

Founder Personality and Start-up Subsidies

Gary Chapman¹ and Hanna Hottenrott^{2,3}

¹Leicester Castle Business School, United Kingdom

²TUM School of Management, Technical University of Munich, Germany

³Centre for European Economic Research (ZEW), Germany

April 2021

Abstract

This study investigates the role of founders' personality, as captured by the dimensions of the 'Big 5' traits and entrepreneurial orientation, in their start-up's access to and use of public subsidies. We document a limited role for the Big 5 personality traits but find a more significant role for founders' entrepreneurial orientation, even after controlling for observable founder and firm characteristics and the selection decision to initially seek external financing. We also document that founder personality influences the *type* (grants or loans) of subsidies that start-ups seek and obtain. When comparing public subsidies to private sources of early-stage finance (banks, venture capital, family and friends), we find a larger role for founders' baseline personality in private sources of financing and the role of founders' entrepreneurial orientation to vary depending on the source. Finally, when disentangling application and allocation, we find little role for personality in explaining rejection, thus, suggesting that personality is more important in explaining start-ups' self-selection into subsidies, rather than policymaker award choices. We discuss implications for research evaluating the effectiveness of subsidy programs as well as for policymaking.

Keywords: Start-up subsidies, start-up financing, entrepreneurship policy, entrepreneurial orientation, Big 5 personality traits, venture capital

JEL codes: G24, L26, O25, O31

Author contact details:

✉gary.chapman@dmu.ac.uk, De Montfort University, Leicester Castle Business School, Department of Management and Entrepreneurship, Leicester, LE2 7BY, UK.

✉hanna.hottenrott@tum.de, TU Munich, School of Management, Department of Economics & Policy, Arcisstraße 21, 80333 Munich, Germany.

Acknowledgements: We thank ZEW for access to the data and Sandra Gottschalk, Qilin Hu Mathew Hughes, Shukhrat Nasirov, Magnus Strobel and Benedikt Schnurr for valuable feedback and comments.

1. Motivation and Introduction

Start-ups can play an important role in innovation, job creation, and economic growth, and in turn, generate significant societal benefits (Wennekers and Thurik, 1999; van Praag and Versloot, 2007; Haltiwanger et al. 2013). Starting-up and growing a new venture is costly, and thus, start-up success depends critically on access to finance (Cassar, 2004; Vaznyte and Andries, 2019, Caggese, 2019). Yet, start-ups are often financially constrained due to limited internal resources and impediments to accessing external finance, which hinders their success (Ostgaard and Birley, 1994). Recognising the societal benefits of start-ups, governments have implemented a plethora of subsidy programmes that aim to alleviate the financial constraints inhibiting start-ups in recent years (Mina et al., 2021). While start-up subsidies have received relatively little attention (see Audretsch et al., 2020), the few existing studies largely confirm their importance as a tool to alleviate financial constraints and enhance performance (e.g., Colombo et al. 2011, 2012; Söderblom et al 2015; Conti, 2018; Buffart et al., 2020; Zhao and Ziedonis, 2020; Hottenrott and Richstein, 2020). Moreover, as recent work raises concerns about the effectiveness of alternative interventions such as angel investors tax credits (Denes et al., 2020), the importance of subsidies as a tool for driving start-up performance has heightened. This potential for alleviating financial constraints and supporting young firms' development begs the important question of what characteristics can help and hinder founders' access to or willingness to make use of subsidies.

The literature studying young firms' access to finance has documented the role of observable founder characteristics, in particular experience and firm characteristics, such as innovative activities, in start-ups' ability to access sources of finance in the form of venture capital and bank loans (Colombo and Grilli, 2007; Haeussler et al., 2014; Bruneel et al., 2020; Caliendo et al., 2020). Emerging, but still scant, work also documents their role in start-up subsidies (Canter and Kusters, 2012; Chapman and Hewitt-Dundas, 2018; Hottenrott and

Richstein, 2020; Mina et al., 2021). A largely omitted variable in this literature, however, has been the role of founder personality. Personality reflects an individual's habitual and enduring patterns of cognition (e.g., attitudes and motivation) and behaviour, and thus, reflects their general orientation toward particular decisions and actions (Winter et al., 1998; Brandstätter, 2011). Personality also signals qualities about an individual to others that can influence their decision-making and behaviour toward the individual (Pianesi et al, 2008). Start-up research has mainly leveraged the concept to examine whether and how founders differ from managers and the performance consequences (e.g., Rauch and Frese, 2007; Zhao et al, 2010). Their role in start-ups' access to finance remains largely unknown, however (Bernardino and Santos, 2016; Vaznyte and Andries, 2019); and to the best of our knowledge, no studies have examined the role of founder personality in start-up subsidies. This omission is striking given the critical role of access to early-stage finance and subsidies for start-up survival and subsequent performance (e.g., Howell, 2017; Conti, 2018).

In response to this research gap, this paper investigates whether and how founder personality matters in their start-ups' use of and access to subsidies. We suggest that personality influences founders' incentives to seek subsidies by shaping their ideation processes and goals (Vaznyte and Andries, 2019), and may influence their likelihood to obtain subsidies (once applied) as policymakers (and other lenders) may view certain personalities as more or less desirable (e.g., policymakers may seek more innovative or creative candidates) in their funding decisions. In the context of new firm founders, it is important to capture both an individuals' general personality and their propensity to be entrepreneurial (Wales et al., 2020). To this end, we first draw on the social psychology literature to capture the general personality of an individual. We focus on the five-factor model (Big5) as this is the most dominant configuration of general personality (McCrae and John, 1992) and has been shown to effectively capture

baseline personality (Saucier and Goldberg, 1998; Hurtz and Donovan, 2000)¹. Next, we focus on the concept of entrepreneurial orientation to capture founders' propensity to be entrepreneurially. While traditionally conceptualised as a firm-level phenomenon, recent work has extended entrepreneurial orientation to the individual-level (Covin et al., 2020; Krueger and Sussan, 2017; Hughes and Morgan, 2007). Founders' entrepreneurial orientation has been shown to effectively represent predispositions toward innovative and entrepreneurial decision-making and behaviour (Covin, 1991; Covin and Slevin, 1988; Anderson et al., 2015; Lumpkin and Dess, 1996; Krueger and Sussan, 2017; Wales et al., 2020). As personality and entrepreneurial orientation both focus on enduring patterns in cognition and behaviour (Covin and Lumpkin, 2011; Wales et al., 2020), we capture founders' entrepreneurial personality using the entrepreneurial orientation construct. Considerable evidence supports the role of founder 'Big 5' and entrepreneurial orientation in shaping start-up decision-making and performance (e.g., Rosenbusch et al., 2013; Zhao et al., 2010), and thus, it is crucial to investigate how these personalities matter in start-ups access to subsidies.

