effect of creativity on the implementation of radical innovativeness, and Morris and Fargher (1974) and Ames and Runco (2005) find a positive effect on venture growth, whereas Heunks (1998) finds no significant effect on venture profit growth. As Lex and Gielnik (2017) suggest, in order to adequately test the main assumption of the model, a longitudinal approach should be considered, as the role of divergent thinking might fluctuate over time. In addition to the rather mixed evidence available so far, little is known about the long-term effect of divergent thinking on entrepreneurial outcomes. Therefore, we hypothesize the following:

H1a: Divergent thinking has a positive long-term effect on business survival in the post-launch phase.

H1b: Divergent thinking has a positive long-term effect on exploratory innovation outcomes in the post-launch phase.

H1c: Divergent thinking has a positive long-term effect on entrepreneurial growth outcomes in the post-launch phase.

### **2.3.2 Divergent thinking non-linearities**

As already mentioned, in the post-launch phase entrepreneurs are not expected to place more emphasis on one of the two cognitive styles, but rather combine them to be innovative and grow their business. However, it is possible that entrepreneurs with higher levels of divergent thinking may give more relevance to it and thus hinder their performance. While, divergent thinking is implicitly assumed to have a linear and positive relation to creative and entrepreneurial performance in theoretical models (Amabile and Pratt, 2016; Lex and Gielnik, 2017), studies suggest that this relationship might not always be the case, especially when it comes to innovation.

Although innovativeness facilitates the design of organizational routines, the discovery of new approaches to technologies and processes, and the ability of firms to adapt to changing market conditions, evidence shows that may not always be beneficial for small and medium-sized firms' perfor-



mance (Rosenbusch *et al.*, 2011). For example, fostering an innovative orientation has more positive effects on overall performance than actually investing in creating innovation process outcomes like patents (Rosenbusch *et al.*, 2011). In turn, Kreiser *et al.* (2013) have shown that the relation between innovation and performance follows a U-shape. However, the attempts to address non-linearities do not focus on divergent thinking but rather on outcomes of it (e.g. innovation). The theory and current evidence have not addressed the question of whether the relation between divergent thinking and entrepreneurial outcomes is always linear, let alone its potential non-linearities in the third phase of entrepreneurship. It is known that divergent thinkers might encounter contradictions and paradoxes, as they allow their minds to go in different directions and explore potentially opposing ideas at the same time (Acar and Runco, 2015), which can result in difficulties in prioritizing and executing ideas, as well as difficulties in decision making (Malhotra and Harrison, 2022). Exploring different perspectives and alternatives to make decisions requires a substantial investment of time and energy (Bartunek *et al.*, 1983), and it has been shown that it reduces performance in simple contexts and under constrained conditions (Malhotra and Harrison, 2022). We argue that even though the relation of divergent thinking with innovation and growth is positive, this relation is not necessarily linear, especially in the third phase of the cumulative process model, where both convergent and divergent thinking are at play. We therefore hypothesize that:

H2: The relationship between divergent thinking and entrepreneurial outcomes in the post-launch phase of entrepreneurship is not linear, as it might be negative for very high levels of divergent thinking.

### **3 Data and measures**

#### **3.1 Data creation**

The data set that we use was initially collected by Caliendo *et al.* (2015, 2020). The authors created a unique data set that enables a comprehensive and in-depth comparison between subsidized start-ups

out of unemployment and non-subsidized start-ups out of non-unemployment in Germany. As previously existing datasets usually did not provide sufficient information to clearly identify both groups and were somewhat restricted with respect to individual information about the founder (such as human capital or intergenerational transmission) and longitudinal information on business development, Caliendo *et al.* (2015) created a new dataset allowing for such a comparison. They drew representative random samples of founders who started a full-time business in the first quarter of 2009. The cohort comprises initially-unemployed individuals who received a start-up subsidy (*Gründungszuschuss*) from the Federal Employment Agency<sup>4</sup>, and business founders who were not unemployed directly prior to start-up and did not receive the subsidy. Different data sources were used to create representative samples of both groups. Subsidized start-ups out of unemployment were registered at the Federal Employment Agency and hence could be easily identified in the administrative data (*Integrated Employment Biographies*) provided by the Institute for Employment Research (IAB). However, identifying the non-subsidized start-ups was not straightforward, mainly due to the absence of a centralized register for all business founders in Germany. Hence, Caliendo *et al.* (2015) relied on three different data sources to obtain contact information for non-subsidized start-ups: (1) the *Chambers of Industry and Commerce* (“Industrie- und Handelskammern”, CCI), (2) the *Chambers of Crafts* (“Handwerkskammern”, CC) and (3) a private address provider to ensure occupational representativeness. Finally, the authors extracted a random sample of business start-ups within the first quarter of 2009 from each data source, and collected the required information on these businesses by means of computer-assisted telephone interviews (CATIs).<sup>5</sup>

The business founders were surveyed twice. The first interview (wave 1) was conducted in 2010 around 19 months after start-up and focused on an extensive list of start-up characteristics, socio-

---

<sup>4</sup>Administrative data shows that virtually all business founders out of unemployment received the start-up subsidy for the time period considered. Individuals were entitled to access the program if they fulfilled certain preconditions. Thus, we are confident that our sample data does not suffer from any positive bias among all previously unemployed entrepreneurs.

<sup>5</sup>A more detailed description of the data-generating process (implementation of the survey, etc.) can be found in Caliendo *et al.* (2015).

demographics, previous labor market experiences and intergenerational transmissions. Additionally to their labor market status, and conditional on the ongoing business activity of their initial start-up from the first quarter in 2009, they were also interviewed about their business performance across various dimensions, including the number of jobs created as well as innovation and expansion activities. The interviews conducted lasted on average 43 minutes. The total number of realized interviews was  $N = 3,835$ , among which roughly 37% of interviewees were female, which is very close to the share of female founders in the general population of entrepreneurs in Germany (41% in 2009, Federal Statistical Office of Germany, 2018). Caliendo *et al.* (2015) show that male subsidized founders significantly lag behind regular founders in terms of income, business growth, and innovation. Caliendo *et al.* (2020) amended the data with a second interview in 2012 (wave 2) that extends the observation window to 40 months after start-up for 2,034 panel observations. They show that the gaps in the mentioned outcomes are relatively constant or even widening over time. Figure A.1 clarifies the data structure.

### 3.2 Estimation sample

Even though the data was initially collected to evaluate the effects of the start-up subsidy and hence start-ups out of unemployment are somehow over-represented, it is an ideal data set for analyzing the performance of business start-ups in Germany as it contains a large set of informative covariates (see e.g., Caliendo *et al.*, 2023b,a) and a broad spectrum of outcomes. While Caliendo *et al.* (2015, 2020) focused on a comparison between subsidized and regular founders, we follow a completely different avenue of research. We use a random sub-sample of the data for which the question on divergent thinking was elicited during the first interview. Additionally to the information from Caliendo *et al.* (2015, 2020), a random sub-sample of 1,038 entrepreneurs from the first wave of interviews (about 25% of the sample) was asked a questionnaire module on cognitive and non-cognitive skills. The purpose of this sub-sample was to gather information on variables such as personality traits, numeracy skills, and memory, among others. We were able to include a battery of ideational behavior items

related to divergent thinking in this module. The scale will be described in more detail in the next sub-section. The same module was given to an additional random sub-sample of 25% in the second wave as well.

We restrict our estimation sample to those entrepreneurs who were surveyed twice, 19 months (wave 1) and 40 months after start-up (wave 2), who completed the module on cognitive and non-cognitive skills in the first wave of the survey, and report the outcomes of interest 40 months after start-up in the second wave. Thus, we avoid potential reverse causality, as entrepreneurial performance might influence divergent thinking, introducing bias in our estimates. This leaves us with a final estimation sample of  $N = 457$  business founders. Since we use longitudinal data, response attrition induces a (very) weak selective bias in our outcome variables. Entrepreneurs participating in both waves might select themselves into the sample. As it turns out, respondents of the two waves are on average older, with a higher education and professional background, they have had shorter unemployment spells, and higher earnings in the past compared to the full sample from wave 1. We follow Caliendo *et al.* (2020) to correct the potential attrition bias in our sample by using an inverse probability weighting. Through the weighting procedure, almost all significant differences are eliminated.<sup>6</sup>

### **3.3 Measures**

#### **3.3.1 Divergent thinking**

The RIBS comprises different items that reflect overt ideational behavior. Given budget constraints, the limited interview time, and the length of the questionnaires, the divergent thinking battery included in the module mentioned above was a shortened version of the RIBS in Runco *et al.* (2001). Individuals in our sample were asked to rate six items from the RIBS, with a focus on the frequency of ideation, attitudes towards ideation, and problem-solving ideation, which are in general the most relevant aspects of divergent thinking tests (Acar and Runco, 2019). This is not uncommon, as – for

---

<sup>6</sup>A detailed description of the weighting procedure is included in the Appendix B.

example – Stuhlfaut and Windels (2015) and Taylor *et al.* (2021) use the same number of items for their analysis. The items were rated on a seven-point Likert scale ranging from (1) strongly disagree to (7) strongly agree, and they are reported in Table 1. Items 1 (“*I have many unusual ideas*”) and 2 (“*I think about ideas more often than most people*”) relate to the frequency of ideation, items 3 (“*I often get excited about my own ideas*”) and 5 (“*I like to think about new ideas just for fun*”) reflect the attitudes of the entrepreneurs towards ideation, and items 4 (“*I often have suggestions or ideas for solving problems*”) and 6 (“*Friends often ask me to help them find ideas or suggest solutions*”) relate to ideation in problem-solving contexts.

[Insert Table 1 about here]

We conduct a factor analysis to assess whether there are underlying factors that might explain the variance of the items as well as their correlation, thus avoiding the disadvantages of a using a mean index, i.e. the simple average over all items.<sup>7</sup> Figure A.2 in the Appendix shows the scree plot of eigenvalues and the loadings from the factor analysis. According to Figure A.2a, retaining the first factor is sufficient to explain most of the variance of the six items, since the eigenvalue of the first factor is the only one larger than 1 and it is also the only one above the first pronounced break of the line. Columns (3) to (5) in Table 1 present the rotated factor loadings and uniqueness of the items. As shown in Figure A.2b and Table 1, all items load predominantly on factor 1, and the loadings are larger than 0.5, showing the strong correlation between the items and the factor. Furthermore, the first factor manages to explain the variance of all six items, as the uniqueness of the items is lower than 0.7. Here, the retained factor shows a stronger correlation with ideation frequency items (1 and 2) and less so with the problem-solving items (4 and 6). Additionally, the Cronbach’s alpha reliability for the items is 0.85.

[Insert Figure 1 about here]

---

<sup>7</sup>By using the mean of the items, one assigns the same weight to each of them. This approach might not reflect the different importance of each item, as they capture different characteristics of ideational behavior, and some items might be more relevant than others in the ideation process.

We then extract a single factor as a divergent thinking factor index. This index describes the common variance of the items, and relies on the data to determine each item's weight in the overall index. Figure 1 shows the histogram and distribution of the standardized factor index and – as a comparison – the standardized mean index (which we get by simply using the mean values of each item). Both distributions are negatively skewed with a slightly long tail at the left-hand side of the distribution, which shows a predominant high divergent thinking level among entrepreneurs (the top of the distribution concentrates more than half of the density). We can see that the computed factor index gives a reliable representation of the data that is not far from the mean computation, with the advantage of giving a data-driven weighting to each item of the scale.

### 3.3.2 Outcome variables

We consider three types of self-reported outcome variables taken from the second wave: i) survival, ii) innovation, and iii) growth-oriented variables.

*Survival* Survival is measured as an indicator variable that takes the value one when the entrepreneur was still self-employed with the same venture that they founded in 2009.<sup>8</sup>

*Innovation* For exploratory innovation activities, we use the information concerning whether founders have filed at least one patent application or applied for trademark protection since start-up (1 if yes, 0 otherwise).<sup>9</sup>

*Growth outcomes* With respect to growth-oriented outcomes, we consider the dimensions of job creation and expansion activities. For job creation, we consider the extensive margin, i.e., an indicator for businesses with at least one employee (1 if at least one employee, 0 otherwise), as well as an indi-

---

<sup>8</sup>While a business in general could keep operations after the founder has left, we use this variable as proxy for business survival considering the characteristics of our sample that makes it unlikely: low rates of job creation (approximately 53% operate without any employees), relatively high share of subsidized start-ups (about 55%), low levels of capital investment (less than 10% made substantial capital investments). Furthermore, less than 8% of the firms that we classify as non-survivors in the second wave of the survey reported having employees in the first wave. All of this suggest a strong dependence on the personal involvement of the founder in the business.

<sup>9</sup>The process of applying for a patent or trademark protection indicates that the firms have produced or coined some type of intellectual property. While this indicator may not be considered the most accurate measure of innovation, we argue that this innovative behavior can be used as proxy of exploratory innovation, in contrast to exploitative innovation, which relates to improvements on implementation or efficiency of current processes within firms. See also Block *et al.* (2014), who propose that trademarks may also be used as a proxy for innovation activities.

cator for businesses that hired employees between the two waves of the survey (1 if hired employees, 0 otherwise). For expansion activities, we observe whether businesses expanded into new business fields or new regions (1 if yes, 0 otherwise), and whether they realized field expansion plans during the time between the two waves (1 if yes, 0 otherwise). This last variable was created by looking at entrepreneurs who stated that they planned to expand their business in wave 1 and reported expansion in wave 2. Table A.1 (Panel A) in the Appendix presents the outcomes of interest 40 months after business formation, while Table A.2 shows the correlations among outcomes.

### 3.3.3 Control variables

There are several determinant factors of entrepreneurship and entrepreneurship performance, both pecuniary and non-pecuniary (Parker, 2018). Given that our research aims to identify the influence of divergent thinking on entrepreneurial performance in the post-launch phase, it is necessary to control for other individual- and business-related variables that are known to affect entrepreneurial outcomes (Shane *et al.*, 2003). Besides, in line with Lex and Gielnik (2017), we include a broad set of covariates that account for variables at different stages of the entrepreneurial process.

*Personal characteristics* These include age, gender, whether there are children in the household, and marital status. There is evidence supporting the consideration of these variables as controls in our analysis. For instance, Kautonen *et al.* (2014) show how age has an influence on entrepreneurial behaviors, measured as the starting or willingness to start a business. Similarly, Fairlie and Robb (2009) describe how female-owned firms have on average less start-up capital and experience, and how this is reflected in performance. Additionally, the interplay between marital status and children has also been shown to be a determinant of entrepreneurial performance (DeMartino and Barbato, 2003).

*Human capital* We include a categorized version of entrepreneurs' completed education level, as evidence shows that there is a significant relation between human capital and entrepreneurial success (Unger *et al.*, 2011b; Marvel *et al.*, 2016).

*Intergenerational transmission* This set of control variables comprises indicators regarding whether the parents were born abroad, were or are self-employed, whether the father was employed at the age of 15, and whether the entrepreneurs have taken over the business from their parents. These controls account for the importance of intergenerational transmission in entrepreneurial outcomes, as described by Dunn and Holtz-Eakin (2000). Evidence shows that entrepreneurs who take over their business from their parents leverage on social capital resources of their family-firm parents to guarantee business survival (Criaco *et al.*, 2021).

*Labor market history* This set of covariates contains information on the duration of dependent employment right before start-up, overall unemployment and employment experience before start-up, as well as income from the last dependent employment. We include these variables as controls taking into account that the duration of former paid employment (Parker, 2018) and income from it influence entrepreneurial entry (Parker, 2018; Astebro and Chen, 2014).

*Local macroeconomic conditions* As business performance is closely connected with the business cycle (Millán *et al.*, 2012; Koellinger and Thurik, 2012; Sedláček and Sterk, 2017), we include the number of vacancies available in relation to the stock of unemployment, the real GDP per capita in 2008 before start-up, and whether they live in East or West Germany.

*Business-related characteristics* This section of control variables includes the industrial sector of the business, whether its foundation was subsidized, and capital invested at start-up. Additionally, our data accounts for detailed information regarding entrepreneurs' preparations before start-up, and a categorical variable industry-specific experience that allows us to determine whether entrepreneurs have gathered domain-specific experience from regular paid employment or former self-employment. As shown by Caliendo *et al.* (2015), formerly subsidized founders lag behind not only in survival and job creation, but especially also in innovation activities. Likewise, there is supportive evidence of the importance of financial capital invested for entrepreneurial performance (Holtz-Eakin *et al.*, 1994; Blanchflower and Oswald, 1998), as well as preparation and information gathering (Westhead



*et al.*, 2009; Honig and Samuelsson, 2014; Delmar and Shane, 2003, 2004), and domain-specific experience, whether it is from self-employment (Jovanovic, 1982; Ucbasaran *et al.*, 2003; Cassar, 2014; Rocha *et al.*, 2015), or regular employment (Dunkelberg *et al.*, 1987; Parker, 2018).