While start-up subsidies have largely been considered as grant-based, an increasingly popular approach is to provide start-up support through subsidized loans (Hottenrott and Richstein, 2020; Zhao and Ziedonis, 2020). As founders and funders may prefer grants or loans depending on the founders' personality (Vaznyte and Andries, 2019), we explicitly differentiate between grants and loans to examine how founder personality may differently impact each. Moreover, as understanding of founder personality in the broader access to early-stage finance literature is limited, we conduct additional analyses to compare the importance of founder

¹ We use the terms 'Big Five' and 'Five Factor Model' interchangeably throughout the paper. While the models were developed independently and differ in their underlying assumptions, both models use the same factor labels and are highly consistent, confirming their interchangeability and generalizability (Matz et al., 2016).

personality in important private sources (i.e., venture capital, non-subsidized bank loans and family & friends) of start-up finance to public subsidies. This enables a more general understanding of the importance of personality in start-up access to early-stage finance and enables us to better understand the reliability of our measures. Finally, in our main analysis, as with most studies, we cannot distinguish between firms' self-selection into a programme, and those that applied but were rejected (Dimos and Pugh, 2016). This limits our understanding as to where in the process personality matters. To shed some light on this, we exploit a portion of our data that provides additional information on start-ups being rejected to distinguish between the role of founders' personality in the two stages.

We examine access to subsidies for a large sample of start-ups founded in Germany between 2007 and 2017 in manufacturing and service sectors. We find a limited role for founder's 'Big 5' baseline personality traits in explaining start-up subsidies, but a more significant role for founder's entrepreneurial orientation, even after controlling for observable founder and firm characteristics. Thus, our results suggest that founders' entrepreneurial personality shapes their start-ups' participation in subsidy programmes. Moreover, we find that founder personality influences the *type* (grants or loans) of subsidies that start-ups seek and obtain. More competitive founders are more likely to have obtained subsidized loans whereas more innovative founders obtain grants. This suggests that different policy instruments serve diverse needs (Giraudo et al. 2019) by targeting different entrepreneurs. Our results further suggest that founder personality also matters for private sources of early-stage finance, with founder 'Big 5' mattering more for private sources than public subsidies, and founder entrepreneurial personality varying across the private sources. When disentangling self and policymaker selection, we find little role for personality in explaining rejection. This suggests that much of the role of personality is in influencing start-ups self-selection into subsidies, rather than policymaker's award choices.

Our results advance a more comprehensive understanding of founders' access to early-stage finance by providing novel empirical evidence on the role that founder baseline and entrepreneurial personality play in affecting start-ups' use of subsidies and other important sources of early-stage finance.

The remainder of this article proceeds as follows. Section 2 discusses the characteristics helping and hindering firms access to subsidies, and sections 2.1 and 2.2 introduce our conceptualizations of founder personality and their role in start-ups' access to and use of subsidies. Section 3 discusses the data and empirical approach, section 4 discusses the empirical results, and section 5 discusses the contributions and implications of our work for policymakers, academics, and start-ups.

2. Start-up Subsidies

As (start-up) subsidies can alleviate firms' financing constraints and enhance their performance (Colombo et al. 2011; Söderblom et al. 2016; Howell, 2017; Conti, 2018; Buffart et al., 2020; Hottenrott and Richstein, 2020), a growing literature has investigated what characteristics help and hinder start-ups' and other firms' access to and use of subsidies. Studying these characteristics is important to understand who is likely to gain access to subsidies, the existence of potential barriers to accessing subsidies and the implicit or explicit selection criteria of policymakers (Blanes and Busom, 2004). These have important implications for guiding start-ups on their likelihood of being able to utilise subsidies to alleviate financing constraints, and for policymakers, on who is acquiring their support and whether, potentially attractive candidates are missing out; thus, reducing the effectiveness of their programme. Moreover, as most studies examining the efficacy of subsidy programmes rely on research designs that require an extensive understanding of the characteristics predicting participation in subsidies

(Blanes and Busom, 2004; Dimos and Pugh, 2016), studying these characteristics is key to enabling robust identification of the effectiveness of subsidy programmes and thus, guiding future policymaking.

Most of this work has focused on general subsidy programmes, rather than in the context of start-ups. Consequently, most research has been upon the role of observable firm characteristics (e.g., Busom and Blanes, 2004; Colombo et al., 2007; Santamaria et al., 2010; Hottenrott and Lopes-Bento, 2014, Hottenrott et al., 2017; Chapman et al., 2018). Antonelli and Crespi (2013) found that prior subsidies, age, size and human capital increased firms' probability of accessing subsidies in Italy, while firm credit rating and exporting did not matter. Busom et al (2014) found that financing constraints, human capital and performing R&D increased the likelihood of accessing subsidies in Spain, while intellectual property protection and exporting did not matter. Mina et al (2021) found that firm size, age, profit and sales affected small and medium-sized firms' (SMEs) probability of seeking E.U. subsidies, while patents and venture capital were important in the subsidy award decisions. These studies generally suggest that firm characteristics, particularly, human capital and R&D intensity, play an important role in the use of and access to subsidies.

Only a small number of studies have specifically examined start-up subsidies and these equally demonstrate the importance of firm characteristics in the use of and access to subsidies (e.g., Canter and Kösters, 2012; Conti, 2018; Chapman and Hewitt-Dundas, 2018; Hottenrott and Richstein, 2020). Given the significant importance of founders to their start-up's success, decision-making and performance (Shane and Stuart, 2002; Dencker and Gruber, 2015), it is not surprising that observable founder characteristics explain participation in subsidy programmes. For instance, Rojas and Huergo (2016) show that start-ups with more experienced and educated founders have greater access to other sources of finance, and thus, be less likely

to seek subsidies. While insightful, an omitted variable in this work – and the broader start-up access to finance literature – has been the role of founders' personality (Vaznyte and Andries, 2019). Although personality has been linked to the survival and success of start-ups (Rosenbusch et al., 2013; Zhao et al., 2010), and thus, of significant interest to policymakers and academics, personality has received very little attention so far. In this paper, we begin to redress this knowledge gap by examining the role of founder personality in start-ups' access to and use of subsidies.

2.1. Personality and Entrepreneurial Behaviour

Personality reflects dimensions of difference between individuals by capturing their enduring and overarching patterns of cognition and behaviour (Brandstätter, 2011; McCrae and Costa, 1997; Smith et al, 2018). Personality shapes individual preferences (e.g., how favourably they view an action or decision), information search (e.g., where they search for information), information processing (e.g., how they interpret and judge information, and their utilisation of it in their decision-making) and behaviour, and thus reflects their general orientation toward particular decisions and actions (Winter et al., 1998; Brandstätter, 2011). Personality shows a high degree of stability across time and context (Roccas et al., 2002), and thus, reflects an individual's general orientation and propensity to respond and act in a particular way across various situations (McCrae and Costa, 1997; Rauch and Frese, 2007). Each type captures different dimensions of an individual's personality, for instance, openness to experience captures the extent to which individuals are imaginative, curious, and open to novel and unconventional ideas, perspectives and experiences, as opposed to preferring convention and familiarity (McCrae and Costa, 1997; George and Zhou, 2001).

We capture both an individuals' general personality and their propensity to be entrepreneurial by focusing on the Big-5 personality traits and founder entrepreneurial

orientation (McCrae and John, 1992; Wales et al., 2020). While each has been shown to shape and influence start-up decision-making, survival and performance (e.g., Rauch and Frese, 2007; Rauch et al., 2009; Zhao et al., 2010; de Jong et al., 2013; Rosenbusch et al., 2013; Kerr et al., 2017), their role in start-ups access to and use of subsidies remains unclear. Moreover, this two-construct approach enables us to capture and distinguish both the influence of the baseline and entrepreneurial personality of founders on their access to start-up subsidies and in turn, produce more refined insights. The five-factor model consists of an individual's openness to experience, conscientiousness, extraversion, agreeableness and neuroticism (Hurtz and Donovan, 2000; McCrae and John, 1992), while entrepreneurial orientation consists of founder's competitiveness, innovativeness, autonomy, proactiveness, and risk tolerance (Lumpkin and Dess, 1996; Anderson et al., 2015; Wales et al., 2020). The two configurations are summarised in Table 1.

Table 1: Description of the Five-Factor and Entrepreneurial Orientation

| Description | |
|--|--|
| <i>Five-Factor (Big5)</i> (e.g., McCrae and John, 1992; George and Zhou, 2001; Zhao and Seibert, 2006) | |
| Openness to experience | Extent to which founders are imaginative, curious, and open to novel and unconventional ideas, perspectives and experiences. |
| Conscientiousness | Extent to which a founder is diligent, persistent and motivated. |
| Extraversion | Extent to which a founder is assertive, active and enthusiastic. |
| Agreeableness | Extent to which a founder is altruistic, caring and emotionally supportive. |
| Neuroticism | Extent to which a founder is emotionally stable (e.g., calm; anxiety) and adjusts well. |
| <i>Entrepreneurial Orientation</i> (e.g., Lumpkin and Dess, 1996; Lumpkin et al., 2009; Pearce et al., 2010; Putninš and Sauka, 2019; Covin et al., 2020) | |
| Competitiveness | Founder's willingness to directly challenge and risk conflict with competitors to grow and succeed. |
| Innovativeness | Extent to which a founder engages in and supports novelty, new ideas and experimentation. |
| Autonomy | Extent to which a founder acts, decides and works independently to bring forth their vision. |
| Proactiveness | Extent to which a founder seeks and exploits new opportunities and innovations to be ahead of competitors. |
| Risk tolerance | Founder's willingness to engage in risky behaviours and make resource commitments with uncertain outcomes. |

2.2. Personality and Start-Up Subsidies

Founder personality may impact start-ups' access to and use of subsidies. Accessing start-up subsidies is the result of a two-stage decision process. First, founders seek out opportunities for start-up subsidies and decide whether or not to apply for a subsidy (i.e., self-selection). Second, from the pool of start-ups that apply, policymakers decide whether or not to allocate subsidies to each start-up (i.e., policymaker selection). As founder's role differs in both decisions, their personality may influence both decisions differently. Thus, while our main focus is on the overall role of founder personality in start-ups' participation in subsidy programmes, we distinguish the self-selection and policymaker-selection decisions in our theorising.

Start-ups must pitch and describe their project idea in their subsidy application. Programmes typically aim to generate societal benefits by funding ideas that would not otherwise be pursued (Falk, 2007), and thus, seek innovative and novel ideas in their design and selection processes. We argue that founder personality will influence the novelty and type of ideas that their start-up generates, and consequently, the fit of their idea for accessing subsidies as a source of finance. Founder information search for solutions and new concepts is a key input to their start-up's ideation process (Gruber et al., 2013; Hsu and Lim, 2014). Engagement in information search, and the breadth and depth of search efforts, is a key determinant of their ability to access novel and non-redundant information (Laursen and Salter, 2006; Hahn et al., 2019), and in turn, develop novel and innovative ideas for their start-up to pursue (Ahn et al, 2017).

Information search is a cognitive process heavily shaped by individuals' personality (Mai, 2016; Halder et al., 2017). Personality can shape whether an individual decides to search, and how broadly and deeply they search. For instance, individuals high on openness to experience may search more broadly and follow more unique search paths due to their curiosity

and imagination. Individuals high on extraversion and conscientiousness may be more likely to engage in more thorough and persistent search efforts due to their diligence and motivation. Thus, personality can affect the novelty and diversity of founder ideation process by shaping the breadth and depth of their information search efforts (Ahn et al., 2017). Personality also influences information processing by shaping motivation to allocate attention to certain information and their predisposition to interpret (e.g., relevant, favourable) and utilise certain information in their decision-making and actions (Humphreys and Revelle, 1984; Heinström, 2003). For instance, founders that display higher innovativeness will be more likely to attend to and positively view information that may provide a breakthrough idea.

As personality is enduring (Rauch and Frese, 2007) and search is path dependent (Gavetti and Levinthal, 2000), the influence of founder personality on search behaviour should be significant and long-lasting (Hahn et al., 2019). Moreover, beyond their direct involvement, founder personality may also signal to start-up employees about acceptable and supported search behaviours (Chirico et al., 2011; Wales et al., 2020), and through controlling resource seeking and allocation, determine which ideas are pursued within the start-up. Founder personality can also influence whether founders will be willing to disclose their proprietary idea as required in a subsidy application (Vaznyte and Andries, 2019). For instance, founders with low risk tolerance and neuroticism may fear expropriation, while those high on openness to new experience may view this as an opportunity to elicit feedback. Collectively, the discussion suggests that founder personality likely influences the novelty of ideas start-ups generate and pursue, and in turn, their likelihood to have an idea that fits with subsidies as a source of finance and that is positively evaluated by policymakers.

Personality may also influence *how* founders describe and explain their idea and project, their need for financing, the benefits it will produce, amongst other information, in their

application. A growing number of discourse-based approaches show how founders' or top managers' personality, style and other cognition characteristics are communicated from their and their firm's written communications to various investors and stakeholders (Mousa et al., 2015; McKenny et al., 2018). As Wales et al. (2020; 7) posits, founders signal their entrepreneurial orientation "via the verbiage used in speeches and publicly available document[s]". Thus, we suggest that founders may communicate their personality to policymakers via their description of the project, its worthiness and benefits, in their application. For instance, founders high on innovativeness, risk preferences, and proactiveness may write with a more optimistic (e.g., change, discover, imagine), ambitious (e.g., bright-idea, game changing, revolutionize) and entrepreneurial (e.g., creator, discover, create) tones in their subsidy application and focus their prose on more exploratory and radical paths to achieve growth and success (Short et al., 2010; Mousa et al., 2015). Whereas those lower on these personalities may adopt more conservative and cautious language in describing their project and its impacts and importance. Policymakers can infer these characteristics in their decision-making process, and thus, they may indirectly influence start-ups likelihood to obtain subsidies.