*Personality Traits and Cognition* It has been shown that personality traits have a significant influence on business survival and other entrepreneurial outcomes (see, e.g. Rauch and Frese, 2007; Kroeck *et al.*, 2010; Zhao *et al.*, 2010; Caliendo *et al.*, 2010, 2014). On the other hand, divergent thinking is also closely connected with personality traits. McCrae (1987) provides evidence that divergent thinking is correlated with openness to experience. Likewise, Chamorro-Premuzic and Reichenbacher (2008) show that divergent thinking has a significant positive relation with openness to experience and extraversion. In terms of cognition, we use numeracy and memory tests to account for this cognitive style, as it is mainly oriented to deriving one single correct answer, emphasizes accuracy and logic, and is intimately related to knowledge (Cropley, 2006). Overall, this set of covariates contains information on the Big Five personality traits, locus of control, risk aversion, as well as numerical cognition and memory tests as proxies for convergent thinking.

The full list of control variables is listed in Panel B of Table A.1 in the Appendix and Table A.3 shows the correlations among them.

### **3.3.4 Common method bias**

Following Podsakoff *et al.*'s (2003) recommendations, we exploit the longitudinal nature of our data set and rely on the temporal separation of measurement to tackle potential common method biases. The measure of divergent thinking and all control variables is taken about 20 months apart from the measure of the outcomes of interest. Additionally, our control variables come from two independent data sources and are partly self-reported and based on administrative information.

## 4 Empirical analysis

### 4.1 Descriptives

Table A.1 in the Appendix shows that the founders in our sample were on average 43 years old at the time of the start-up, about 36% are female, about 62% did not have children living in the household, and they are mostly from West Germany (about 80%). Most of them attended upper secondary school (43%), and have experience in the field in which they opened their business, mainly from former dependent employment (65%). Their business fields are mainly related to services (32%), manufacturing (16%) and retail sectors (17%). The upper part of Table A.1 shows all outcome variables 40 months after businesses were started. Overall, we observe that nearly two-thirds of the businesses are still operating at the end of our observation period. Nearly half (47%) of them have at least one employee by that time and 39% hired employees in between the first (after 19 months) and second wave (after 40 months). 13% expanded into new regions and 27% into new fields (where 21% realized a field expansion plan by  $t_{40}$  that they had stated in  $t_{19}$ ). Most interestingly with respect to our innovation outcome, 12% of the businesses filed an application for a patent or trademark.<sup>10</sup>

### 4.2 Estimation strategy

In order to test the influence of divergent thinking on post-launch entrepreneurial outcomes, we estimate logit regressions for all binary outcome variables with different specifications of divergent thinking (linear and quadratic).<sup>11</sup> As described in Section 3.3.3, we control for an extensive set of

---

<sup>10</sup>To put this into perspective, Niefert (2005), using data from the ZEW Foundation Panel, (Almus *et al.*, 2000) finds that 3.2% of a sample of German start-ups founded in the early-1990s applied for at least one patent by 1999/2000. However, since numbers are not conditional on survival, they underestimate patent applications for survivors. Based on a sample of 21,517 German businesses founded between 1995-1998 originating from the same data source, Engel and Keilbach (2007) report that 2.2% of all start-ups applied for at least one patent at the time of business formation.

<sup>11</sup>In order to decide about the underlying distribution for our binary regressions – i.e. decide between a probit model (standard normal distribution) and logit model (logistic distribution) – we use different criteria suggested in the literature (see, e.g., Chen and Tsurumi, 2010). First, we use the Akaike Information Criterion (AIC), which is given by:  $-2LL + 2k$ , where  $LL$  is the maximized log likelihood and  $k$  is the number of parameters estimated. Next, we also compare the correct prediction rates. For each observation  $i$ , we compute the estimated response probability  $\hat{p}_i = \hat{P}(y_i = 1|\mathbf{x}) = G(\mathbf{x}'\hat{\beta})$ . If  $\hat{p}_i \geq \bar{y}$ , then we predict a success  $\hat{y}_i = 1$ , if  $\hat{p}_i < \bar{y}$  the prediction  $\hat{y}_i$  is 0. The fraction of observations where the prediction  $\hat{y}_i$  is identical to the actual value  $y_i$  is the correct prediction rate (the higher, the better). The results of these tests can be found in Panel A of Table 2 for the logit estimation and Panel A of Table A.5 for the probit estimation. Both criteria strongly favor a logistic regression, which we use for our main analysis. However, in the robustness section 4.5, we test the robustness of our results with respect to the underlying distribution and run a probit regressions.

individual socio-demographic and business-related characteristics, local macroeconomic conditions, as well as other personality traits and characteristics that are shown to influence entrepreneurial development and might be confounders driving the differences in outcomes between entrepreneurs with different levels of divergent thinking. The following logit regression for patents and trademark protection is exemplary for all outcome variables. The probability of applying for patents or trademark protection is described as a function of divergent thinking and other covariates:

$$P(\text{Patents or TM} | DT_i, \mathbf{X}_i) = F(\alpha + \beta DT_i + \mathbf{X}_i' \gamma), \quad (1)$$

where  $DT_i$  is operationalized based on the factor analysis described in Section 3.3.1, and  $\mathbf{X}_i$  stands for the vector of control variables described in Section 3.3.3. In order to capture possible non-linearities, we use divergent thinking as a continuous variable in a linear specification first to test Hypotheses H1a-c, and then add it in quadratic form to test Hypothesis H2.

Additionally, in order to test the interaction effect of experience (Hypothesis H3), we estimate the following regression using patents and trademark protection as an example:

$$P(\text{Patents or TM} | DT_i, \mathbf{X}_i) = F(\alpha + \beta_1 DT_i + \beta_2 \text{exper}_i + \beta_3 DT_i \times \text{exper}_i + \mathbf{X}_i' \gamma), \quad (2)$$

where  $\text{exper}_i$  is an indicator of having domain-specific experience. We differentiate between experience from self-employment and from regular employment. All control variables used in equation 1 are included in  $\mathbf{X}_i'$  for equation 2.

### 4.3 Main results

#### 4.3.1 Hypothesis 1

Table 2 shows the relation between divergent thinking and post-launch entrepreneurial outcomes. Estimates are shown in terms of marginal effects at the mean from logit estimations for Panel A (linear specification) and logit coefficients for Panel B (quadratic specification).<sup>12</sup> In Panel A, col-

---

<sup>12</sup>See Table A.1 for the complete list of covariates included in  $\mathbf{X}_i$ .

umn (2) shows support for our first hypothesis regarding exploratory innovation. An increase of one standard deviation ( $SD = 0.91$ ) in the divergent thinking factor<sup>13</sup> is associated with an increase of 4.1 percentage points (marginal effect:  $b = 0.041$ ,  $p < 0.1$ ) in the probability of applying for patents or trademark protection, which represents a relative effect of 34% in relation to the mean.<sup>14</sup> This confirms our Hypothesis H1b, namely that divergent thinking has a positive influence on exploratory innovation outcomes in the post-launch phase 40 months after start-up.

Likewise, we find support for Hypothesis H1c, tested by estimations columns (3) to (7) of Panel A. Overall, divergent thinking has a positive effect on entrepreneurial growth in the post-launch phase 40 months after business foundation. An increase of one standard deviation in the divergent thinking factor is associated with an increase of 9.5 percentage points (p.p.) in the probability of having employees ( $b = 0.095$ ,  $p < 0.01$ ), 4.8 p.p. in the probability of expanding into new business fields ( $b = 0.048$ ,  $p < 0.1$ ), 4.9 p.p. in the probability of expanding into new regions ( $b = 0.049$ ,  $p < 0.05$ ), 6.5 p.p. in the probability of having had hired employees between  $t_{19}$  and  $t_{40}$  ( $b = 0.65$ ,  $p < 0.05$ ), and 4.2 p.p. in the realization of field expansion plans ( $b = 0.042$ ,  $p < 0.1$ ). The relative effect of divergent thinking on these outcomes ranges from about 16% to 38% with respect to the mean. The only variable for which we do not observe significant effects of divergent thinking in the linear specification is business survival. Given that there is no evidence of divergent thinking affecting the probability of business survival in the post-launch phase 40 months after start-up ( $b = -0.005$ ,  $p = 0.819$ ), we cannot confirm Hypothesis H1a in the linear specification.

[Insert Table 2 about here]

---

<sup>13</sup>To put this into perspective and give an example, a one standard deviation increase moves an individual from the 50%-th to the 87%-th percentile of the divergent thinking distribution.

<sup>14</sup>The relatively low significance of the marginal effect on Patents or TM ( $p = 0.08$ ) can be explained by a low number of positive responses in the outcome along with a relatively small sample size, which reduces the statistical power to detect significant effects.

### 4.3.2 Hypothesis 2

We test hypothesis H2 using the quadratic form of the divergent thinking factor as an additional explanatory variable. Panel B of Table 2 reports logit coefficients for the linear and squared divergent thinking factor. The results show a positive and significant role of squared divergent thinking for patents and trademark protection applications (logit coefficient:  $\beta_2 = 0.724$ ,  $p < 0.1$ ), which suggests that the relation between divergent thinking and exploratory innovation in the post-launch phase might not be fully linear, but innovation is always higher, the higher divergent thinking levels are. We find similar results for survival in terms of squared divergent thinking ( $\beta_2 = 0.405$ ,  $p < 0.01$ ), albeit not in its linear form ( $p > 0.1$ ). On the other hand, the relation between divergent thinking and the probability of having employees describes an inverse U-shape ( $\beta_1 = 0.529$ ,  $p < 0.05$ ;  $\beta_2 = -0.354$ ,  $p < 0.05$ ), suggesting that the positive effect of divergent thinking on such outcome starts decreasing after a certain point.

However, this evidence is not completely informative by itself. In this case, our variables of interest – i.e. divergent thinking in linear and quadratic form – are highly correlated, and therefore we conduct a series of tests to validate their joint significance, and the necessity of including divergent thinking in a quadratic form. First, we test for joint significance using the Wald test, and find support for the inclusion of divergent thinking in its quadratic form for most outcomes (with the only exception being the realization of business field expansion plans). Additionally, following Wooldridge (2002), we use the likelihood-ratio test (LRT) to assess whether divergent thinking in its quadratic form contributes to the model.<sup>15</sup> The test shows that the quadratic term is significant for all outcomes, even though the  $p$ -value for realized plans of field expansion is only 0.095. Finally, we assess the fit of our specifications using the AIC, which confirms that the model including squared divergent thinking fits the data better for all outcomes apart from whether the entrepreneurs realized field expansion

---

<sup>15</sup>The LRT allows us to assess whether a predictor or group of predictors significantly contribute to a model, by comparing two nested models (Wooldridge, 2002). The test statistic of the LRT is  $LR = -2(L_1 - L_0)$ , where  $L_0$  and  $L_1$  are the log likelihood values associated with the full and constrained models, respectively.

plans. Overall, we find evidence of a non-linear relation between divergent thinking and business survival, applications for patents or trademark protection, and having employees. We find slight evidence for potential non-linearities for the rest of the growth outcomes, as the inclusion of divergent thinking in its quadratic form is relevant for the model.<sup>16</sup>

As we have hypothesized in Section 2.3.2 that the relationship between divergent thinking and entrepreneurial outcomes in the post-launch phase might be negative for very high levels of divergent thinking, we conduct an additional test in Panel C of Table 2. Here, we split the divergent thinking factor into quartiles (baseline: lowest quartile) and look at the results for the upper three quartiles. The results underline the non-linearity in the effects on business survival. While we do not find a statistically significant effect for the fourth quartile ( $b = 0.025$ ,  $p = 0.688$ ), the marginal effects for the second quartile ( $b = -0.125$ ,  $p < 0.05$ ) and third quartile ( $b = -0.185$ ,  $p < 0.01$ ) are negative, statistically significant, and economically relevant (as they relate to relative effects of -17.6% and -26.1% in comparison to people in the first quartile who have an average survival rate of 71%). The effects of divergent thinking on applications for patents or trademark protection is highest in the fourth quartile, and we see decreasing marginal returns for having or hiring employees.

[Insert Figure 2 about here]

Finally, we further contrast these findings by plotting the marginal effects of divergent thinking on our selected outcomes. Figure 2 confirms our findings for business survival, patents and trademark applications, and having employees. Figure 2 shows that the relation between divergent thinking and survival is non-linear. When looking at the bottom of the divergent thinking distribution, there seems to be a negative effect. This provides suggestive evidence concerning why the overall linear effect on survival in Table 2 is not significant. In the case of applying for patents or trademark protection, we observe that the relation with divergent thinking is quasi-linear and always positive. If we compare very low and very high values of divergent thinking, the effect on patents or trademark protection is

---

<sup>16</sup>These results are not driven by the constructed factor index. Table A.6 replicates the analysis of potential non-linearities using the continuous divergent thinking mean index and yields similar results.

significantly different. Finally, we find an inverse U-shape relation of divergent thinking with job creation outcomes and regional expansions, and a weaker inverse U-shape for field expansion outcomes. However, given that their confidence intervals overlap, these findings are not conclusive.

Overall, we find evidence supporting Hypothesis H2, namely that the relationship between divergent thinking and entrepreneurial outcomes in the post-launch phase is not necessarily linear. This is particularly true for business survival, where we find a pronounced non-linear effect of divergent thinking. For exploratory innovations we find evidence of non-linearities as well. In this case we observe increasing marginal returns, as the highest effect is found at the top end of the distribution. For having or hiring employees, the relation rather follows an inverse U-shape, indicating decreasing marginal returns. For some of the other outcomes results are partly inconclusive – due to overlapping confidence intervals, which might be due to the small sample size – but suggestive of potential non-linearities.

## **4.4 Moderation Analysis**

### **4.4.1 An interactionist perspective: the role of experience**

Divergent thinking and entrepreneurial performance are not related in a vacuum. As theorized and shown by empirical studies, different factors are at play and might provide specific contexts in which the relation operates, as well as serve as mediators of the divergent thinking effect (Amabile, 1988; Baer, 2012; Gielnik *et al.*, 2012; Amabile and Pratt, 2016; Lex and Gielnik, 2017; Warnick *et al.*, 2021). Domain-specific skills, knowledge, and expertise play a significant role in the creative process (Sternberg, 2005; Gemmell *et al.*, 2012; Amabile and Pratt, 2016), yet evidence is mixed regarding the role of experience in creativity. Some argue that it is a necessary condition to generate novel and useful ideas, while others show that experience affects the ability to generate such ideas, as it creates a mindset that relies on routines and reinforced associations (Schilling, 2005; Agnoli *et al.*, 2019). Experience in a specific domain might inhibit the generation of new ideas, as well as the ability

of creative problem-solving (Schilling, 2005). Entrepreneurs might develop *functional fixedness*<sup>17</sup>, a mindset that prevents individuals from exploring or considering different ideas or solutions to problems. Entrepreneurs who have found a way of solving a certain problem are likely to use the same path when similar or even different problems arise, and thus ignore different and potentially better ideas to approach problems. On the other hand, experience facilitates the recognition of viable ideas, and can therefore produce novel combinations of resources that end up in creative achievements (Tiwana and McLean, 2005; Taylor and Greve, 2006). Experienced entrepreneurs might prevent process losses caused by communication problems, coordination, or conflict management, all of which can foster innovation (Taylor and Greve, 2006). Furthermore, given the relation of experience and knowledge in entrepreneurship (Rae and Carswell, 2000), knowledge plays a paradoxical role as it supplies the resources from which novel ideas are generated, although it carries a potential inhibiting effect on creativity (Ward, 2004).

Previous evidence suggests that prior entrepreneurial experience helps entrepreneurs to avoid taking inefficient paths, even though they might initially appear to be novel and original (Baron and Ensley, 2006). The recognition of viable opportunities involves pattern recognition, for which cognitive frameworks acquired through experience play a significant role: experienced entrepreneurs have a better picture of viable opportunities than novice ones, as they connect the dots differently (Baron and Ensley, 2006). This goes in line with Agnoli *et al.* (2019), who argue that domain-specific experience acts as a mediator of divergent thinking, as it helps entrepreneurs to develop sophisticated strategies to optimally use their ideational abilities to carry through creative goals. In other words, experienced entrepreneurs have a more refined strategic thinking that controls ideation and selects more suitable ideas for different scenarios. Furthermore, evidence shows that the interaction of divergent thinking with knowledge and information (and therefore a level of domain-specific experience) moderates the effect of divergent thinking on different entrepreneurial outcomes (Gielnik *et al.*, 2012, 2014; Xiao

---

<sup>17</sup>Duncker and Lees (1945) developed the concept of functional fixedness, which describes a situation in which an individual cannot think of other uses for an object different to the common ones.



*et al.*, 2022).