Finally, founder personality has been linked to the success and growth of their start-ups (Rauch et al., 2009; Zhao et al., 2010; de Jong et al, 2013; Rosenbusch et al., 2013; Kerr et al, 2017). For instance, founders that are proactive are more likely to seek, identify and exploit new opportunities and innovations that can drive their start-ups growth (Covin and Slevin, 1991; Rauch and Frese, 2007). By shaping start-up growth and performance, we suggest founder personality may influence their perceived need to seek subsidies. For instance, founders scoring low on innovativeness, proactiveness and openness to experience may prefer maintaining and exploiting the status quo in their business strategies. In turn, this should reduce their incentives to search for and seize opportunities for subsidies due to their lower resource needs (Yin et al., 2020). Moreover, due to their lower growth orientation, they may be more

likely to pursue other sources of finance. This may also make them less likely to be awarded subsidies, as policymakers may focus their resources on more innovative and growth-orientated firms to maximise the potential for societal benefits. Whereas founders scoring high on these characteristics may be pursuing more radical ideas and business strategies. In turn, they will be more likely to seek out and exploit opportunities for obtaining subsidies to acquire the greater resources needed to initiate their innovative plans and drive growth (Covin and Slevin, 1991). Moreover, greater success in innovation efforts may not offset financial constraints as their investment opportunities may require greater resources over time (Hottenrott and Peters, 2012); thus, founders scoring high may have greater resource needs over the long-term, further increasing their likelihood to seek subsidies. At the same time, their greater performance and growth may signal their quality to other funders and thus, provide them with greater access to private sources of finance, reducing their reliance on subsidies as a source of finance (Rojas and Huergo, 2016). Thus, by influencing start-up growth and success, founder personality may also indirectly influence start-ups likelihood to seek subsidies.

Our above discussion suggests that founder personality may influence both start-ups self-selection into subsidies and policymakers' allocation decisions. To this end, we investigate whether, and to what extent, founder personality, as captured by the five-factor model and entrepreneurial orientation, matter, over and above observable founder and firm characteristics, in start-ups use of and access to subsidies.

3. Data

While start-ups are a key source of innovation, jobs and growth, Germany lags behind countries such as the U.K. and Netherlands in Europe to rank 10th in number of start-ups per 1 million population (State of European Tech, 2020). As access to finance is a key inhibitor for start-ups (Cassar, 2004; Caggese, 2019), our questions on why founders do (not) make use of subsidies

to support their start-ups, and the role of personality, are particularly salient and policy relevant in the German context. Thus, we investigate detailed data on newly founded, legally independent businesses in Germany collected by the IAB/ZEW Start-up panel. A stratified random sample of newly registered firms is interviewed via computer-aided telephone survey each year since 2008 [see Fryges et al. (2009) for a detailed description of the survey design]. The full data set comprises information on about 26,000 start-ups founded between 2005 and 2018.

For the following analysis, we use those survey waves that contain information on personality. The waves collected in the years 2014-2017 contain questions on entrepreneurial orientation and the waves 2018 and 2019 the questions on the baseline personality traits. The item ‘risk tolerance’ is also available for the years 2018 and 2019. In total, we use information on 11,082 unique start-ups founded between 2007 and 2017. The data set contains quantitative and qualitative information about the founder(s) such as experience, education, and gender. Firm specific information (e.g., legal form, exporting activity, R&D expenditures, and profits) is also collected via the questionnaire as well as the financing sources used and whether the firm received some form of public start-up subsidy.

3.1 Variables

The key variables of interest are the measures for founder personality. As noted earlier, we focus on two dominant categorisations of founder personality, namely the Big 5 to capture their baseline personality, and entrepreneurial orientation to capture their entrepreneurial personality. Theoretically, we understand founder Big 5 and entrepreneurial orientation to be multi-dimensional constructs and thus, we construct them as each consisting of five individual components (McAdams et al., 1992; Lumpkin and Dess, 1996; Lumpkin et al., 2009; Covin and Wales, 2012); openness to experience, conscientiousness, extraversion, agreeableness, and

neuroticism for the ‘Big 5’; innovativeness, proactiveness, risk taking, autonomous and competitiveness for entrepreneurial orientation. Both the five-factor personality traits and entrepreneurial orientation are measured based upon previously established item scales (Covin and Slevin, 1989; Vaznyte and Andries, 2019). The corresponding survey questions are shown in appendix Table A.1. and Table A.2, respectively. We validate our theoretically grounded multi-dimensional conceptualisations of both Big 5 and entrepreneurial orientation in our data using factor analysis, with eigenvalues supporting five factor solutions. The measures used in the main analysis are obtained as the average item score for each factor (e.g., Chapman and Hewitt-Dundas, 2018). Tables A.3 to A.6 show the results of the principal component factor analyses for both the 15 Big 5 items as well as the ten entrepreneurial orientation items.

We deploy three binary subsidy variables as our main dependent variables, namely, any subsidy (whether the start-up received some form of public subsidy), grant (whether the start-up received a subsidy in the form of a grant), and loan (whether the start-up received a subsidized loan or a government loan guarantee). As personality may also be captured or conveyed via observable founder and firm characteristics (e.g., the founder of a start-up with significant R&D intensity may be capturing or inferring innovativeness, proactiveness and openness to experience), we comprehensively account for the role of observable founder and firm characteristics in our models to disentangle what explanatory power founder personality characteristics add over and above the founder and firm observable characteristics that are typically observable to the researcher.

Table 2 shows descriptive statistics for the personality measures and Table 3 for the range of subsidy indicators as well as founder and firm characteristics that we include as controls (see Table A.7 for a definitions table; Tables A.8 and A.9 show pair-wise correlations between variables). The different coverage periods for each set of personality measures results in different subsamples for the corresponding analyses consisting of 5,483 firm-year

observations for the Big 5 subsample (Panel A) and 11,023 firm-year observations for the entrepreneurial orientation subsample (Panel B).

Table 2: Main personality variables (average item scores)

| Panel A: Big 5 | Obs. | Mean | Std. Dev. | Min | Max |
|---|--------|-------|-----------|-----|-----|
| Openness | 5,483 | 3.753 | 0.766 | 1 | 5 |
| Conscientiousness | 5,483 | 4.282 | 0.632 | 1 | 5 |
| Extraversion | 5,483 | 3.878 | 0.743 | 1 | 5 |
| Agreeableness | 5,483 | 4.029 | 0.668 | 1 | 5 |
| Neuroticism | 5,483 | 2.360 | 0.765 | 1 | 5 |
| Panel B: Entrepreneurial Orientation | | | | | |
| Competitiveness | 11,023 | 2.517 | 1.373 | 1 | 5 |
| Innovativeness | 11,023 | 2.363 | 1.304 | 1 | 5 |
| Proactiveness | 11,023 | 3.822 | 1.161 | 1 | 5 |
| Risk tolerance | 11,023 | 2.590 | 1.298 | 1 | 5 |
| Autonomy | 11,023 | 2.244 | 1.188 | 1 | 5 |

Note: The number of observations are firm-year observations.