However, little is known about the potential moderating effects of different types of domain-specific experience, such as experience from self-employment and regular employment. There is, however, some suggestive evidence. For instance, earlier evidence shows that previous self-employment experience has in itself a positive effect on performance (Jovanovic, 1982; Ucbasaran *et al.*, 2003; Bosma and Van Praag, 2004; Cassar, 2014; Rocha *et al.*, 2015), and is linked to learning processes in terms of networking, and venture management (Cope, 2011), which in turn might exacerbate the *functional fixedness* mindset. Likewise, experience from former regular employment might have an influence in ideation – as described in Bhidé (1994). Many entrepreneurs generate ideas for new ventures from former jobs, and there is suggestive evidence that entrepreneurs who obtained their business idea from previous jobs have higher growth rates (Dunkelberg *et al.*, 1987; Parker, 2018). Not only that, different working environments might affect creative behavior (Ensor *et al.*, 2001; Dul *et al.*, 2011), and previous employment variety (e.g. occupation, industry) might influence the quality of creative achievements (Åstebro and Yong, 2016). In a post-hoc moderation analysis, we examine whether different types of domain-specific experience have heterogeneous moderating effects.

#### **4.4.2 Moderating effects of experience**

We use the specification in equation (2) and differentiate between types of experience. Table 3 shows the interaction effects of experience from self-employment and from regular employment for the relation between divergent thinking and the outcomes of interest in terms of coefficients from logit estimations. Experience from regular employment has a positive significant moderating role for patents or trademark applications, regional expansions, and the realization of field expansions (logit coefficient:  $\beta = 2.195$ ,  $p < 0.01$ ;  $\beta = 2.196$ ,  $p < 0.01$ ;  $\beta = 0.816$ ,  $p < 0.05$ ). In turn, experience from self-employment shows a negative interaction effect for survival, applying for patents or trademark protection, and the probability of hiring employees between  $t_{19}$  and  $t_{40}$  ( $\beta = -0.722$ ,  $p < 0.05$ ;  $\beta = -1.768$ ,  $p < 0.05$ ;  $\beta = -1.025$ ,  $p < 0.05$ ). We do not observe any interaction effects of regular

or self-employment on the probability of having employees or business field expansions. Identifying these interaction effects is difficult with the small sample at hand and we will discuss this in Section 5.2. Table A.4 in the Appendix shows the marginal effects of these interactions as predictive margins of our outcomes. There are significant marginal effect on business survival of having domain specific experience only from regular employment (column 3) compared to not having experience neither from regular nor from self-employment (column 1). For other outcomes, although the effects are not significantly different from each other, they are all relatively large and significantly different from zero.

[Insert Table 3 about here]

Overall, divergent thinking interactions with different types of domain-specific experience have a significant effect on most outcomes of interest. In particular, having domain-specific experience from regular employment has a positive moderating effect on exploratory innovations, and the realization of business fields expansion plans. Whereas, domain-specific experience from self-employment shows negative moderating effects on business survival, exploratory innovation and job creation. This suggests that entrepreneurs with domain-specific experience from self-employment might develop a *functional fixedness* mindset that prevents them from exploring novel ways of approaching problems or new ideas. On the contrary, entrepreneurs with domain-specific experience from regular employment seems to gain from such experience, as they report better performance in terms of innovation and growth.

#### 4.5 Robustness analysis

We turn now to consider the robustness of our conclusions to a variety of important issues. The results are reported in Table A.5.

**Distributional assumptions – Probit vs. Logit** In Section 4.2, we have explained why the logit regression – based on the AIC and the correct prediction rates – is our preferred choice. Nevertheless,

given the differences in the cumulative distributions at the tails, and the nature of some of our binary outcomes with low positive responses, we want to test the robustness of our results with respect to this distributional assumption and replicate our main results from Panel A in Table 2 using a probit regression. Panel A in Table A.5 in the Appendix shows that the marginal effects of the divergent thinking factor on business field expansions, regional expansions, having hired employees between  $t_{20}$  and  $t_{40}$ , and the realization of field expansion plans are almost identical for both models. There are some differences for applying for patents and trademark protection, and the probability of having employees. However, these differences are relatively small, and hence, the results are robust with respect to the distributional assumption.

**Continuous mean index** In order to test the robustness of the results in relation to the construction of our divergent thinking factor index, Panel B of Table A.5 shows the estimates when using the continuous standardized divergent thinking mean index. The marginal effects of the divergent thinking mean index closely resemble those of the factor analysis, particularly for the probability of applying for patents or trademark protection, having employees, expanding into new business fields, having hired employees, and realizing business fields expansions. The largest difference can be found for regional expansions, where an increase of one standard deviation in the divergent thinking mean index is associated with an increase of 4.2 p.p. in the probability of expanding into new regions, whereas it was 4.9 p.p. with the factor index. Finally, as with the factor index, there is no significant relation between divergent thinking and business survival. Overall, the marginal effects are qualitatively and quantitatively very similar.

**Panel attrition weights** In Panel C of Table A.5, we replicate the analysis from Table 2 without using panel attrition weights (see Section 3.2 for a discussion). Marginal effects change only slightly. Variables that were significant in the main estimation remain significant. One exception is the results for patents, which becomes slightly smaller and loses statistical significance, most likely due to the

small sample size. Hence, the results are robust with respect to attrition weights.

## **5 Discussion and Conclusion**

### **5.1 Key findings and implications**

The aim of the present study was to investigate the role of divergent thinking in the third phase of the entrepreneurial process, namely the post-launch phase. Drawing upon the cumulative process model of creativity in entrepreneurship (Lex and Gielnik, 2017), we hypothesize that divergent thinking has a lasting effect on post-launch entrepreneurial outcomes up until 40 months after start-up, and that this relation is not always linear. Finally, given that domain-specific experience allows entrepreneurs to recognize viable business opportunities more efficiently (Baron and Ensley, 2006), and it shapes individuals' ideational abilities (Agnoli *et al.*, 2019), we investigate whether different types of domain-specific experience act as a moderator of the effect of divergent thinking on entrepreneurial performance.

In this paper, we provide current robust evidence of the role of divergent thinking on different entrepreneurial outcomes in the post-launch phase of the entrepreneurial process. As Lex and Gielnik (2017) point out, a longitudinal analysis is necessary in order to test the model. Therefore, we use a representative longitudinal sample of 457 German entrepreneurs from a two-wave survey. We are able to test our hypotheses on business survival, patents or trademark applications, extensive job creation, business fields expansion, and regional expansions, as well as on having hired employees in the past 20 months of the post-launch phase, and having realized business field expansion plans. Additionally, our rich data set allows us to account for a broad set of potential confounders as control variables.

We find supportive evidence for our first hypotheses, as divergent thinking has a positive effect on post-launch innovation and growth outcomes 40 months after business foundation. Thus, we confirm our theoretical framework based on Lex and Gielnik (2017), as well as previous evidence in line with these findings (Morris and Fargher, 1974; Ames and Runco, 2005; Baron and Tang, 2011). Additionally, we find strong evidence of non-linearities in the relation of divergent thinking with

business survival, confirming our hypothesis. Low divergent thinking values have a negative effect on survival, and are significantly different from the positive effects observed for values at the top of the distribution. Even though we cannot argue that divergent thinking measures innovativeness itself, this finding is in line with Hyytinen *et al.* (2015), who show that start-up innovativeness is not necessarily associated with the probability of business survival in the early stages of firm development. For patents or trademark applications, the relationship is also non-linear, but it is always positive, i.e. it shows increasing marginal returns, confirming the expected relation of divergent thinking with innovation (Sarooghi *et al.*, 2015). For job creation outcomes, the relation follows an inverse U-shape, indicating decreasing marginal returns. This is in line with the idea that extremely high levels of divergent thinking might be counter-productive (Rosenbusch *et al.*, 2011; Acar and Runco, 2015). For expansion outcomes, the relations tend to have an inverse U-shape, but results are not conclusive.

As for the moderating role of different types of domain-specific experience, we find supporting evidence of our hypothesis, as we find that experience from regular and self-employment has significant moderating effects for divergent thinking on most post-launch outcomes. Experience from regular employment has a positive interaction effect on the probability of applying for patents or trademark protection, having hired employees between survey waves, and having realized field expansion plans. This is in line with Dunkelberg *et al.* (1987) and Parker (2018), who describe how entrepreneurs take ideas from former regular employment to apply them into their new ventures, which is reflected in higher growth rates, and Madsen *et al.* (2003), who show that experience in previous employment influences the building of networks that secure venture growth. In turn, having domain-specific experience from self-employment has a negative moderating effect on business survival, patent or trademark applications, and the probability of having hired employees. These results are in line with the *functional fixedness* theory. Experience from previous self-employment might limit the capacity for ideation, as entrepreneurs might stick to previous processes and ways of solving problems. This seems to affect their capacity for creative problem-solving, which is reflected in

their lower probability of survival, innovation, and job creation.

## **5.2 Limitations and suggestions for future research**

We acknowledge that the scope of our results has its own limitations and some of them are closely related to the survey data that we use. First, due to budget constraints and the limited interview time, we have to rely on a shortened version of the RIBS to measure the divergent thinking levels in our sample. While we believe that we have covered the most relevant aspects of divergent thinking with the chosen items – which is also supported by the strong predictive power of our estimates – grasping the variability of the entire construct by Runco *et al.* (2001) would have been more ideal. Clearly, considering several measures of divergent thinking (e.g., the Alternative Uses Task, Kuhn and Holling, 2009b; Hass, 2015), their correlations and stability over time in future research would be very beneficial and help to draw more robust conclusions. Second, all of the outcomes in the survey have been operationalized as dichotomous variables. An operationalization of the outcomes of interest as continuous variables might help identifying more accurate effects, and might allow exploring potential heterogeneities in more detail. Additionally, we use a proxy for explorative innovation – whether founders have filed at least one patent application or applied for trademark protection – which might not cover the full bandwidth of innovative behavior and actions in the post-launch phase. Hence, broadening the scope of outcome variables in future research would also be beneficial. Third, our small sample makes it hard to identify non-linearities and interaction effects with precision. Given the suggestive evidence that we present, we encourage further research on these topics, ideally in a longitudinal setting with temporal separation of measurement to tackle potential common method biases. Especially the non-linearity in the relation between divergent thinking and survival (but also some of the innovation and growth outcomes) seems to be a very interesting avenue for future research, as it could shed light on what an optimal level of divergent thinking might be.

### 5.3 Contributions and practical implications

Despite the limitations, the present findings offer several useful contributions. First, it provides new evidence of the link between divergent thinking and entrepreneurial performance. We show the positive effect of divergent thinking on post-launch innovation and growth outcomes, and this confirms our theoretical framework based on Lex and Gielnik (2017). Thus, we contribute to the creativity and entrepreneurship research stream, showing the relevance of divergent thinking as a significant explanatory variable for business success in yet another context. Second, we provide evidence of non-linearities of divergent thinking with survival, exploratory innovations, and growth outcomes, as well as suggestive evidence of potential non-linearities in the relationship of divergent thinking with expansion outcomes. We further confirm that the relation between divergent thinking and innovation outcomes is always positive – as inferred from the literature (Sarooghi *et al.*, 2015) – with increasing marginal returns. For job creation outcomes, the relation has an inverse U-shape, indicating decreasing marginal returns. Evidence is not conclusive regarding non-linearities for expansion outcomes. Third and finally, we analyze the moderating effect of different types of domain-specific experience. We show that domain-specific experience from regular employment has a positive moderating effect on exploratory innovations, job creation, and expansion outcomes, whereas domain-specific experience from self-employment show a negative moderating effect on business survival, and exploratory innovations. Therefore, we show that self-employment experience might hinder creative thinking and creative achievement, possibly by creating a so called *functional fixedness* mindset, in which entrepreneurs rely mostly on established routines to approach new ideas and solve problems.

The findings of our study also have practical implications for business owners and policy-makers. As divergent thinking is a stable cognitive ability and proves to be a significant predictor of innovative performance and business growth in the post-launch, it might serve as a tool for policy-makers and private investors to identify and foster businesses with innovative and growth potential, leading to a more efficient allocation of public and private resources. Likewise, understanding the influence of

such cognitive skills in the entrepreneurial process helps both policy-makers and business coaches to accommodate entrepreneurial educational programs according to different cognitive styles, accounting for divergent thinking, or to develop training programs aiming at developing divergent thinking skills, which have already shown potential benefits for prospective entrepreneurs (Aylesworth and Cleary, 2020).



## References

- ACAR, S. and RUNCO, M. A. (2015). Thinking in multiple directions: hyperspace categories in divergent thinking. *Psychology of Aesthetics, Creativity, and the Arts*, **9** (1), 41.
- and — (2019). Divergent thinking: New methods, recent research, and extended theory. *Psychology of Aesthetics, Creativity, and the Arts*, **13** (2), 153.
- AGNOLI, S., MASTRIA, S., KIRSCH, C. and CORAZZA, G. E. (2019). Creativity in the advertisement domain: the role of experience on creative achievement. *Frontiers in Psychology*, **10**, 1899.
- ALMUS, M., ENGEL, D. and PRANTL, S. (2000). *The “Mannheim Foundation Panels” of the Centre for European Economic Research (ZEW)*. ZEW-Dokumentation 00-02, Centre for European Economic Research (ZEW), Mannheim.
- AMABILE, T. M. (1988). A model of creativity and innovation in organizations. *Research in Organizational Behavior*, **10** (1), 123–167.
- and PRATT, M. G. (2016). The dynamic componential model of creativity and innovation in organizations: making progress, making meaning. *Research in Organizational Behavior*, **36**, 157–183.
- AMES, M. and RUNCO, M. A. (2005). Predicting entrepreneurship from ideation and divergent thinking. *Creativity and Innovation Management*, **14** (3), 311–315.
- ARDICHVILI, A., CARDOZO, R. and RAY, S. (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing*, **18** (1), 105–123.
- ASTEBRO, T. and CHEN, J. (2014). The entrepreneurial earnings puzzle: Mismeasurement or real? *Journal of Business Venturing*, **29**, 88–105.
- ÅSTEBRO, T. and YONG, K. (2016). Invention quality and entrepreneurial earnings: The role of prior employment variety. *Entrepreneurship Theory and Practice*, **40** (2), 381–400.
- AUDRETSCH, D. B., COAD, A. and SEGARRA, A. (2014). Firm growth and innovation. *Small business economics*, **43** (4), 743–749.
- AYLESWORTH, A. and CLEARY, R. (2020). Reawakening creativity for business leaders: removing obstacles. *Journal of Education for Business*, **95** (4), 248–254.
- BAER, J. (2010). Is creativity domain specific. *The Cambridge handbook of creativity*, **321**.
- BAER, M. (2012). Putting creativity to work: the implementation of creative ideas in organizations. *Academy of Management Journal*, **55** (5), 1102–1119.
- BARON, R. A. (2007). Entrepreneurship: A process perspective. In *The psychology of entrepreneurship*, Society for Industrial and Organizational Psychology, pp. 19–39.
- and ENSLEY, M. D. (2006). Opportunity recognition as the detection of meaningful patterns: Evidence from comparisons of novice and experienced entrepreneurs. *Management science*, **52** (9), 1331–1344.
- and TANG, J. (2011). The role of entrepreneurs in firm-level innovation: joint effects of positive affect, creativity, and environmental dynamism. *Journal of Business Venturing*, **26** (1), 49–60.
- BARTUNEK, J. M., GORDON, J. R. and WEATHERSBY, R. P. (1983). Developing “complicated” understanding in administrators. *Academy of management Review*, **8** (2), 273–284.
- BASADUR, M. and HAUSDORF, P. A. (1996). Measuring divergent thinking attitudes related to creative problem solving and innovation management. *Creativity Research Journal*, **9** (1), 21–32.
- BENNER, M. J. and TUSHMAN, M. L. (2003). Exploitation, exploration, and process management: the productivity dilemma revisited. *Academy of management review*, **28** (2), 238–256.
- BHIDE, A. (1994). How entrepreneurs craft strategies that work. *Harvard Business Review*, **72** (2), 150–161.
- BLANCHFLOWER, D. G. and OSWALD, A. J. (1998). What makes an entrepreneur? *Journal of Labor Economics*, **16**, 26–60.
- BLOCK, J. H., DE VRIES, G., SCHUMANN, J. and SANDNER, P. (2014). Trademarks and venture capital valuation. *Journal of Business Venturing*, **29** (4), 525–542.
- BOSMA, N. and VAN PRAAG, M. (2004). The value of human and social capital investments for the business performance of start-ups. *Small Business Economics*, **23** (3), 227–236.
- BROPHY, D. R. (2001). Comparing the attributes, activities, and performance of divergent, convergent, and combination thinkers. *Creativity Research Journal*, **13** (3-4), 439–455.
- CALIENDO, M., FOSSEN, F. and KRITIKOS, A. (2010). The impact of risk attitudes on entrepreneurial survival. *Journal of Economic Behavior and Organization*, **76** (1), 45–63.
- , — and — (2014). Personality characteristics and the decisions to become and stay self-employed. *Small Business Economics*, **42** (4), 787–814.
- , HOGENACKER, J., KÜNN, S. and WIESSNER, F. (2015). Subsidized start-ups out of unemployment: a comparison to regular business start-ups. *Small Business Economics*, **45** (1), 165–190.