Note that both samples are sufficiently large for the planned analysis and comparable in terms of sample characteristics and industry coverage (see Table A.10 for the distribution of firms across sectors in both sectors). The share of firms receiving some form of public support is 10% in the smaller Big 5-sample and 17.6% in the larger EO-sample; the latter provides information on several years per firm allowing for more years for subsidies to occur. Grants are more common than subsidized loans in both samples. In both samples only about 17% of start-ups involve a female founder and the share of opportunity-driven firm foundation is high at about 84%. A high share of founders are relatively experienced with about 17 years of industry experience and a relatively high share of re-starting entrepreneurs (in both samples).

Table 3: Descriptive Statistics

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|----------------------------|--------|-------|-----------|-----|-------|
| Panel A: Big 5 | | | | | |
| <i>Subsidy information</i> | | | | | |
| Any subsidy | 5,483 | 0.107 | 0.310 | 0 | 1 |
| Grant | 5,440 | 0.072 | 0.258 | 0 | 1 |
| Subsidized Loan | 5,397 | 0.047 | 0.212 | 0 | 1 |
| <i>Controls</i> | | | | | |
| Profit | 5,483 | 0.690 | 0.463 | 0 | 1 |
| Experience | 5,483 | 17.33 | 10.60 | 1 | 58 |
| ln(R&D expenditures) | 5,483 | 2.431 | 4.428 | 0 | 15.42 |
| Failure experience | 5,483 | 0.033 | 0.178 | 0 | 1 |
| Restarter | 5,483 | 0.411 | 0.492 | 0 | 1 |
| ln(employees) | 5,483 | 1.319 | 0.674 | 0 | 5.185 |
| Female | 5,483 | 0.172 | 0.377 | 0 | 1 |
| Opportunity driven | 5,483 | 0.849 | 0.358 | 0 | 1 |
| Academic | 5,483 | 0.492 | 0.500 | 0 | 1 |
| Founder age | 5,483 | 45.20 | 11.21 | 18 | 99 |
| Team | 5,483 | 0.211 | 0.408 | 0 | 1 |
| Exporter | 5,483 | 0.198 | 0.399 | 0 | 1 |
| East Germany | 5,483 | 0.135 | 0.342 | 0 | 1 |
| Cohort | 5,483 | 3.438 | 1.753 | 1 | 7 |
| Limited liability | 5,483 | 0.534 | 0.499 | 0 | 1 |
| Panel B: EO | | | | | |
| <i>Subsidy information</i> | | | | | |
| Any subsidy | 11,023 | 0.176 | 0.381 | 0 | 1 |
| Grant | 10,895 | 0.120 | 0.325 | 0 | 1 |
| Subsidized Loan | 10,764 | 0.079 | 0.269 | 0 | 1 |
| <i>Controls</i> | | | | | |
| Profit | 11,023 | 0.653 | 0.476 | 0 | 1 |
| Experience | 11,023 | 16.61 | 10.23 | 1 | 61 |
| ln(R&D expenditures) | 11,023 | 2.550 | 4.514 | 0 | 18.84 |
| Failure experience | 11,023 | 0.061 | 0.240 | 0 | 1 |
| Restarter | 11,023 | 0.427 | 0.495 | 0 | 1 |
| ln(employees) | 11,023 | 1.358 | 0.662 | 0 | 5.228 |
| Female | 11,023 | 0.175 | 0.380 | 0 | 1 |
| Opportunity driven | 11,023 | 0.837 | 0.369 | 0 | 1 |
| Academic | 11,023 | 0.511 | 0.500 | 0 | 1 |
| Founder age | 11,023 | 44.13 | 10.92 | 17 | 98 |
| Team | 11,023 | 0.329 | 0.470 | 0 | 1 |
| Exporter | 11,023 | 0.194 | 0.396 | 0 | 1 |
| East Germany | 11,023 | 0.138 | 0.345 | 0 | 1 |
| Cohort | 11,023 | 2.883 | 1.837 | 1 | 7 |
| Limited liability | 11,023 | 0.561 | 0.496 | 0 | 1 |

Note: The number of observations are firm-year observations. For the distribution of observations across industry see Table A10.

4. Methods and Results

Method

Given the nature of start-up subsidies, and their public funders' predominant pursuit of societal benefits and additionality, we expect that – besides founders' personality – observable founder and firm characteristics that reflect the start-ups innovation potential likely play an important role in start-up subsidies. In a first step, we therefore investigate the role of a founder's personality for the likelihood to receive some form of public subsidy (any subsidy, grant, subsidized loan). As we utilise two panels because of the variable coverage, we thereby estimate separate models for the five baseline personality traits and the five entrepreneurial orientation indicators. We start by including only those key variables of interest and then add in two subsequent steps, founder and company characteristics which have been linked to the receipt of public start-up subsidies in previous studies (e.g., Rojas and Huergo, 2016; Hottenrott et al., 2018; Chapman and Hewitt-Dundas, 2018; Hottenrott and Richstein, 2020). Most of these characteristics are time-invariant and the others are measured in t .

With regard to the sources of start-up financing, the subsequent analysis proceeds as follows: We first investigate the role of personality for participating in subsidy programs and distinguish thereby between grants and subsidized loans. Second, we look at other sources of financing to investigate differences in the role of personality for different types of start-up financing. In particular, we derive information from the survey on whether start-ups received some form of Venture Capital (VC) financing² (about 9% in both samples), bank financing not subject to subsidized interest rates or guarantees (about 22% in both samples) or whether founders borrowed money from family and friends (about 13% in both samples). Table 4 reports the descriptive statistics for these alternative financing sources in both samples, with the prevalence

² This comprises Business Angels as well as Venture Capital Funds (including Corporate Venture Capital).

comparable in both. Third, we consider rejected applicants and explore how personality impacts rejection likelihood. In all cases, we estimate models suitable for discrete dependent variables as our outcome variables of interest are binary indicators.