- , KRITIKOS, A., RODRIGUEZ, D. and STIER, C. (2023a). Self-efficacy and entrepreneurial performance of start-ups. *IZA Discussion Paper No. 15848, forthcoming in: Small Business Economics*.
- , — and STIER, C. (2023b). The influence of start-up motivation on entrepreneurial performance. *IZA Discussion Paper No. 15793, forthcoming in: Small Business Economics*.
- , KÜNN, S. and WEISSENBERGER, M. (2020). Catching up or lagging behind? the long-term business and innovation potential of subsidized start-ups out of unemployment. *Research Policy*, **49** (10), 104053.
- CASSAR, G. (2014). Industry and startup experience on entrepreneur forecast performance in new firms. *Journal of Business Venturing*, **29** (1), 137–151.
- CASTILLO-VERGARA, M., ALVAREZ-MARIN, A. and PLACENCIO-HIDALGO, D. (2018). A bibliometric analysis of creativity in the field of business economics. *Journal of Business Research*, **85**, 1–9.
- CHAMORRO-PREMUZIC, T. and REICHENBACHER, L. (2008). Effects of personality and threat of evaluation on divergent and convergent thinking. *Journal of Research in Personality*, **42** (4), 1095–1101.
- CHEN, C., HIMSEL, A., KASOF, J., GREENBERGER, E. and DMITRIEVA, J. (2006). Boundless creativity: evidence for the domain generality of individual differences in creativity. *The Journal of Creative Behavior*, **40** (3), 179–199.
- CHEN, G. and TSURUMI, H. (2010). Probit and logit model selection. *Communications in Statistics–Theory and Methods*, **40** (1), 159–175.
- CHEN, M.-H., CHANG, Y.-Y. and LO, Y.-H. (2015). Creativity cognitive style, conflict, and career success for creative entrepreneurs. *Journal of Business Research*, **68** (4), 906–910.
- CHEN, X.-P., YAO, X. and KOTHA, S. (2009). Entrepreneur passion and preparedness in business plan presentations: a persuasion analysis of venture capitalists’ funding decisions. *Academy of Management journal*, **52** (1), 199–214.
- CLAPHAM, M. M., COWDERY, E. M., KING, K. E. and MONTANG, M. A. (2005). Predicting work activities with divergent thinking tests: a longitudinal study. *The Journal of Creative Behavior*, **39** (3), 149–166.
- COPE, J. (2011). Entrepreneurial learning from failure: an interpretative phenomenological analysis. *Journal of Business Venturing*, **26** (6), 604–623.
- CRIACO, G., VAN OOSTERHOUT, J. H. and NORDQVIST, M. (2021). Is blood always thicker than water? family firm parents, kinship ties, and the survival of spawns. *Journal of Business Venturing*, **36** (6), 106161.
- CROPLEY, A. (2006). In praise of convergent thinking. *Creativity research journal*, **18** (3), 391–404.
- DELMAR, F. and SHANE, S. (2003). Does business planning facilitate the development of new ventures? *Strategic management journal*, **24** (12), 1165–1185.
- and — (2004). Legitimizing first: organizing activities and the survival of new ventures. *Journal of business venturing*, **19** (3), 385–410.
- DEMARTINO, R. and BARBATO, R. (2003). Differences between women and men MBA entrepreneurs: exploring family flexibility and wealth creation as career motivators. *Journal of Business Venturing*, **18** (6), 815 – 832.
- DIMOV, D. (2007). Beyond the single-person, single-insight attribution in understanding entrepreneurial opportunities. *Entrepreneurship Theory and Practice*, **31** (5), 713–731.
- DUL, J., CEYLAN, C. and JASPERS, F. (2011). Knowledge workers’ creativity and the role of the physical work environment. *Human resource management*, **50** (6), 715–734.
- DUNCKER, K. and LEES, L. S. (1945). On problem-solving. *Psychological monographs*, **58** (5), i.
- DUNKELBERG, W. C., COOPER, A. C., WOO, C. and DENNIS, W. (1987). New firm growth and performance. *Frontiers of entrepreneurship research*, pp. 307–321.
- DUNN, T. and HOLTZ-EAKIN, D. (2000). Financial capital, human capital, and the transition to self-employment: evidence from intergenerational links. *Journal of Labor Economics*, **18**, 282–305.
- ECKHARDT, J. T. and SHANE, S. A. (2003). Opportunities and entrepreneurship. *Journal of management*, **29** (3), 333–349.
- ENGEL, D. and KEILBACH, M. (2007). Firm-level implications of early stage venture capital investment - an empirical investigation. *Journal of Empirical Finance*, **14** (2), 150–167.
- ENSOR, J., COTTAM, A. and BAND, C. (2001). Fostering knowledge management through the creative work environment: a portable model from the advertising industry. *Journal of Information Science*, **27** (3), 147–155.
- FAIRLIE, R. W. and ROBB, A. M. (2009). Gender differences in business performance: evidence from the Characteristics of Business Owners survey. *Small Business Economics*, **33** (4), 375–395.
- FEDERAL STATISTICAL OFFICE OF GERMANY (2018). *Statistisches Jahrbuch 2018, Kapitel 13: Arbeitsmarkt*. Tech. rep.
- FILLIS, I. and RENTSCHLER, R. (2010). The role of creativity in entrepreneurship. *Journal of Enterprising*

- Culture*, **18** (01), 49–81.
- FRITSCH, M. and KRITIKOS, A. S. (2016). Entrepreneurship and the business cycle. *CESifo DICE Report*, **14** (3), 24–28.
- GEMMELL, R. M., BOLAND, R. J. and KOLB, D. A. (2012). The socio-cognitive dynamics of entrepreneurial ideation. *Entrepreneurship Theory and Practice*, **36** (5), 1053–1073.
- GIELNIK, M. M., FRESE, M., GRAF, J. M. and KAMPSCHULTE, A. (2012). Creativity in the opportunity identification process and the moderating effect of diversity of information. *Journal of Business Venturing*, **27** (5), 559–576.
- , KRÄMER, A.-C., KAPPEL, B. and FRESE, M. (2014). Antecedents of business opportunity identification and innovation: investigating the interplay of information processing and information acquisition. *Applied Psychology*, **63** (2), 344–381.
- GUILFORD, J. P. (1967). Creativity: yesterday, today and tomorrow. *The Journal of Creative Behavior*, **1** (1), 3–14.
- HASS, R. W. (2015). Feasibility of online divergent thinking assessment. *Computers in Human Behavior*, **46**, 85–93.
- HEUNKS, F. J. (1998). Innovation, creativity and success. *Small Business Economics*, **10** (3), 263–272.
- HOLTZ-EAKIN, D., JOULFAIAN, D. and ROSEN, H. (1994). Sticking it out: entrepreneurial survival and liquidity constraints. *Journal of Political Economy*, **102** (1), 53–75.
- HONIG, B. and SAMUELSSON, M. (2014). Data replication and extension: a study of business planning and venture-level performance. *Journal of Business Venturing Insights*, **1-2**, 18–25.
- HYYTINEN, A., PAJARINEN, M. and ROUVINEN, P. (2015). Does innovativeness reduce startup survival rates? *Journal of Business Venturing*, **30** (4), 564–581.
- JANSEN, J. J., VAN DEN BOSCH, F. A. and VOLBERDA, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: effects of organizational antecedents and environmental moderators. *Management science*, **52** (11), 1661–1674.
- JOVANOVIĆ, B. (1982). Selection and the evolution of industry. *Econometrica*, **50** (3), 649–670.
- KAUTONEN, T., DOWN, S. and MINNITI, M. (2014). Ageing and entrepreneurial preferences. *Small Business Economics*, **42** (3), 579–594.
- KIM, K. H. (2008). Meta-analyses of the relationship of creative achievement to both IQ and divergent thinking test scores. *The Journal of Creative Behavior*, **42** (2), 106–130.
- KOELLINGER, P. and THURIK, A. (2012). Entrepreneurship and the business cycle. *The Review of Economics and Statistics*, **94** (4), 1143–1156.
- KREISER, P. M., MARINO, L. D., KURATKO, D. F. and WEAVER, K. M. (2013). Disaggregating entrepreneurial orientation: the non-linear impact of innovativeness, proactiveness and risk-taking on sme performance. *Small business economics*, **40** (2), 273–291.
- KROECK, K. G., BULLOUGH, A. M. and REYNOLDS, P. D. (2010). Entrepreneurship and differences in locus of control. *Journal of Applied Management and Entrepreneurship*, **15** (1), 21.
- KUHN, J.-T. and HOLLING, H. (2009a). Exploring the nature of divergent thinking: a multilevel analysis. *Thinking Skills and Creativity*, **4** (2), 116–123.
- and — (2009b). Measurement invariance of divergent thinking across gender, age, and school forms. *European Journal of Psychological Assessment*, **25** (1), 1.
- LANGE, J. E., MOLLOV, A., PEARLMUTTER, M., SINGH, S. and BYGRAVE, W. D. (2007). Pre-start-up formal business plans and post-start-up performance: a study of 116 new ventures. *Venture Capital*, **9** (4), 237–256.
- LEX, M. and GIELNIK, M. M. (2017). Creativity and entrepreneurship: a process perspective. *The Wiley Handbook of Entrepreneurship*, pp. 139–172.
- MADSEN, H., NEERGAARD, H. and ULHØI, J. P. (2003). Knowledge-intensive entrepreneurship and human capital. *Journal of Small Business and Enterprise Development*.
- MALHOTRA, S. and HARRISON, J. S. (2022). A blessing and a curse: How chief executive officer cognitive complexity influences firm performance under varying industry conditions. *Strategic Management Journal*, **43** (13), 2809–2828.
- MARVEL, M. R., DAVIS, J. L. and SPROUL, C. R. (2016). Human capital and entrepreneurship research: a critical review and future directions. *Entrepreneurship Theory and Practice*, **40** (3), 599–626.
- MATTHEW, C. T. (2009). Leader creativity as a predictor of leading change in organizations <sup>1</sup>. *Journal of Applied Social Psychology*, **39** (1), 1–41.
- MCCRAE, R. R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology*, **52** (6), 1258.

- , ARENBERG, D. and COSTA, P. T. (1987). Declines in divergent thinking with age: cross-sectional, longitudinal, and cross-sequential analyses. *Psychology and Aging*, **2** (2), 130.
- MILLÁN, J. M., CONGREGADO, E. and ROMÁN, C. (2012). Determinants of self-employment survival in Europe. *Small Business Economics*, **38** (2), 231–258.
- MORRIS, J. L. and FARGHER, K. (1974). Achievement drive and creativity as correlates of success in small business. *Australian Journal of Psychology*, **26** (3), 217–222.
- NIEFERT (2005). *Patenting Behaviour and Employment Growth in German Start-up Firms: A Panel Data Analysis*. Discussion Paper 05-03, Centre for European Economic Research (ZEW), Mannheim.
- PALMIERO, M., DI GIACOMO, D. and PASSAFIUME, D. (2014). Divergent thinking and age-related changes. *Creativity Research Journal*, **26** (4), 456–460.
- , NORI, R. and PICCARDI, L. (2017). Verbal and visual divergent thinking in aging. *Experimental Brain Research*, **235** (4), 1021–1029.
- PARKER, S. C. (2018). *The Economics of Entrepreneurship*. New York, Cambridge: Cambridge University Press, 2nd edn.
- PODSAKOFF, P. M., MACKENZIE, S. B., LEE, J.-Y. and PODSAKOFF, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, **88** (5), 879.
- RAE, D. and CARSWELL, M. (2000). Using a life-story approach in researching entrepreneurial learning: the development of a conceptual model and its implications in the design of learning experiences. *Education+ training*, **42** (4/5), 220–228.
- RAISCH, S. and BIRKINSHAW, J. (2008). Organizational ambidexterity: antecedents, outcomes, and moderators. *Journal of management*, **34** (3), 375–409.
- RAUCH, A. and FRESE, M. (2000). Psychological approaches to entrepreneurial success: a general model and an overview of findings. In C. Cooper and I. Robertson (eds.), *International Review of Industrial and Organizational Psychology*, vol. 15, Wiley, pp. 101–142.
- and — (2007). Let's put the person back into entrepreneurship research: a meta-analysis on the relationship between business owners' personality traits, business creation, and success. *European Journal of Work and Organizational Psychology*, **16** (4), 353–385.
- REID, S. E., DE BRENTANI, U. and KLEINSCHMIDT, E. J. (2014). Divergent thinking and market visioning competence: an early front-end radical innovation success typology. *Industrial Marketing Management*, **43** (8), 1351–1361.
- ROCHA, V., CARNEIRO, A. and AMORIM VARUM, C. (2015). Serial entrepreneurship, learning by doing and self-selection. *International Journal of Industrial Organization*, **40**, 91–106.
- ROPER, S. (1997). Product innovation and small business growth: a comparison of the strategies of german, uk and irish companies. *Small Business Economics*, **9** (6), 523–537.
- ROSENBUSCH, N., BRINCKMANN, J. and BAUSCH, A. (2011). Is innovation always beneficial? a meta-analysis of the relationship between innovation and performance in SMEs. *Journal of business Venturing*, **26** (4), 441–457.
- ROSKOS-EWOLDSSEN, B., BLACK, S. R. and MCCOWN, S. M. (2008). Age-related changes in creative thinking. *The Journal of Creative Behavior*, **42** (1), 33–59.
- RUNCO, M. A. (2008). Commentary: Divergent thinking is not synonymous with creativity. *Psychology of Aesthetics, Creativity, and the Arts*.
- (2010). Divergent thinking, creativity, and ideation. *The Cambridge Handbook of Creativity*, **413**, 446.
- and ACAR, S. (2012). Divergent thinking as an indicator of creative potential. *Creativity Research Journal*, **24** (1), 66–75.
- , PLUCKER, J. A. and LIM, W. (2001). Development and psychometric integrity of a measure of ideational behavior. *Creativity Research Journal*, **13** (3-4), 393–400.
- SAROOGHI, H., LIBAERS, D. and BURKEMPER, A. (2015). Examining the relationship between creativity and innovation: a meta-analysis of organizational, cultural, and environmental factors. *Journal of business venturing*, **30** (5), 714–731.
- SCHILLING, M. A. (2005). A “small-world” network model of cognitive insight. *Creativity Research Journal*, **17** (2-3), 131–154.
- SCOTT, S. G. and BRUCE, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, **37** (3), 580–607.
- SEDLÁČEK, P. and STERK, V. (2017). The growth potential of startups over the business cycle. *American Economic Review*, **107** (10), 3182–3210.
- SHAFI, K. (2021). Investors' evaluation criteria in equity crowdfunding. *Small Business Economics*, **56** (1),

- SHANE, S. (2003). *A General Theory of Entrepreneurship: The Individual-opportunity Nexus*. New horizons in entrepreneurship, Edward Elgar Publishing.
- and DELMAR, F. (2004). Planning for the market: business planning before marketing and the continuation of organizing efforts. *Journal of Business Venturing*, **19** (6), 767–785.
- , LOCKE, E. and COLLINS, C. (2003). Entrepreneurial motivation. *Human Resource Management Review*, **13**, 257–280.
- and NICOLAOU, N. (2015). Creative personality, opportunity recognition and the tendency to start businesses: a study of their genetic predispositions. *Journal of Business Venturing*, **30** (3), 407–419.
- STERNBERG, R. J. (2005). The domain generality versus specificity debate: how should it be posed? In *Creativity Across Domains*, Psychology Press, pp. 317–324.
- STUHLFAUT, M. W. and WINDELS, K. (2015). The creative code: a moderator of divergent thinking in the development of marketing communications. *Journal of Marketing Communications*, **21** (4), 241–259.
- TANG, J., KACMAR, K. M. M. and BUSENITZ, L. (2012). Entrepreneurial alertness in the pursuit of new opportunities. *Journal of Business Venturing*, **27** (1), 77–94.
- TAYLOR, A. and GREVE, H. R. (2006). Superman or the fantastic four? knowledge combination and experience in innovative teams. *Academy of management Journal*, **49** (4), 723–740.
- TAYLOR, C. L., KAUFMAN, J. C. and BARBOT, B. (2021). Measuring creative writing with the storyboard task: the role of effort and story length. *The Journal of Creative Behavior*, **55** (2), 476–488.
- THORNHILL, S. (2006). Knowledge, innovation and firm performance in high- and low-technology regimes. *Journal of Business Venturing*, **21** (5), 687–703.
- TIWANA, A. and MCLEAN, E. R. (2005). Expertise integration and creativity in information systems development. *Journal of management information systems*, **22** (1), 13–43.
- UCBASARAN, D., WRIGHT, M., WESTHEAD, P. and BUSENITZ, L. W. (2003). The impact of entrepreneurial experience on opportunity identification and exploitation: habitual and novice entrepreneurs. In *Cognitive approaches to entrepreneurship research*, vol. 6, Emerald Group Publishing Limited, pp. 231–263.
- UNGER, J. M., RAUCH, A., FRESE, M. and ROSENBUSCH, N. (2011a). Human capital and entrepreneurial success: a meta-analytical review. *Journal of Business Venturing*, **26** (3), 341–358.
- , —, — and — (2011b). Human capital and entrepreneurial success: A meta-analytical review. *Journal of Business Venturing*, **26** (3), 341–358.
- VINCENT, A. S., DECKER, B. P. and MUMFORD, M. D. (2002). Divergent thinking, intelligence, and expertise: a test of alternative models. *Creativity Research Journal*, **14** (2), 163–178.
- WARD, T. B. (2004). Cognition, creativity, and entrepreneurship. *Journal of business venturing*, **19** (2), 173–188.
- WARNICK, B. J., KIER, A. S., LAFRANCE, E. M. and CUTTLER, C. (2021). Head in the clouds? cannabis users' creativity in new venture ideation depends on their entrepreneurial passion and experience. *Journal of Business Venturing*, **36** (2), 106088.
- WESTHEAD, P., UCBASARAN, D. and WRIGHT, M. (2009). Information search and opportunity identification: the importance of prior business ownership experience. *International Small Business Journal*, **27** (6), 659–680.
- WILLIAMS, S. D. (2004). Personality, attitude, and leader influences on divergent thinking and creativity in organizations. *European Journal of Innovation Management*.
- WOODMAN, R. W., SAWYER, J. E. and GRIFFIN, R. W. (1993). Toward a theory of organizational creativity. *Academy of Management Review*, **18** (2), 293–321.
- WOOLDRIDGE, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press.
- XIAO, T., MAKHIJA, M. and KARIM, S. (2022). A knowledge recombination perspective of innovation: review and new research directions. *Journal of Management*, **48** (6), 1724–1777.
- ZHAO, H., SEIBERT, S. E. and LUMPKIN, G. (2010). The relationship of personality to entrepreneurial intentions and performance: a meta-analytic review. *Journal of Management*, **36** (2), 381–404.
- ZHOU, J. (2008). New look at creativity in the entrepreneurial process. *Strategic Entrepreneurship Journal*, **2** (1), 1–5.

## Tables and Figures

Table 1: Divergent thinking items in  $t_{19}$  and factor loadings

	Mean	SD	Factor Analysis		
			Factor 1	Factor 2	Uniqueness
	(1)	(2)	(3)	(4)	(5)
<i>Items</i>					
1. I have many unusual ideas	4.48	1.70	0.70	0.25	0.45
2. I think about ideas more often than most people	4.64	1.60	0.74	0.28	0.37
3. I often get excited about my own ideas	5.06	1.46	0.58	0.48	0.43
4. I often have suggestions or ideas for solving problems	5.50	1.09	0.38	0.48	0.62
5. I like to think about new ideas just for fun	4.97	1.70	0.59	0.39	0.50
6. Friends often ask me to help them find ideas or suggest solutions	4.69	1.60	0.42	0.37	0.68
Divergent Thinking (Mean Index)	4.89	1.15			
Number of observations	457				

*Notes:* The table shows mean and standard deviation of the divergent thinking items and the divergent thinking mean index, as well as the rotated results for exploratory principal factor analysis conducted on divergent thinking items. Divergent thinking values go from 1 (very low) to 7 (very high). Reports on items are the average values on a 7-point Likert-type scale from 1 "strongly disagree" to 7 "strongly agree".

Table 2: Divergent thinking in  $t_{19}$  and entrepreneurial outcomes in  $t_{40}$ 

	Survival (1)	Patents or TM (2)	Employees (yes/no) (3)	Field Expansion (4)	Regional Expansion (5)	Hired Employees (6)	Realized Field Expansion Plans (7)
<i>A. Continuous Divergent Thinking Factor Index in <math>t_{19}</math> - Linear Specification (Marginal Effects)</i>							
DT Factor Index in $t_{19}$	-0.005 (0.023)	0.041* (0.023)	0.095*** (0.025)	0.048* (0.026)	0.049** (0.023)	0.065** (0.027)	0.042* (0.024)
Pseudo $R^2$	0.328	0.477	0.398	0.275	0.450	0.278	0.345
Mean	0.65	0.11	0.45	0.27	0.13	0.39	0.22
Relative Effect	-0.79%	34.02%	20.78%	17.40%	38.00%	16.75%	19.43%
Classification Rate	78.77%	84.13%	81.94%	74.92%	81.90%	77.46%	76.45%
AIC	888.42	340.71	585.13	613.52	367.09	675.51	487.81
<i>B. Divergent Thinking Factor Index in <math>t_{19}</math> - Quadratic Specification (Coefficients)</i>							
DT Factor Index in $t_{19}$ linear	0.205 (0.189)	0.828* (0.475)	0.529** (0.216)	0.315 (0.198)	0.689* (0.385)	0.281 (0.189)	0.362 (0.240)
DT Factor Index in $t_{19}$ squared	0.405*** (0.119)	0.724* (0.372)	-0.354** (0.161)	-0.077 (0.191)	-0.407 (0.331)	-0.209 (0.128)	-0.091 (0.290)
Pseudo $R^2$	0.352	0.506	0.412	0.276	0.460	0.285	0.346
Joint significance							
Wald test $p$ -value	0.000	0.001	0.000	0.070	0.029	0.002	0.117
LR-Test $p$ -value	0.000	0.000	0.000	0.057	0.004	0.001	0.095
Classification Rate	80.09%	83.17%	81.29%	75.24%	83.17%	76.83%	76.45%
AIC	865.48	336.60	576.69	614.99	364.90	672.39	489.36
<i>C. Divergent Thinking Factor Index in <math>t_{19}</math> - Distribution in Quartiles</i>							
Quartile 2	-0.125** (0.059)	0.015 (0.057)	0.124* (0.071)	0.071 (0.070)	0.060 (0.055)	-0.012 (0.076)	0.063 (0.068)
Quartile 3	-0.185*** (0.058)	0.126** (0.053)	0.284*** (0.073)	0.101 (0.071)	0.080 (0.060)	0.227*** (0.079)	0.125* (0.064)
Quartile 4	0.025 (0.063)	0.151*** (0.058)	0.222*** (0.063)	0.092 (0.074)	0.078 (0.051)	0.154** (0.074)	0.062 (0.073)
Pseudo $R^2$	0.357	0.500	0.405	0.273	0.443	0.293	0.347
Observations	457	315	310	315	315	315	293
<i>Controls:</i>							
A. Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
B. Human Capital	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C. Intergenerational transmission	Yes	Yes	Yes	Yes	Yes	Yes	Yes
D. Labor market history	Yes	Yes	Yes	Yes	Yes	Yes	Yes
E. Local macroeconomic conditions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F. Business-related characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
G. Personality traits & cognition	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Panel A shows the marginal effects of the divergent thinking factor (19 months after business foundation) on post-launch outcomes (40 months after business foundation) based on a logit estimation. Panel B shows logit coefficients based on logit regressions of divergent thinking in linear and quadratic form on the outcomes interest. Panel C shows the marginal effects of binary indicators for the quartiles of the divergent thinking factor index using Quartile 1 as the baseline. Covariates include all control variables listed in Table A.1. Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Relative effects with respect to the mean are reported. Wald test applies  $\chi^2$  test of linear restrictions. LRT test statistic is  $LR = -2(L_1 - L_0)$ , where  $L_0$  and  $L_1$  are the log likelihood values associated with the full and constrained models, respectively. Classification rate: for each observation  $i$ , we compute the estimated response probability  $\hat{p}_i = \hat{P}(y_i = 1|\mathbf{x}) = G(\mathbf{x}'\hat{\beta})$ . If  $\hat{p}_i \geq \bar{y}$ , then we predict a success  $\hat{y}_i = 1$ , if  $\hat{p}_i < \bar{y}$  the prediction  $\hat{y}_i$  is 0. The fraction of observations where the prediction  $\hat{y}_i$  is identical to the actual value  $y_i$  is the correct prediction rate. Akaike Information Criterion (AIC) is given by  $-2LL + 2k$ , where  $LL$  is the maximized log likelihood and  $k$  is the number of parameters estimated. A definition of the outcome measures can be found in Section 3.3.2

Table 3: Divergent thinking and domain-specific experience

	Survival (1)	Patents or TM (2)	Employees (yes/no) (3)	Field Expansion (4)	Regional Expansion (5)	Hired Employees (6)	Realized plans Field Expansion (7)
<i>A. Experience from Regular and Self-Employment</i>							
DT Factor $\times$ Employment experience	0.037 (0.261)	2.195*** (0.809)	0.224 (0.423)	0.498 (0.329)	2.196*** (0.800)	0.504 (0.422)	0.861** (0.426)
DT Factor $\times$ Self-employment experience	-0.722** (0.338)	-1.768** (0.779)	-0.486 (0.379)	-0.001 (0.422)	0.714 (0.832)	-1.025** (0.423)	0.498 (0.475)
DT Factor	0.079 (0.252)	0.103 (0.650)	0.616 (0.463)	-0.071 (0.319)	-0.878* (0.501)	0.054 (0.393)	-0.259 (0.321)
Employment experience	1.165*** (0.311)	0.253 (0.739)	0.112 (0.423)	0.379 (0.447)	-0.454 (0.628)	0.002 (0.378)	0.437 (0.453)
Self-employment experience	0.766* (0.449)	-0.118 (0.909)	0.906** (0.458)	0.520 (0.445)	1.805** (0.856)	0.808* (0.425)	0.283 (0.542)
Pseudo $R^2$	0.334	0.503	0.387	0.277	0.485	0.276	0.351
Observations	457	315	310	315	315	315	293
Controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes

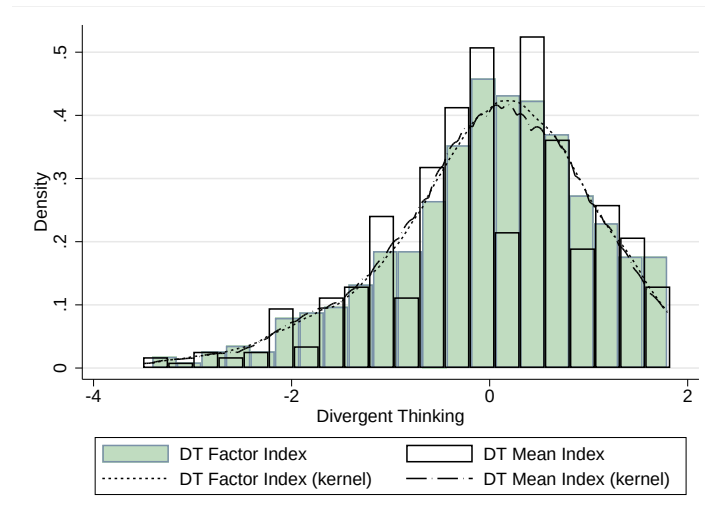
*Notes:* Table shows logit coefficients of logit estimations of the interactions of the divergent thinking factor (19 months after business foundation) with dummy variables for having had domain-specific experience from regular employment and self-employment, as well as for the divergent thinking factor, and the two types of experience individually. We control for the interaction of divergent thinking with other type of experience.

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

A definition of the outcome measures can be found in Section 3.3.2

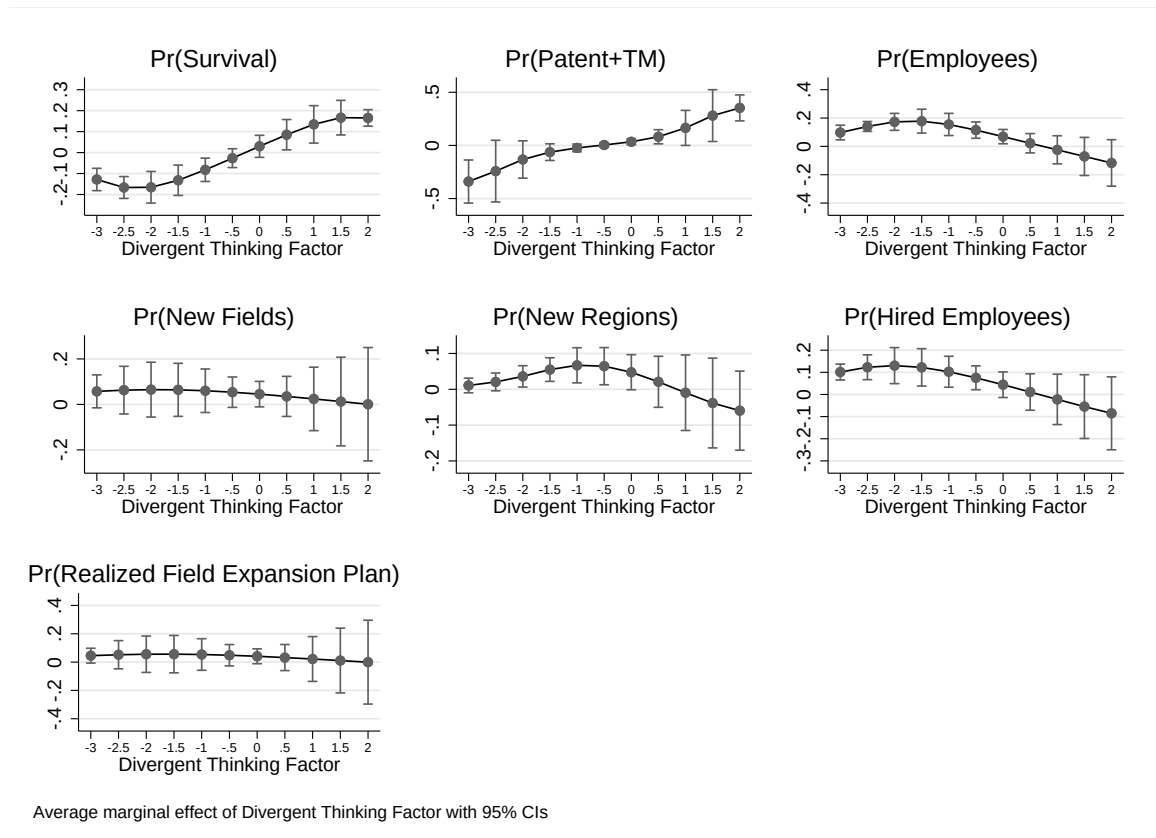


Figure 1: Histogram of divergent thinking factor and mean indices in  $t_{19}$



Note: The figure shows histograms and kernel distributions of the divergent thinking factor and mean indices 19 months after business foundation.

Figure 2: Estimated marginal effects effect of divergent thinking in  $t_{19}$  on post-launch entrepreneurial outcomes in  $t_{40}$



Note: The figure shows marginal effects of of the divergent thinking factor 19 months after business foundations on post-launch outcomes 40 months after business foundation at different values of the divergent thinking factor with 95% confidence intervals.