Table 4: Alternative financing sources

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|------------------|------|-------|-----------|-----|-----|
| Panel A: Big5 | | | | | |
| VC financing | 1916 | 0.094 | 0.292 | 0 | 1 |
| Bank financing | 1915 | 0.224 | 0.417 | 0 | 1 |
| Family & Friends | 1915 | 0.131 | 0.337 | 0 | 1 |
| Panel B: EO | | | | | |
| VC financing | 4880 | 0.092 | 0.288 | 0 | 1 |
| Bank financing | 4878 | 0.217 | 0.412 | 0 | 1 |
| Family & Friends | 4880 | 0.134 | 0.341 | 0 | 1 |

Finally, we test the sensitivity of the results to the modelling assumptions. For doing so, we first account for the simultaneous financing choices faced by the entrepreneur and the interrelatedness of different sources of financing. In particular, we employ conditional mixed process estimations (Roodman, 2011) that allow us to estimate several equations jointly accounting for structural dependence between the different financing sources. Second, we estimate the models using predicted factor scores from the factor analyses directly as main explanatory variables rather than employing average item values. Finally, we estimate selection models that account for the decision to seek external financing in the first stage (and the role of personality in this decision) before exploring how personality relates to the choice of the financing source including public subsidies.

Results

Tables 5 and 6 show the results for the five factor personality traits and the entrepreneurial orientation measures, respectively. Models 1-3 show the results for any type of subsidy, models 3-6 for grants and models 7-9 for subsidized loans. In Table 5 and model 1 only the openness trait correlates positively and statistically significantly with the likelihood of receiving a subsidy, whereas conscientiousness correlates negatively. The test for joint significance of all

five traits suggests that they are jointly significant [$\chi^2(5) = 15.78^{**}$]. This persists in model 2 once founder characteristics are controlled for. However, once firm characteristics are added in model 3, the traits are no longer statistically significant suggesting that those traits may also be reflected in firm characteristics. For example, founders with greater openness may be more likely to allocate their firm resources to R&D to explore new opportunities and may choose to found firms in particular industries. The test for joint significance of all five traits in model 2 still suggests some explanatory power [$\chi^2(5) = 10.29^*$], while in model 3 this is no longer the case [$\chi^2(5) = 2.18$]. When we distinguish grants from loans, we find that the results for grants look similar to the ones for any subsidy, while for loans the five factors do not even explain participation in loan-based programs when we do not include any other characteristics [$\chi^2(5) = 4.13$].

The picture looks slightly different in Table 6 when considering entrepreneurial orientation. Here, competitiveness and proactiveness explain the likelihood to receive any type of subsidy even after accounting for founder and firm characteristics [$\chi^2(5) = 37.26^{***}$]. When differentiating between grants and subsidized loans, different patterns emerge. For grants, founder innovativeness and proactiveness matter even after accounting for observable firm and founder characteristics [$\chi^2(5) = 17.67^{***}$]. This could also be due to a correlation between entrepreneurial orientation and self-confidence that encourages those founders to pursue their ideas in subsidies (Hayward et al., 2006); yet we cannot directly test this assertion. For subsidized loans, higher proactiveness and competitiveness explain their use in all models (7-9), even after accounting for observable founder and firm characteristics [$\chi^2(5) = 34.24^{***}$].

4.1. Other Sources of Early-Stage Finance

We perform a corresponding analysis that employs alternative sources of entrepreneurial financing as dependent variables (Venture Capital, non-subsidized bank loans, family & friends) to investigate differences between the roles of personality for public subsidies and those other sources. Tables 7 and 8 show the results for the alternative sources of financing. Unlike for public subsidies, we find that for VC, higher values in the personality trait openness significantly predicts VC financing even after accounting for observable founder and firm characteristics (Table 7) whereas agreeableness correlated negatively. Interestingly, openness also positively predicts borrowing from family and friends, but is negatively associated with bank financing. In addition, a higher degree of neuroticism is associated with a higher likelihood to borrow from family and friends. Overall, baseline personality matters more for borrowing from family and friends after controlling for other characteristics than for any of the other sources as indicated by the test of joint significance of the Big 5 traits [$\chi^2(5) = 25.02^{***}$].

Still, founder baseline personality traits seem to matter more for the private sources of finance, than for public sources. For entrepreneurial orientation (Table 8), we find that in particular the likelihood to receive VC is associated with higher competitiveness, innovativeness and risk tolerance even accounting for the entire set of control variables [$\chi^2(5) = 25.46^{***}$]. This is in line with the idea that VCs typically pursue highly innovative founders with high growth potential. In contrast to that, bank financing is negatively related to innovativeness and positively to proactiveness and higher risk tolerance is linked to borrowing from family and friends.

Table 5: Big 5 personality traits and start-up subsidies

| | (1) Any Subsidy | (2) Any Subsidy | (3) Any Subsidy | (4) Grants | (5) Grants | (6) Grants | (7) Loans | (8) Loans | (9) Loans |
|-----------------------------|----------------------------|---------------------------|--------------------------|-----------------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Openness | 0.081*** (0.031) | 0.079** (0.032) | 0.018 (0.035) | 0.084** (0.036) | 0.078** (0.037) | 0.014 (0.042) | 0.036 (0.039) | 0.047 (0.040) | 0.029 (0.041) |
| Conscientiousness | -0.088** (0.036) | -0.066* (0.037) | -0.047 (0.040) | -0.111*** (0.041) | -0.072* (0.042) | -0.036 (0.047) | -0.023 (0.044) | -0.041 (0.045) | -0.066 (0.048) |
| Extraversion | 0.009 (0.032) | -0.002 (0.032) | 0.009 (0.036) | -0.014 (0.037) | -0.013 (0.037) | 0.003 (0.042) | 0.061 (0.040) | 0.039 (0.041) | 0.031 (0.044) |
| Agreeableness | -0.053 (0.036) | -0.034 (0.036) | -0.018 (0.038) | -0.047 (0.041) | -0.025 (0.041) | -0.002 (0.044) | -0.010 (0.046) | -0.007 (0.047) | -0.001 (0.049) |
| Neuroticism | -0.023 (0.030) | -0.003 (0.031) | -0.015 (0.034) | -0.035 (0.035) | 0.003 (0.035) | -0.002 (0.039) | 0.021 (0.038) | 0.000 (0.039) | -0.029 (0.042) |
| Industry experience | | 0.000 (0.003) | 0.004 (0.003) | | 0.001 (0.003) | 0.004 (0.004) | -0.000 (0.004) | 0.004 (0.004) | |
| Failure experience | | 0.188 (0.123) | 0.230* (0.138) | | 0.045 (0.151) | 0.173 (0.173) | 0.387*** (0.144) | 0.248 (0.157) | |
| Serial entrepreneur | | -0.008 (0.052) | -0.163*** (0.060) | | 0.038 (0.058) | -0.161** (0.069) | -0.194*** (0.071) | -0.233*** (0.080) | |
| Female | | -0.090 (0.066) | -0.049 (0.074) | | -0.145* (0.076) | -0.075 (0.087) | 0.048 (0.084) | 0.020 (0.092) | |
| Opportunity driven | | 0.042 (0.069) | -0.064 (0.076) | | 0.085 (0.081) | -0.037 (0.092) | -0.052 (0.085) | -0.098 (0.090) | |
| University degree | | 0.247*** (0.050) | 0.133** (0.063) | | 0.377*** (0.057) | 0.159** (0.073) | -0.008 (0.065) | 0.142* (0.080) | |
| Founder age | | -0.013*** (0.003) | -0.015*** (0.003) | | -0.010*** (0.003) | -0.011*** (0.004) | -0.014*** (0.004) | -0.013*** (0.004) | |
| ln(employees) | | | 0.398*** (0.038) | | | 0.371*** (0.042) | | 0.348*** (0.048) | |
| Team | | | 0.116 (0.075) | | | 0.114 (0.083) | | -0.068 (0.113) | |
| ln(R&D) | | | 0.060*** (0.006) | | | 0.061*** (0.007) | | 0.028*** (0.009) | |
| Profit | | | -0.305*** (0.055) | | | -0.284*** (0.064) | | -0.217*** (0.069) | |
| Exporter | | | -0.009 (0.068) | | | 0.004 (0.078) | | -0.065 (0.094) | |
| Firm age | | | -0.140*** (0.018) | | | -0.107*** (0.020) | | -0.181*** (0.024) | |
| Limited liability | | | -0.164* (0.064) | | | 0.011 (0.075) | | -0.332*** (0.081) | |
| East Germany | | | 0.609*** (0.063) | | | 0.801*** (0.070) | | 0.282*** (0.082) | |
| Observations | 5,483 | 5,483 | 5,483 | 5,440 | 5,440 | 5,440 | 5,397 | 5,397 | 5,397 |
| Pseudo R-square | 0.004 | 0.020 | 0.176 | 0.010 | 0.030 | 0.220 | 0.021 | 0.043 | 0.137 |
| Joint significance of Big 5 | 15.78** | 10.29* | 2.18 | 15.63*** | 7.89 | 0.670 | 4.13 | 3.78 | 3.64 |