## A Supplementary Appendix

Table A.1: Descriptives for outcomes and control variables

	Mean (1)	SD (2)
<b>A. Postlaunch outcomes</b>		
Self-employed with same business (firm survival)	0.65	0.48
Patents or Trademark	0.12	0.32
At least one employee	0.47	0.50
Expansion to new fields of business	0.27	0.45
Expansion to new regions	0.13	0.33
Hired employees from $t_{19}$ to $t_{40}$	0.39	0.49
Realized field expansion plans from $t_{19}$ to $t_{40}$	0.21	0.41
<b>B. Controls</b>		
<i>A. Personal characteristics</i>		
Age at start-up (in years)	43.11	10.62
Male	0.64	0.48
Children in household		
No children	0.62	0.49
Children under six years	0.18	0.38
Children between six and 14 years	0.29	0.45
Married	0.58	0.49
<i>B. Human capital</i>		
School achievement		
None or lower secondary school	0.20	0.40
Middle secondary school	0.37	0.48
Upper secondary school	0.43	0.50
<i>C. Intergenerational transmission</i>		
Parents born abroad	0.18	0.38
Parents are/were self-employed	0.36	0.48
Business takeover from parents	0.09	0.28
Father of respondent employed at age 15	0.88	0.32
<i>D. Labor market history</i>		
Duration of dependent employment right before start-up		
<1 year	0.05	0.22
5 or more years	0.47	0.50
Monthly net income from last dep. employment right before start-up		
Non-employed	0.24	0.43
€0–€1,000	0.13	0.34
>€1,000–€1,500	0.18	0.39
>€1,500–€2,500	0.25	0.44
>€2,500	0.14	0.35
Dependently employed and income not specified	0.04	0.20
Unemployment experience before start-up <sup>a</sup>		
Not specified	0.01	0.12
0	0.23	0.42
>0–≤2	0.25	0.43
>2–≤5	0.24	0.43
>5	0.26	0.44

(Table A.1 continued on next page)

(Table A.1 continued)

	Mean (1)	SD (2)
Employment experience before start-up <sup>a</sup>		
≤50	0.20	0.40
>50–≤70	0.19	0.39
>70–≤90	0.33	0.47
>90–≤99	0.12	0.32
>99	0.15	0.36
E. Local macroeconomic conditions		
Vacancies related to stock of unemployed	15.12	6.68
Real GDP per capita in 2008 (in €1,000)	34.11	14.29
East Germany	0.20	0.40
F. Business-related characteristics		
Sectoral distribution of businesses		
Manufacturing, crafts	0.16	0.37
Construction	0.07	0.25
Retail	0.17	0.38
IT	0.05	0.22
Other Services	0.32	0.46
Other sectors	0.19	0.39
Subsidized	0.56	0.50
Preparations for business start		
Seek intensive advisory service	0.52	0.50
Self-judgement	0.22	0.41
Recover industry informations	0.47	0.50
Provide business plan	0.66	0.47
Dispose financing plan for start-up-phase	0.61	0.49
Other measures	0.35	0.48
Industry-specific experience before start-up		
Due to dependent employment	0.65	0.48
Due to former self-employment	0.22	0.42
Due to secondary employment	0.20	0.40
Due to hobby	0.29	0.46
Due to honorary office	0.08	0.26
None	0.14	0.35
Capital invested at start-up		
Not specified	0.03	0.17
<€5,000	0.52	0.50
€5,000–<€50,000	0.36	0.48
≥€50,000	0.09	0.29
Capital at start consisted entirely of own equity	0.51	0.50
G. Personality traits & Cognition		
Conscientiousness	6.10	0.82
Extraversion	5.71	1.10
Agreeableness	6.13	0.95
Neuroticism	3.99	1.42
Openness	4.95	1.41
Locus of control	5.46	0.80
Readiness to take risks	5.85	2.08
Numeracy test I	0.73	0.44
Numeracy test II	0.35	0.48
Memory test (hit rate from 0 to 10)	6.81	1.64
Number of obs.	457	

Notes: The table shows the means of postlaunch outcomes and all considered covariates for the whole sample. All reported numbers are shares (unless stated otherwise). All outcomes in Panel A except Self-employed with same business (N=457) are conditional on business survival and reported for those who are still in business only (n=315). Realized field expansion plans (n= 297) is based on a slightly lower number of observations due to non-responses.

<sup>a</sup>Reported as the share of working time, standardized by age 15.

Table A.2: Correlation matrix of divergent thinking and entrepreneurial outcomes

	1.	2.	3.	4.	5.	6.	7.
1. Divergent Thinking Factor	1.00						
2. Patents or Trademark	0.10*	1.00					
3. At least one employee	0.06	0.12**	1.00				
4. Expansion to new fields of business	0.20***	0.11*	0.07	1.00			
5. Expansion to new regions	0.14**	0.14**	0.20***	0.32***	1.00		
6. Hired employees from $t_{19}$ to $t_{40}$	0.02	0.13**	0.66***	0.07	0.18***	1.00	
7. Realized field expansion plans from $t_{19}$ to $t_{40}$	0.23***	0.13**	0.06	0.86***	0.32***	0.06	1.00

*Notes:* The table shows the correlation matrix of divergent thinking and outcomes conditional on business survival. All outcomes are conditional on business survival and reported for those who are still in business only (n=315). Realized field expansion plans (n= 297) is based on a slightly lower number of observations due to non-responses. \*\*\*/\*\*/\* indicates statistical significance at the 1/5/10% level.

Table A.3: Correlation matrix of divergent thinking and covariates

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. DT Factor	1.00																
2. Age	0.04	1.00															
3. Male	0.10**	0.01	1.00														
4. No children	0.16***	0.16***	0.12***	1.00													
5. Children under 6 y.	-0.12**	-0.05	-0.07	-0.80***	1.00												
6. Children b/w. 6 and 14	-0.10**	0.31***	-0.07	-0.38***	0.29***	1.00											
7. Married	0.02	0.18***	0.11**	0.10**	-0.08*	0.31***	1.00										
8. None or lower school	-0.02	-0.07	-0.15***	-0.06	-0.02	0.12**	0.02	1.00									
9. Middle school	0.00	-0.08*	0.06	-0.02	0.09*	-0.06	-0.05	-0.44***									
10. Upper school	-0.02	-0.06	0.06	-0.02	-0.03	0.01	0.04	0.02	-0.06	1.00							
11. Parents born abroad	-0.01	-0.12**	0.05	-0.10**	0.11**	0.11**	-0.08*	-0.08*	0.02	0.04	-0.03	1.00					
12. Parents are/were SE	-0.08*	-0.08*	0.16***	-0.08*	0.07	0.07	-0.06	0.02	0.02	-0.03	0.01	0.41***	1.00				
13. Biz. takeover from parents	-0.07	-0.05	0.02	-0.02	-0.00	0.00	-0.06	0.00	0.00	0.04	0.01	0.01	0.06	1.00			
14. Employed father at 15	0.07	-0.12***	-0.02	0.03	-0.03	-0.03	-0.09*	-0.06	0.04	0.01	-0.06	-0.01	-0.07	0.04	1.00		
15. Employment duration < 1y.	-0.02	0.27***	0.16***	-0.06	0.06	0.11**	0.23***	0.02	0.06	-0.07	-0.06	0.05	0.11**	0.02	-0.22***	1.00	
16. Employment duration ≥ 5	-0.03	-0.07	-0.20**	-0.03	-0.02	0.05	-0.01	-0.00	-0.05	0.05	0.01	-0.02	-0.02	-0.01	-0.13**	-0.53***	1.00
17. Income pre SE: None	-0.10**	-0.07	0.04	0.12***	-0.05	-0.13***	-0.15***	0.07	0.13***	-0.19***	0.04	0.03	0.05	-0.01	0.18***	0.02	-0.27***
18. Income pre SE: 1,000-1,500	-0.07	0.07	0.16***	-0.03	0.12**	0.02	0.06	0.09*	-0.08*	0.00	-0.01	0.03	0.03	0.05	0.00	0.27***	-0.33***
19. Income pre SE: 1,500-2,500	0.08*	0.16**	0.21***	-0.05	-0.01	0.05	0.12**	-0.14***	-0.13**	0.24**	0.04	-0.09*	-0.11**	-0.02	-0.07	0.25***	-0.23***
20. Income pre SE: ≥ 2,500	-0.10**	0.04	-0.12***	-0.06	-0.05	0.09**	0.00	-0.06	0.10**	-0.05	0.05	-0.09*	0.21***	-0.01	0.05	0.05	-0.12**
21. Income pre SE: No specified	0.04	-0.01	-0.12**	-0.06	-0.05	0.09**	0.00	-0.06	0.10**	-0.05	0.05	-0.09*	0.21***	-0.01	0.05	0.05	-0.12**
23. UE exp.: No specified	-0.09*	0.01	0.06	-0.02	-0.02	-0.03	0.06	0.02	-0.05	0.03	-0.03	0.03	0.08	0.09*	0.08*	-0.03	0.02
24. UE exp.: 0	0.04	0.02	0.07	-0.06	-0.02	0.06	0.04	-0.09*	-0.09**	0.16***	-0.10**	0.03	0.03	0.09*	-0.08*	-0.04	0.22***
25. UE exp.: 0-2	0.03	0.10**	-0.08*	-0.05	0.03	0.07	0.04	-0.02	-0.05	0.02	-0.03	-0.04	-0.06	-0.05	-0.01	0.05	-0.01
26. UE exp.: 2-5	-0.00	-0.13***	-0.02	0.15***	0.02	-0.12***	-0.14***	0.11**	0.11**	-0.20***	0.06	-0.04	-0.05	0.02	0.07	-0.16***	-0.13***
27. UE exp.: > 5	-0.06	-0.27***	-0.07	-0.01	0.05	-0.04	-0.16***	-0.18***	-0.21***	0.34***	0.04	0.03	-0.03	0.00	0.02	-0.32***	0.19***
28. EM exp.: ≤ 50	-0.08*	-0.07	-0.14***	-0.11**	0.07	0.06	0.01	-0.11**	-0.06	0.15***	0.06	-0.01	-0.09*	0.08*	0.03	0.04	-0.05
29. EM exp.: 50-70	0.08*	0.08*	0.00	0.03	0.03	-0.01	0.01	-0.07	0.12**	-0.06	-0.04	-0.04	-0.03	0.02	-0.03	0.12***	-0.10**
30. EM exp.: 70-90	0.03	0.12***	0.09*	0.07	-0.04	-0.08*	-0.01	0.09*	0.13***	-0.19***	-0.00	-0.01	0.08*	-0.10**	-0.06	0.12**	-0.03
31. EM exp.: 90-99	0.01	0.16**	0.16***	0.01	-0.14***	0.07	0.08*	0.34***	0.04	-0.31***	0.11**	0.04	0.09*	-0.02	0.03	0.06	-0.02
32. EM exp.: > 99	0.07	-0.03	-0.01	0.02	-0.04	0.00	-0.06	0.04	-0.14***	0.10**	0.22***	0.08*	0.02	-0.03	0.05	-0.02	0.06
33. Vacancies rel. to UE	0.07	0.04	0.02	-0.05	0.02	0.06	0.02	-0.07	-0.17***	0.22***	0.02	0.08*	-0.01	-0.08*	0.00	0.08*	-0.04
34. Real GDP pc (2008)	-0.04	-0.13***	0.01	0.04	-0.03	-0.07	-0.17***	-0.16***	0.19**	-0.05	-0.07	0.02	0.06	0.07	-0.08*	0.00	-0.04
35. East Germany	0.07	0.04	0.02	0.01	-0.06	0.01	0.06	0.19***	0.01	-0.16***	0.08*	0.06	0.18***	0.02	-0.06	0.11**	0.02
36. Sector: Manufacture	-0.06	0.05	0.17***	-0.00	0.09**	0.00	-0.00	0.09**	0.04	-0.11**	0.00	-0.04	-0.05	0.05	-0.03	0.00	-0.08*
37. Sector: Construction	-0.05	0.06	0.05	-0.03	-0.04	0.00	-0.05	0.07	0.06	-0.11**	0.02	0.02	0.01	0.02	0.02	0.02	-0.00
38. Sector: Retail	0.07	-0.08*	0.12**	0.12**	-0.07	-0.11**	-0.06	-0.06	-0.05	0.09**	0.04	-0.05	-0.07	-0.03	-0.02	-0.04	0.02
39. Sector: IT	-0.03	0.05	-0.13***	-0.06	0.15***	0.01	0.10**	-0.12**	-0.03	0.12***	-0.02	-0.07	-0.06	-0.04	-0.01	-0.05	0.03
40. Sector: Other services	0.05	-0.09*	-0.08*	0.02	-0.07	0.01	-0.07	-0.11**	-0.07	0.15***	-0.04	0.06	0.02	-0.03	0.05	-0.02	0.02
41. Sector: Other	0.01	-0.10**	0.03	0.02	0.03	0.01	-0.09*	-0.03	0.01	0.02	-0.09*	-0.09*	-0.21***	0.03	0.03	0.09*	-0.39***
42. Subsidized	0.08*	-0.10**	-0.02	-0.06	0.08*	0.09*	-0.01	0.01	0.11**	-0.12**	-0.11**	0.03	0.02	-0.07	-0.00	0.16***	-0.24***
43. Preparation: Seek advice	0.14***	-0.01	-0.01	0.08	-0.04	-0.04	-0.05	0.04	-0.01	-0.02	-0.04	0.06	-0.09*	-0.07	-0.05	0.04	-0.07
44. Preparation: Self-judgement	0.17***	-0.06	-0.02	0.02	0.01	-0.01	-0.07	-0.03	0.05	-0.02	0.00	0.01	-0.10**	-0.03	-0.07	0.07	-0.15***
45. Preparation: Industry info.																	

(Table A.3 continued on next page)

(Table A.3 continued)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
46. Preparation: Biz. plan	0.14***	-0.06	0.07	-0.02	0.01	0.03	-0.07	-0.04	0.00	0.04	-0.04	-0.06	-0.18***	-0.02	-0.01	0.11**	-0.33***
47. Preparation: Finance plan	0.15***	-0.10**	0.06	-0.04	0.00	0.03	-0.07	-0.04	-0.04	0.07	-0.03	-0.00	-0.12**	-0.03	-0.02	0.10**	-0.21***
48. Preparation: Other	-0.07	-0.01	-0.06	-0.07	0.07	0.10**	0.09**	-0.11**	-0.00	0.09*	-0.02	0.08*	0.03	-0.03	-0.05	-0.02	0.07
49. Experience: Dep. employment	-0.01	-0.04	0.19***	0.01	-0.04	0.01	-0.02	-0.05	-0.01	0.05	-0.05	0.06	0.11**	0.07	-0.08	0.10**	-0.19***
50. Experience: Self-employment	0.15***	0.15***	0.12***	0.10**	-0.13***	-0.05	-0.09*	0.11**	-0.12**	0.03	-0.01	-0.03	-0.03	-0.09*	-0.00	-0.17***	0.05
51. Experience: secondary EM	0.07	0.04	0.04	0.10**	-0.07	-0.06	-0.03	-0.02	-0.10**	0.11**	-0.06	-0.14***	-0.12**	-0.10**	-0.03	-0.05	-0.02
52. Experience: Hobby	0.13***	-0.15***	0.01	0.08	-0.11**	-0.08*	-0.15***	-0.02	0.04	-0.03	0.07	-0.04	-0.08*	0.03	0.03	-0.14***	0.04
53. Experience: Honorary office	0.03	0.04	0.00	-0.07	0.01	0.09**	0.08*	-0.09*	0.05	0.03	-0.08	0.08*	-0.06	0.01	0.00	0.07	-0.01
54. Experience: None	-0.05	0.06	-0.14***	-0.01	0.06	0.00	0.01	0.07	0.07	-0.13***	-0.06	-0.05	-0.06	-0.08	0.14***	-0.01	-0.01
55. Capital: No specified	-0.01	-0.09*	-0.02	-0.05	0.06	-0.03	-0.08*	-0.05	-0.05	0.09**	0.01	0.18***	0.24***	-0.05	-0.04	0.03	-0.10**
56. Capital: <5,000	-0.07	-0.02	-0.20***	0.03	-0.07	-0.01	0.02	-0.02	0.07	-0.05	0.03	-0.12**	-0.19***	0.06	0.06	-0.20***	0.14***
57. Capital: 5,000-50,000	0.08*	0.06	0.14***	0.03	0.02	-0.04	0.03	0.10**	-0.04	-0.04	-0.03	0.05	0.03	-0.07	-0.04	0.12**	-0.09*
58. Capital: ≥ 50,000	-0.01	-0.01	0.12**	-0.09*	0.07	0.09**	0.04	-0.09**	-0.02	0.10**	-0.02	0.02	0.13***	0.05	-0.02	0.12**	-0.04
59. Capital is own equity	0.05	0.11**	0.01	0.05	-0.08*	0.02	-0.01	0.05	-0.00	-0.04	-0.04	-0.03	-0.10**	-0.06	-0.02	0.03	-0.01
60. B5: Conscientiousness	0.13***	0.03	-0.20***	0.02	-0.03	-0.02	-0.05	0.03	0.15***	-0.17***	-0.10**	0.07	-0.00	-0.01	0.02	0.05	-0.05
61. B5: Extraversion	0.24***	-0.09**	-0.16***	0.02	0.02	-0.04	-0.03	0.05	-0.01	-0.04	-0.09*	-0.01	-0.15***	-0.01	0.02	-0.20***	0.09*
62. B5: Agreeableness	0.17***	-0.04	-0.16***	0.07	0.01	-0.09*	-0.13***	0.08	0.09**	-0.15***	-0.07	0.00	-0.06	0.01	-0.01	-0.12***	0.10**
63. B5: Neuroticism	-0.04	-0.03	-0.11**	0.05	-0.10**	-0.02	-0.01	0.09*	0.11**	-0.18***	0.07	0.00	0.02	0.00	0.01	-0.02	0.02
64. B5: Openness	0.47***	0.03	-0.10**	0.12***	-0.08*	-0.14***	-0.03	-0.00	-0.01	0.02	0.09*	-0.07	-0.11**	0.07	-0.01	-0.07	0.10**
65. Locus of control	0.14***	-0.16***	0.12**	-0.02	0.05	0.03	-0.05	-0.18***	0.06	0.09**	-0.09*	0.05	-0.03	0.07	-0.01	0.05	-0.02
66. Risk willingness	0.27***	-0.02	0.12**	-0.00	0.05	-0.01	-0.09**	0.02	-0.07	0.06	0.12**	0.03	-0.13***	0.00	0.08*	-0.08	-0.05
67. Numeracy I	0.02	0.09**	0.21***	0.05	0.01	-0.02	-0.04	-0.14***	-0.12***	0.23***	-0.08	0.05	0.04	0.01	-0.04	0.07	-0.07
68. Numeracy II	-0.00	-0.03	0.19***	-0.04	0.01	0.06	0.00	-0.18***	-0.08	0.22***	-0.11**	0.09*	0.05	0.06	-0.04	0.09*	-0.09*
69. Memory	-0.01	-0.24***	-0.15***	-0.11**	0.04	0.07	-0.08*	-0.18***	0.05	0.09**	-0.07	0.11**	0.02	0.03	0.10**	-0.10**	0.11**

(Table A.3 continued on next page)

(Table A.3 continued)

	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.
18. Income pre SE: 0-1,000	1.00																
19. Income pre SE: 1,000-1,500	-0.19***	1.00															
20. Income pre SE: 1,500-2,500	-0.23***	-0.28***	1.00														
21. Income pre SE: 2,500	-0.16***	-0.10***	-0.12***	1.00													
22. Income pre SE: No specified	-0.08*	-0.10**	-0.24***	-0.09*	1.00												
23. UE exp.: No specified	0.03	0.05	-0.07	0.03	0.16***	1.00											
24. UE exp.: 0	-0.14***	-0.08*	-0.13***	0.18***	0.08*	-0.06	1.00										
25. UE exp.: 0-2	-0.06	-0.08*	0.02	0.18***	-0.08*	-0.07	-0.32***	1.00									
26. UE exp.: 2-5	0.04	-0.00	0.14***	-0.04	-0.01	-0.07	-0.33***	-0.34***	1.00								
27. UE exp.: >5	0.15***	0.14***	-0.01	-0.16***	-0.06	-0.07	-0.33***	-0.34***	-0.34***	1.00							
28. EM exp.: ≤50	0.00	-0.08*	-0.03	-0.11**	0.00	0.01	0.04	0.01	0.03	-0.04	1.00						
29. EM exp.: 50-70	0.01	-0.01	-0.05	0.14***	-0.02	-0.03	-0.08*	0.00	0.03	0.03	-0.25***	1.00					
30. EM exp.: 70-90	-0.01	0.02	0.09**	0.00	-0.01	0.01	-0.09*	-0.02	0.00	0.10**	-0.36***	-0.34***	1.00				
31. EM exp.: 90-99	0.08	0.02	-0.02	-0.02	-0.04	-0.04	0.06	-0.03	0.08*	-0.10**	-0.18***	-0.18***	-0.18***	1.00			
32. EM exp.: >99	-0.06	0.07	-0.01	-0.01	0.06	0.05	0.12**	0.05	-0.06	-0.12**	-0.21***	-0.20***	-0.30***	-0.15***	1.00		
33. Vacancies rel. to UE	-0.10**	0.04	0.04	0.02	-0.15***	-0.04	0.07	0.04	0.04	-0.13***	0.00	0.10**	-0.10**	-0.00	0.02	1.00	
34. Real GDP pc (2008)	-0.14***	0.00	0.02	0.16***	0.00	-0.02	-0.01	0.06	0.08*	-0.12**	0.09*	0.00	-0.01	-0.00	-0.09*	-0.13***	1.00
35. East Germany	0.07	0.10**	-0.10**	-0.08*	0.13***	-0.02	-0.10**	0.07	-0.04	0.06	0.02	0.03	0.05	0.09*	0.08*	0.04	0.01
36. Sector: Manufacture	0.04	-0.02	0.02	-0.09*	0.06	0.02	0.13***	-0.09**	0.00	-0.04	-0.08*	-0.15***	-0.15***	0.13***	0.04	-0.08*	-0.08*
37. Sector: Construction	-0.06	0.11**	0.12**	-0.09*	-0.06	0.03	-0.13***	-0.05	-0.04	0.20***	-0.03	-0.01	0.04	-0.05	0.07	-0.02	0.05
38. Sector: Retail	0.01	0.03	-0.10**	-0.02	0.17***	0.01	0.05	-0.07	0.04	-0.02	0.06	-0.02	-0.06	0.05	-0.00	0.03	0.10**
39. Sector: IT	-0.05	-0.03	0.01	0.09*	-0.05	-0.03	0.08*	0.05	-0.04	-0.08*	0.03	0.09**	0.01	-0.06	-0.09*	-0.01	0.02
40. Sector: Other services	0.01	-0.02	-0.03	0.04	-0.05	0.00	0.08*	0.02	0.05	-0.03	0.03	0.09*	0.01	-0.04	-0.04	0.05	0.02
41. Sector: Other	-0.00	-0.07	0.03	0.06	-0.07	-0.02	-0.05	0.11**	-0.05	-0.00	0.09*	0.01	-0.06	-0.01	-0.07	0.02	0.08*
42. Subsidized	0.21***	0.12**	0.12**	0.07	-0.13***	0.02	-0.52***	0.10**	0.21***	0.18***	-0.02	0.03	0.08*	-0.05	-0.07	-0.02	0.08*
43. Preparations: Seek advice	0.09*	0.06	0.14***	-0.01	-0.06	-0.06	-0.19***	0.01	0.11**	0.08*	-0.05	-0.02	0.05	0.02	0.00	-0.03	-0.02
44. Preparations: Self-judgement	0.03	-0.01	0.05	0.00	-0.02	-0.03	-0.04	-0.05	0.01	0.08*	0.02	0.01	-0.03	0.06	-0.04	0.01	0.04
45. Preparation: Industry info.	0.06	0.06	0.06	0.03	-0.08*	-0.06	-0.14***	-0.03	0.10**	0.08*	-0.00	-0.04	0.08*	0.04	-0.10**	-0.03	0.06
46. Preparation: Biz. plan	0.05	0.09*	0.15***	0.11**	-0.06	-0.00	-0.40***	0.10**	0.15***	0.14***	-0.03	-0.05	0.12***	-0.00	-0.07	-0.05	0.08*
47. Preparation: Finance plan	0.07	0.01	0.08*	0.09**	-0.03	0.01	-0.32***	0.11**	0.12**	0.08*	-0.05	0.08*	0.07	-0.02	-0.02	-0.03	0.13***
48. Preparation: Other	0.01	-0.08*	-0.00	0.02	-0.05	0.00	-0.02	0.05	0.05	-0.03	-0.04	0.08*	-0.02	-0.05	0.01	0.01	0.05
49. Experience: Dep. employment	0.06	-0.03	0.08*	0.05	0.10**	0.06	0.01	0.10**	0.03	-0.12***	0.03	-0.11**	0.01	0.07	0.03	-0.02	0.05
50. Experience: Self-employment	0.01	-0.08*	0.01	-0.00	0.02	-0.01	-0.03	0.03	-0.00	0.01	-0.04	-0.12***	0.00	-0.02	0.19***	-0.03	-0.02
51. Experience: secondary EM	0.10**	-0.07	0.05	-0.00	-0.11**	-0.03	-0.07	-0.05	0.12**	0.00	0.03	-0.01	-0.00	0.05	-0.06	-0.01	0.07
52. Experience: Hobby	0.07	0.09**	-0.04	-0.12***	-0.07	0.03	0.05	-0.12**	0.04	0.02	0.08*	-0.11**	0.05	0.05	-0.12**	-0.02	-0.03
53. Experience: Honorary office	0.04	-0.04	-0.02	0.03	0.03	-0.03	0.02	0.01	0.00	-0.02	0.05	0.00	-0.00	-0.03	-0.03	-0.03	0.09*
54. Experience: None	-0.04	0.07	0.02	-0.06	-0.01	-0.05	-0.05	-0.03	-0.01	0.09**	-0.03	0.12***	-0.07	-0.02	0.01	0.02	-0.07
55. Capital: No specified	-0.03	-0.02	-0.08	-0.07	0.59***	-0.02	0.04	-0.10**	0.09*	-0.02	0.10**	-0.08*	0.08*	-0.06	-0.07	-0.13***	0.06
56. Capital: <5,000	0.07	0.05	-0.13***	-0.13***	-0.02	0.03	-0.00	-0.03	0.05	-0.02	0.12**	0.08*	-0.15***	-0.05	0.00	0.04	-0.02
57. Capital: 5,000-50,000	-0.06	-0.00	0.18***	0.04	-0.16***	-0.00	-0.06	0.08	-0.04	0.02	-0.15***	-0.07	0.13***	0.07	0.03	0.03	0.00
58. Capital: ≤ 50,000	-0.01	-0.07	-0.04	0.20***	-0.03	-0.04	0.08*	-0.03	-0.06	0.01	-0.02	0.02	-0.01	0.02	-0.01	-0.04	-0.01
59. Capital is own equity	-0.05	-0.01	0.06	0.07	-0.13***	0.07	-0.11**	0.06	0.05	-0.03	-0.09**	-0.00	0.03	-0.02	0.10**	0.03	-0.00
60. B5: Conscientiousness	0.02	0.19***	0.02	-0.14***	-0.06	0.03	-0.09**	-0.00	0.09*	0.03	-0.14***	-0.04	0.09**	0.02	0.05	-0.05	-0.03
61. B5: Extraversion	0.00	-0.01	-0.02	-0.07	-0.02	0.06	-0.09**	-0.03	0.10**	0.00	-0.04	0.04	0.02	-0.04	-0.01	-0.03	0.02
62. B5: Agreeableness	0.07	0.12***	-0.08*	-0.22***	-0.00	0.03	-0.11**	-0.05	0.00	0.14***	-0.03	-0.00	0.06	-0.01	-0.05	-0.07	-0.04
63. B5: Neuroticism	0.08*	0.08*	-0.01	-0.10***	-0.13***	0.03	-0.11**	-0.06	-0.10**	0.16***	-0.00	-0.04	0.01	0.07	-0.02	-0.07	-0.12**
64. B5: Openness	0.10**	0.10**	0.05	-0.14***	-0.01	-0.16***	0.10**	-0.07	-0.10**	0.03	0.02	0.02	0.01	-0.02	0.01	-0.04	-0.05
65. Locus of control	-0.06	-0.02	0.02	0.09*	-0.03	-0.05	-0.03	0.12**	-0.01	-0.07	-0.10**	-0.03	0.10**	0.02	-0.03	-0.03	0.04
66. Risk willingness	-0.09*	0.01	0.02	0.11**	-0.01	0.02	-0.13***	0.03	0.09**	0.00	-0.05	0.01	0.05	0.00	-0.04	-0.01	0.10**
67. Numeracy I	-0.07	-0.03	0.04	0.16***	-0.04	-0.07	-0.06	0.14***	0.05	-0.11**	0.04	-0.00	0.02	-0.04	-0.03	0.06	0.11**
68. Numeracy II	0.02	-0.11**	-0.01	0.26***	-0.06	-0.09*	-0.03	0.14***	-0.01	-0.07	-0.04	0.05	0.03	-0.04	0.00	0.00	-0.00
69. Memory	0.08*	-0.04	-0.07	0.00	-0.15***	-0.01	-0.03	0.04	0.02	-0.03	0.03	0.19***	-0.05	-0.10**	-0.10**	0.05	-0.04

(Table A.3 continued on next page)

(Table A.3 continued)

	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.
35. East Germany	1.00																
36. Sector: Manufacture	0.01	1.00															
37. Sector: Construction	0.10**	-0.12**															
38. Sector: Retail	0.03	-0.20***	1.00														
39. Sector: IT	-0.01	-0.10**	-0.06	-0.11**	1.00												
40. Sector: Other services	-0.10**	-0.30***	-0.18***	-0.31***	-0.16***	1.00											
41. Sector: Other	-0.01	-0.21***	-0.13***	-0.22***	-0.11**	-0.33***	1.00										
42. Subsidized	0.11**	-0.17***	0.13***	-0.10***	0.01	0.04	1.00										
43. Preparations: Seek advice	0.12**	0.04	0.13***	-0.10**	0.00	0.02	0.00	1.00									
44. Preparations: Self-judgement	-0.03	0.03	-0.02	0.02	0.00	-0.01	-0.05	0.05	0.00	1.00							
45. Preparation: Industry info.	0.08*	-0.04	0.06	0.00	-0.01	-0.02	0.02	0.19***	0.18***	0.28***	1.00						
46. Preparation: Biz. plan	0.08*	-0.07	0.15***	-0.12**	-0.02	-0.03	0.09**	0.62**	0.31***	0.13***	0.29***	1.00					
47. Preparation: Finance plan	0.12***	-0.02	0.07	-0.04	-0.03	-0.04	0.06	0.52***	0.25***	0.12***	0.29***	0.72***	1.00				
48. Preparation: Other	-0.09*	-0.13***	-0.11**	-0.08*	-0.05	0.18***	0.09*	0.03	-0.10**	-0.08*	-0.06	-0.11**	-0.03	1.00			
49. Experience: Dep. employment	0.04	0.10**	0.08*	-0.11**	0.13***	-0.08*	-0.02	0.07	0.18***	0.01	0.02	0.12***	0.05	-0.01	1.00		
50. Experience: Self-employment	-0.06	0.01	0.00	0.09**	0.05	-0.05	-0.03	-0.00	0.02	0.01	-0.01	0.03	0.03	0.06	0.06	1.00	
51. Experience: secondary EM	-0.04	-0.03	-0.08*	-0.02	0.05	0.05	-0.01	0.09**	0.02	-0.04	0.07	0.11**	0.06	0.08*	-0.03	0.20***	1.00
52. Experience: Hobby	0.11**	0.14**	0.07	0.03	0.04	-0.08	-0.09*	-0.04	-0.01	0.08*	0.14**	0.03	0.05	-0.08*	-0.04	0.07	0.21***
53. Experience: Honorary office	0.03	0.03	-0.05	0.02	-0.03	0.03	0.01	-0.02	-0.07	-0.04	-0.01	-0.04	-0.04	0.04	-0.02	-0.00	0.10**
54. Experience: None	0.00	-0.07	-0.08	0.01	-0.10*	0.06	-0.06	-0.04	-0.01	0.02	0.07	0.10**	0.07	0.03	0.06	-0.09*	-0.06
55. Capital: No specified	0.14***	0.06	-0.05	0.05	-0.04	0.00	-0.06	-0.04	-0.12***	-0.06	-0.13***	-0.21***	-0.22***	-0.01	-0.13***	-0.02	0.05
56. Capital: <5,000	-0.04	-0.09*	-0.13***	0.03	0.01	0.06	0.02	-0.01	0.11**	0.08	0.12**	0.18***	0.15***	0.07	0.12**	0.09*	-0.06
57. Capital: 5,000-50,000	-0.02	0.05	0.16***	-0.07	0.05	-0.02	-0.06	0.07	0.03	-0.04	-0.01	0.01	0.10**	-0.08*	0.00	-0.05	-0.13***
58. Capital: ≤ 50,000	0.02	0.04	-0.02	0.03	-0.07	-0.06	0.09**	-0.08*	0.03	-0.04	0.05	0.10**	0.06	0.05	0.01	0.08*	0.07
59. Capital is own equity	0.04	-0.00	0.04	0.06	-0.05	-0.03	-0.03	0.06	0.05	0.05	0.10**	0.11**	0.02	-0.03	0.06	-0.14***	-0.09*
60. B5: Conscientiousness	0.07	0.05	0.03	-0.03	-0.07	0.05	-0.06	0.04	0.08	0.08	0.13***	0.07	0.02	-0.03	0.02	-0.02	0.04
61. B5: Extraversion	0.03	-0.13***	-0.05	-0.01	-0.02	0.08*	0.05	0.09**	0.04	0.13***	0.10**	0.09*	0.06	0.05	0.02	-0.08*	-0.10**
62. B5: Agreeableness	0.12**	-0.11**	-0.03	-0.03	-0.04	0.09**	0.06	0.09*	0.06	0.08*	0.11**	0.05	0.01	-0.03	-0.05	-0.08*	-0.10**
63. B5: Neuroticism	0.06	0.04	0.17***	-0.01	-0.07	-0.07	0.04	-0.06	0.00	0.01	0.04	-0.00	-0.03	-0.10**	0.00	-0.01	0.07
64. B5: Openness	0.05	0.10**	0.00	-0.04	-0.01	-0.01	0.03	-0.03	0.01	0.10**	0.05	0.01	0.03	-0.11**	-0.03	0.07	0.04
65. Locus of control	0.06	-0.10**	-0.02	-0.00	0.04	0.04	-0.01	0.09*	0.06	0.09*	0.07	0.16***	0.16***	0.06	0.02	-0.03	0.07
66. Risk willingness	0.02	-0.08	-0.00	0.04	0.03	0.00	0.02	0.08*	0.06	0.04	0.10**	0.13***	0.15***	-0.04	-0.07	0.09*	-0.04
67. Numeracy I	-0.11**	-0.05	0.03	-0.05	0.05	0.03	0.00	0.09*	0.01	0.01	0.00	0.07	0.06	0.10**	0.03	0.02	0.04
68. Numeracy II	-0.05	-0.11**	-0.03	-0.01	0.21***	-0.01	-0.03	0.10**	-0.01	0.02	-0.01	0.03	0.09*	0.08	0.06	0.09*	0.04
69. Memory	0.00	-0.06	-0.06	0.06	0.05	-0.04	0.02	0.01	0.00	-0.04	0.09*	-0.04	0.01	0.05	-0.12**	-0.04	0.04