Notes: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain a constant; models 3, 6, and 9 also contain the set of industry and year dummies.

Table 6: Entrepreneurial Orientation and start-up subsidies

| | (1) Any Subsidy | (2) Any Subsidy | (3) Any Subsidy | (4) Grants | (5) Grants | (6) Grants | (7) Loans | (8) Loans | (9) Loans |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Competitiveness | 0.047*** (0.011) | 0.048*** (0.011) | 0.029** (0.012) | 0.028* (0.012) | 0.028** (0.012) | 0.009 (0.013) | 0.081*** (0.014) | 0.084*** (0.014) | 0.065*** (0.014) |
| Innovativeness | 0.056*** (0.012) | 0.067*** (0.012) | 0.014 (0.014) | 0.088*** (0.013) | 0.091*** (0.014) | 0.027* (0.015) | -0.018 (0.016) | 0.002 (0.016) | -0.014 (0.018) |
| Proactiveness | 0.070*** (0.014) | 0.075*** (0.014) | 0.053*** (0.015) | 0.068*** (0.016) | 0.069*** (0.016) | 0.045*** (0.016) | 0.038** (0.018) | 0.046** (0.018) | 0.031* (0.019) |
| Risk tolerance | 0.029** (0.012) | 0.030** (0.012) | 0.016 (0.013) | 0.024* (0.013) | 0.021 (0.014) | 0.003 (0.014) | 0.020 (0.015) | 0.026* (0.015) | 0.019 (0.016) |
| Autonomy | -0.004 (0.012) | -0.005 (0.013) | -0.011 (0.013) | -0.007 (0.014) | -0.004 (0.014) | -0.006 (0.015) | -0.000 (0.016) | -0.008 (0.016) | -0.019 (0.017) |
| Industry experience | | -0.001 (0.002) | -0.000 (0.002) | | -0.002 (0.002) | -0.002 (0.002) | | 0.001 (0.003) | 0.001 (0.003) |
| Failure experience | | 0.176*** (0.061) | 0.213*** (0.064) | | 0.240*** (0.068) | 0.298*** (0.071) | | 0.056 (0.077) | 0.050 (0.079) |
| Serial entrepreneur | | -0.207*** (0.035) | -0.281*** (0.037) | | -0.206*** (0.039) | -0.288*** (0.042) | | -0.164*** (0.044) | -0.192*** (0.048) |
| Female | | 0.044 (0.040) | 0.026 (0.043) | | 0.018 (0.045) | 0.031 (0.048) | | 0.037 (0.051) | -0.021 (0.054) |
| Opportunity driven | | -0.018 (0.040) | -0.054 (0.042) | | -0.049 (0.044) | -0.084* (0.046) | | 0.042 (0.052) | 0.017 (0.055) |
| University degree | | 0.040 (0.032) | 0.023 (0.037) | | 0.144*** (0.035) | 0.101** (0.041) | | -0.148*** (0.041) | -0.094* (0.049) |
| Founder age | | -0.005*** (0.002) | -0.007*** (0.002) | | -0.002 (0.002) | -0.004* (0.002) | | -0.008*** (0.003) | -0.009*** (0.003) |
| ln(employees) | | | 0.306*** (0.025) | | | 0.298*** (0.028) | | | 0.277*** (0.032) |
| Team | | | 0.081** (0.038) | | | 0.035 (0.042) | | | 0.121** (0.048) |
| ln(R&D) | | | 0.031*** (0.004) | | | 0.037*** (0.004) | | | 0.010* (0.005) |
| Profit | | | -0.216*** (0.033) | | | -0.208*** (0.037) | | | -0.203*** (0.041) |
| Exporter | | | 0.121*** (0.041) | | | 0.105** (0.045) | | | 0.096* (0.053) |
| Firm age | | | -0.094*** (0.011) | | | -0.075*** (0.012) | | | -0.121*** (0.015) |
| Limited liability | | | -0.172*** (0.038) | | | -0.129*** (0.043) | | | -0.235*** (0.049) |
| East Germany | | | 0.423*** (0.041) | | | 0.558*** (0.044) | | | 0.066 (0.055) |
| Observations | 11023 | 11023 | 11023 | 10895 | 10895 | 10895 | 10764 | 10764 | 10764 |
| Pseudo R-square | 0.047 | 0.054 | 0.112 | 0.050 | 0.058 | 0.127 | 0.041 | 0.054 | 0.101 |
| Joint significance of EO [chi ² (5)] | 142.68*** | 157.36*** | 37.26*** | 132.09*** | 127.62*** | 17.67*** | 57.03*** | 69.41*** | 34.24*** |

Notes: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain year fixed effects and a constant; models 3, 6, and 9 also contain the set of industry dummies.