(Table A.3 continued on next page)



(Table A.3 continued)

	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.
52. Experience: Hobby	1.00																	
53. Experience: Honorary office	0.13***	1.00																
54. Experience: None	-0.27***	-0.12**	1.00															
55. Capital: No specified	0.05	0.05	0.06	1.00														
56. Capital: <5,000	-0.03	-0.03	-0.09*	-0.18***	1.00													
57. Capital: 5,000-50,000	-0.04	-0.01	0.03	-0.13***	-0.78***	1.00												
58. Capital: ≤ 50,000	0.02	-0.00	-0.01	-0.17***	-0.33***	-0.24***	1.00											
59. Capital is own equity	-0.01	-0.02	0.00	0.03	-0.15***	0.31***	-0.16***	1.00										
60. B5: Conscientiousness	-0.01	-0.03	-0.02	0.00	0.01	0.00	-0.06	0.05	1.00									
61. B5: Extraversion	0.02	0.01	0.07	0.10***	0.12**	-0.10**	-0.01	-0.03	0.21***	1.00								
62. B5: Agreeableness	0.08*	-0.04	0.00	-0.14***	-0.01	0.06	0.04	-0.01	0.32***	0.25***	1.00							
63. B5: Neuroticism	0.10**	0.00	-0.09*	-0.09**	0.09*	-0.09*	0.04	-0.08	0.11**	-0.11**	0.21***	1.00						
64. B5: Openness	0.01	0.03	-0.08	0.08	-0.10**	0.05	0.05	0.01	0.23***	0.21***	0.05	0.09**	1.00					
65. Locus of control	-0.03	-0.01	0.02	0.06	-0.04	0.00	0.03	0.01	0.01	0.28***	0.02	-0.29***	-0.06	1.00				
66. Risk willingness	0.01	0.11**	-0.03	-0.01	-0.04	0.04	-0.00	0.01	-0.09**	-0.11**	-0.11**	-0.18***	0.24***	0.13***	1.00			
67. Numeracy I	0.00	0.02	-0.08*	-0.01	-0.07	0.02	0.09*	0.07	-0.16***	-0.10**	-0.15***	-0.07	-0.13***	0.14***	-0.02	1.00		
68. Numeracy II	0.04	-0.05	0.01	-0.08*	-0.00	0.02	0.01	-0.02	0.06	0.10**	0.05	-0.05	0.08	0.14***	-0.03	0.28***	1.00	
69. Memory																		1.00

Notes: The table shows the correlation matrix of divergent thinking and all considered control variables. \*\*\*/\*\*/\* indicates statistical significance at the 1/5/10% level.

Table A.4: Interactions' marginal effects as predicted probabilities of entrepreneurial outcomes

	Emp. Exp. = 0 Self-emp. Exp. = 0 (1)	Emp. Exp. = 0 Self-emp. Exp. = 1 (2)	Emp. Exp. = 1 Self-emp. Exp. = 0 (3)	Emp. Exp. = 1 Self-emp. Exp. = 1 (4)
Survival	0.524 [0.467,0.581]	0.644 [0.527,0.760]	0.699 [0.660,0.738]	0.796 [0.713,0.879]
Patents or TM	0.102 [0.056,0.148]	0.112 [0.031,0.194]	0.147 [0.102,0.192]	0.111 [0.042,0.181]
Employees (yes/no)	0.418 [0.319,0.517]	0.538 [0.418,0.658]	0.437 [0.379,0.495]	0.556 [0.451,0.660]
Field Expansion	0.217 [0.120,0.313]	0.289 [0.149,0.429]	0.274 [0.212,0.336]	0.350 [0.237,0.462]
Regional Expansion	0.114 [0.055,0.174]	0.239 [0.126,0.351]	0.104 [0.072,0.137]	0.246 [0.141,0.350]
Hired Employees	0.360 [0.260,0.459]	0.485 [0.352,0.618]	0.367 [0.307,0.428]	0.489 [0.374,0.603]
Realized Field Exp. Plans	0.159 [0.082,0.236]	0.194 [0.075,0.314]	0.221 [0.163,0.279]	0.272 [0.179,0.364]

*Notes:* Table shows the predicted probabilities of entrepreneurial outcomes based on logit estimation of divergent thinking factor (19 months after business foundations) interacted with indicators of domain specific experience (from employment and self-employment) reported in Table 3.  
95% confidence intervals in brackets.

Table A.5: Robustness checks

	Survival (1)	Patents or TM (2)	Employees (yes/no) (3)	Field Expansion (4)	Regional Expansion (5)	Hired Employees (6)	Realized plans Field Expansion (7)
<i>A. Continuous Divergent Thinking Factor Index in <math>t_{19}</math>- Probit Estimation</i>							
DT Factor Index in $t_{19}$	-0.002 (0.023)	0.034* (0.018)	0.089*** (0.025)	0.047* (0.024)	0.051*** (0.017)	0.066** (0.026)	0.041** (0.021)
Pseudo $R^2$	0.326	0.464	0.390	0.276	0.444	0.278	0.345
Classification Rate	77.68%	83.17%	80.32%	73.33%	81.27%	75.56%	75.77%
AIC	892.65	352.09	591.78	612.70	369.85	675.73	487.54
<i>B. Continuous Divergent Thinking Mean Index in <math>t_{19}</math></i>							
DT Mean Index in $t_{19}$	-0.012 (0.023)	0.042* (0.023)	0.091*** (0.024)	0.051** (0.025)	0.042** (0.021)	0.059** (0.027)	0.043* (0.024)
Pseudo $R^2$	0.328	0.499	0.397	0.270	0.439	0.291	0.341
<i>C. Continuous Divergent Thinking Factor Index in <math>t_{19}</math>- Without Attrition Weights</i>							
DT Factor Index in $t_{19}$	-0.005 (0.022)	0.028 (0.037)	0.096*** (0.025)	0.043* (0.026)	0.048** (0.021)	0.073*** (0.027)	0.043* (0.025)
Pseudo $R^2$	0.317	0.449	0.380	0.268	0.384	0.255	0.309
Observations	457	315	310	315	315	315	293
Controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Panel A shows marginal effects based on a probit estimation of divergent thinking factor (19 months after business foundations) on the outcomes of interest (40 months after business foundation). Panel B shows marginal effects based on a logit estimation of the mean index divergent thinking 19 months after business foundations on the outcomes of interest 40 months after business foundation. Panel C shows the marginal effects of the divergent thinking factor 19 months after business foundations on post-launch outcomes 40 months after business foundation based on a logit estimation without panel attrition weights. Covariates include all control variables listed in Table A.1.

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

A definition of the outcome measures can be found in Section 3.3.2

Table A.6: Non-linearities for continuous divergent thinking mean index

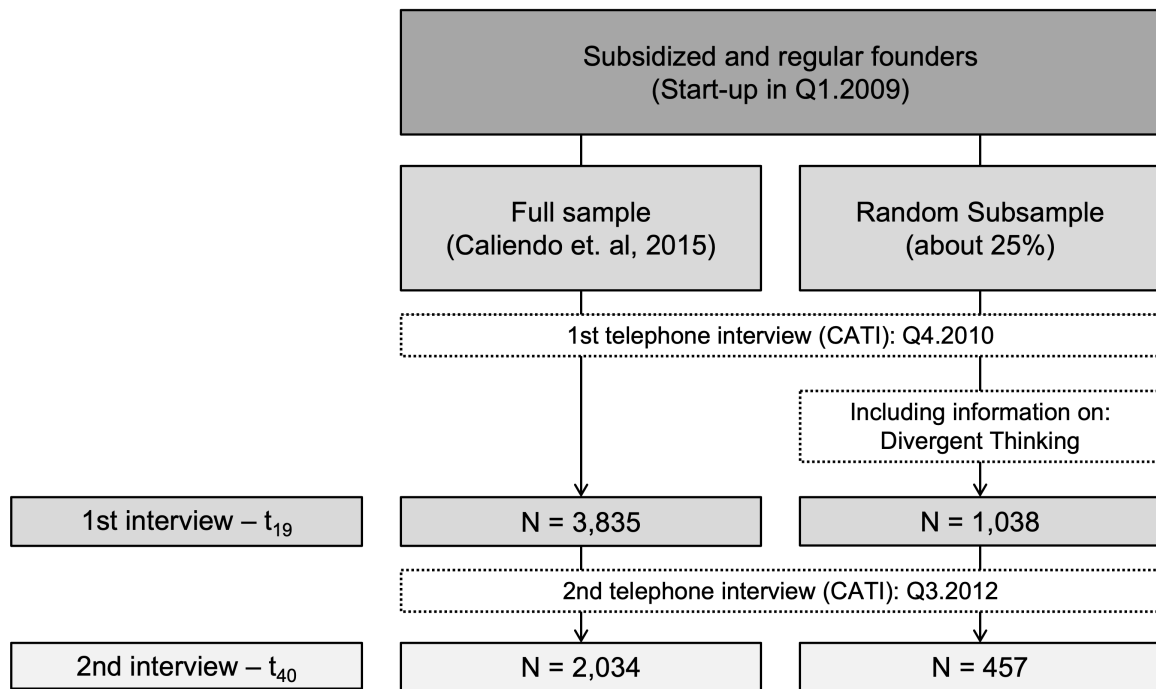
	Survival (1)	Patents or TM (2)	Employees (yes/no) (3)	Field Expansion (4)	Regional Expansion (5)	Hired Employees (6)	Realized plans Field Expansion (7)
<i>A. Continuous Divergent Thinking Mean Index in <math>t_{19}</math> - Quadratic Specification (Coefficients)</i>							
DT Mean Index in $t_{19}$	0.149 (0.188)	0.892* (0.513)	0.488** (0.209)	0.320* (0.194)	0.587 (0.367)	0.234 (0.187)	0.367 (0.234)
DT Mean Index in $t_{19}$	0.367*** (0.116)	0.770* (0.394)	-0.361** (0.159)	-0.108 (0.195)	-0.455 (0.336)	-0.223* (0.128)	-0.087 (0.289)
Pseudo $R^2$	0.349	0.510	0.411	0.278	0.458	0.285	0.346
<i>B. Continuous Divergent Thinking Mean Index in <math>t_{19}</math> - Distribution in Quartiles</i>							
Quartile 2	-0.169*** (0.056)	0.013 (0.050)	0.100 (0.084)	0.093 (0.069)	0.065 (0.059)	0.046 (0.077)	0.148** (0.065)
Quartile 3	-0.183*** (0.055)	0.126** (0.054)	0.253*** (0.067)	0.125* (0.068)	0.110** (0.054)	0.219*** (0.073)	0.192*** (0.066)
Quartile 4	0.029 (0.062)	0.176*** (0.056)	0.176*** (0.059)	0.090 (0.067)	0.039 (0.044)	0.144** (0.071)	0.089 (0.070)
Pseudo $R^2$	0.363	0.512	0.399	0.276	0.454	0.287	0.365
Controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Panel A shows logit coefficients based on logit regressions of the divergent thinking mean index in linear and quadratic form on the outcomes of interest. Panel B shows the marginal effects of binary indicators for the quartiles of the divergent thinking mean index using Quartile 1 as the baseline. Covariates include all control variables listed in Table A.1.

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

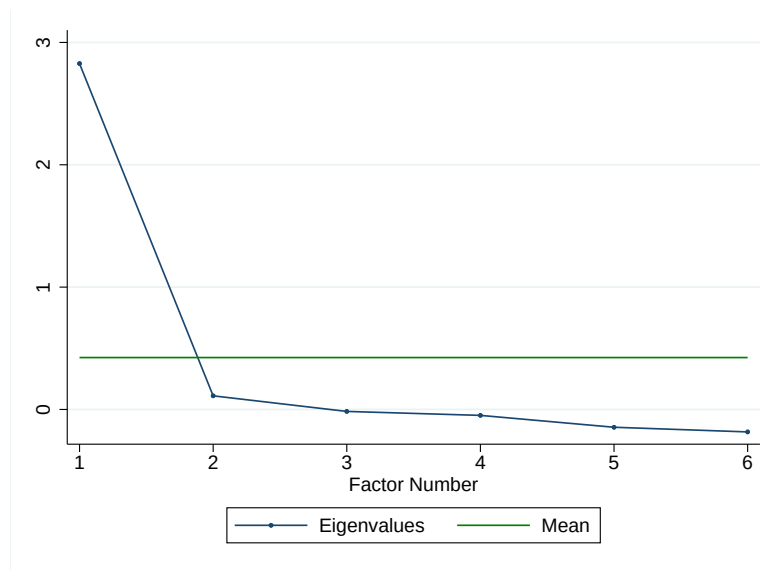
A definition of the outcome measures can be found in Section 3.3.2

Figure A.1: Data generation and sample restrictions

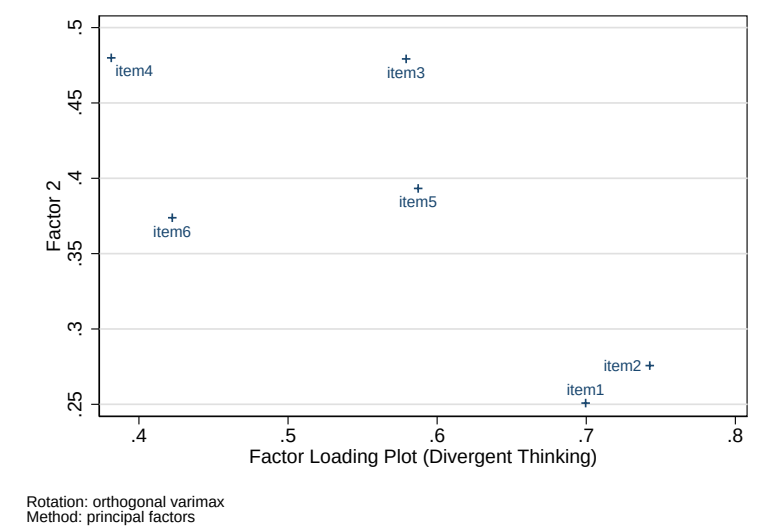


Note: For details on the construction of the data set, see Section 3.2 in the text and Caliendo *et al.* (2015, Section 4).

Figure A.2: Factor analysis for divergent thinking items in  $t_{19}$



(a) Scree plot of Eigenvalues



(b) Factor loadings plot

*Items:*

1. I have many unusual ideas.
2. I think about ideas more often than most people.
3. I often get excited about my own ideas.
4. I often have suggestions or ideas for solving problems.
5. I like to think about new ideas just for fun.
6. Friends often ask me to help them find ideas or suggest solutions.

*Note:* The figure shows the scree plot of eigenvalues and the factor loadings plot for the exploratory principal factor analysis conducted on divergent thinking items in  $t_{19}$ .

## B Supplementary Appendix: Panel Attrition

Details on the weighting procedure to correct for selective panel attrition As shown in the paper, the implementation of the panel survey in wave 2 introduced a weak selection bias due to panel attrition (see Section 3.2 in the manuscript for details). To correct for this endogenous panel attrition, we apply a weighting procedure that is based on weighting panel observations with the inverse participation probability, i.e., the inverse of the individual probability to participate in the wave 2 survey. The participation probability is estimated using probit regression:

$$p_i = \text{Prob}(s_i = 1 | x_{i1}), \quad (1)$$

where  $p_i$  is the probability to participate in the wave 2 interview and  $s_i$  is an individual response indicator, taking the value 1 if individual  $i$  participated in the wave 2 interview, and 0 otherwise.  $X_{i1}$  denotes a vector of observable characteristics available in wave 1, i.e., characteristics at startup as well as outcome variables at the time of the wave 1 interview.

The inverse of the participation probability  $\hat{p}_i$  is then used to correct the outcome variables in the second wave  $y_i$ :

$$\hat{y}_i = \frac{N\hat{w}_i}{\sum_{i=1}^N \hat{w}_i} (y_i | s_i = 1), \text{ with } \hat{w}_i = \frac{s_i}{\hat{p}_i} \quad (2)$$

This weighting method assumes that interview drop-outs are random, conditional on observable characteristics ( $x_i$ ) included in the probit model. Therefore, it is important to have a large vector of observable characteristics available to make the weighting procedure a valid strategy. The data at hand allow us to control for both general characteristics such as age, education, and labor market history as well as outcome variables as collected during the first interview. As mentioned in the paper, the inverse probability weighting procedure removes almost all significant differences in observable characteristics and reduces the (insignificant) differences in outcome variables even further.<sup>18</sup> Thus, the large set of variables used in the construction of the panel weights makes us confident that the conditional on observables assumption is fulfilled in our case.

---

<sup>18</sup>Detailed probit estimation results are available from the authors upon request.