Table 7: Big 5 personality traits and alternative sources of financing

| | (1) VC | (2) VC | (3) VC | (4) Bank | (5) Bank | (6) Bank | (7) Family & Friends | (8) Family & Friends | (9) Family & Friends |
|--|----------------------------|---------------------------|---------------------------|-----------------------------|-----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| Openness | 0.167*** (0.059) | 0.151** (0.061) | 0.117* (0.068) | -0.143*** (0.044) | -0.121*** (0.045) | -0.083* (0.047) | 0.179*** (0.053) | 0.199*** (0.054) | 0.199*** (0.056) |
| Conscientiousness | -0.087 (0.063) | 0.000 (0.069) | 0.061 (0.082) | 0.062 (0.055) | 0.005 (0.056) | -0.035 (0.058) | -0.020 (0.060) | -0.033 (0.063) | -0.055 (0.064) |
| Extraversion | 0.017 (0.061) | 0.003 (0.062) | 0.009 (0.071) | 0.054 (0.046) | 0.049 (0.047) | 0.038 (0.048) | 0.035 (0.053) | 0.004 (0.053) | 0.001 (0.054) |
| Agreeableness | -0.121* (0.065) | -0.105 (0.066) | -0.145* (0.076) | 0.029 (0.051) | 0.039 (0.052) | 0.050 (0.054) | -0.081 (0.059) | -0.061 (0.060) | -0.073 (0.061) |
| Neuroticism | -0.097* (0.053) | -0.018 (0.057) | 0.036 (0.069) | 0.018 (0.043) | -0.018 (0.044) | -0.025 (0.047) | 0.178*** (0.047) | 0.164*** (0.049) | 0.139*** (0.049) |
| Industry experience | | -0.014*** (0.005) | -0.013** (0.005) | | 0.012*** (0.004) | 0.007* (0.004) | | -0.003 (0.005) | -0.001 (0.005) |
| Failure experience | | -0.101 (0.205) | 0.109 (0.238) | | -0.246 (0.174) | -0.133 (0.185) | | -0.007 (0.174) | -0.107 (0.179) |
| Serial entrepreneur | | 0.203** (0.095) | -0.016 (0.106) | | -0.010 (0.075) | 0.044 (0.078) | | 0.006 (0.092) | 0.084 (0.097) |
| Female | | -0.309** (0.127) | -0.306** (0.140) | | -0.069 (0.091) | -0.119 (0.095) | | 0.107 (0.106) | 0.058 (0.110) |
| Opportunity driven | | 0.465*** (0.172) | 0.329 (0.205) | | -0.175* (0.095) | -0.150 (0.099) | | -0.234** (0.110) | -0.173 (0.112) |
| University degree | | 0.513*** (0.094) | -0.001 (0.111) | | -0.342*** (0.072) | -0.240*** (0.081) | | 0.048 (0.084) | 0.167* (0.093) |
| Founder age | | -0.002 (0.005) | -0.003 (0.005) | | -0.013*** (0.004) | -0.013*** (0.004) | | -0.025*** (0.005) | -0.023*** (0.005) |
| ln(employees) | | | 0.416*** (0.067) | | | 0.261*** (0.054) | | | -0.032 (0.064) |
| Team | | | 0.254** (0.123) | | | -0.009 (0.105) | | | -0.111 (0.136) |
| ln(R&D) | | | 0.051*** (0.010) | | | -0.019** (0.009) | | | 0.004 (0.010) |
| Profit | | | -0.753*** (0.122) | | | 0.322*** (0.073) | | | -0.073 (0.086) |
| Exporter | | | -0.174 (0.125) | | | -0.022 (0.097) | | | 0.181* (0.109) |
| Firm age | | | -0.063* (0.033) | | | 0.085*** (0.021) | | | -0.025 (0.027) |
| Limited liability | | | 0.464*** (0.146) | | | -0.082 (0.087) | | | -0.252** (0.100) |
| East Germany | | | 0.158 (0.137) | | | 0.038 (0.095) | | | -0.036 (0.114) |
| Observations | 1,916 | 1,916 | 1,916 | 1,915 | 1,915 | 1,915 | 1,915 | 1,915 | 1,915 |
| Pseudo R-square | 0.031 | 0.091 | 0.299 | 0.006 | 0.036 | 0.092 | 0.028 | 0.069 | 0.096 |
| Joint significance of Big 5 [chi ² (5)] | 14.21** | 7.50 | 6.42 | 12.07** | 8.16 | 4.57 | 30.13*** | 28.71*** | 25.02*** |

Notes: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain a constant; models 3, 6, and 9 also contain the set of industry dummies.

Table 8: Entrepreneurial orientation and alternative sources of financing

| | (1) VC | (2) VC | (3) VC | (4) Bank | (5) Bank | (6) Bank | (7) Family & Friends | (8) Family & Friends | (9) Family & Friends |
|---|----------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|---------------------------|----------------------------|---------------------------|---------------------------|
| Competitiveness | 0.075*** (0.019) | 0.075*** (0.020) | 0.048** (0.022) | 0.030* (0.016) | 0.031* (0.016) | 0.018 (0.016) | -0.020 (0.017) | -0.018 (0.018) | -0.012 (0.018) |
| Innovativeness | 0.202*** (0.022) | 0.162*** (0.023) | 0.078*** (0.026) | -0.115*** (0.017) | -0.090*** (0.018) | -0.038* (0.020) | -0.047** (0.019) | -0.011 (0.020) | -0.003 (0.022) |
| Proactiveness | 0.068** (0.030) | 0.056* (0.030) | 0.013 (0.031) | 0.037* (0.020) | 0.048** (0.020) | 0.040* (0.021) | 0.001 (0.022) | 0.006 (0.022) | 0.002 (0.022) |
| Risk tolerance | 0.117*** (0.022) | 0.091*** (0.023) | 0.051** (0.024) | -0.030* (0.017) | -0.008 (0.018) | -0.008 (0.018) | 0.037* (0.019) | 0.039** (0.020) | 0.044** (0.020) |
| Autonomy | -0.020 (0.024) | -0.002 (0.025) | 0.010 (0.027) | 0.009 (0.018) | 0.000 (0.018) | -0.000 (0.018) | 0.040** (0.019) | 0.029 (0.019) | 0.019 (0.020) |
| Industry experience | | -0.011*** (0.004) | -0.009** (0.004) | | 0.014*** (0.003) | 0.009*** (0.003) | | -0.006** (0.003) | -0.004 (0.003) |
| Failure experience | | -0.502*** (0.136) | -0.379*** (0.143) | | 0.077 (0.085) | 0.135 (0.088) | | 0.095 (0.091) | 0.067 (0.093) |
| Serial entrepreneur | | 0.214*** (0.063) | 0.049 (0.067) | | -0.080 (0.050) | -0.042 (0.054) | | -0.112** (0.054) | -0.046 (0.058) |
| Female | | -0.019 (0.078) | -0.062 (0.084) | | -0.032 (0.058) | -0.058 (0.060) | | 0.109* (0.063) | 0.096 (0.067) |
| Opportunity driven | | 0.142 (0.101) | 0.061 (0.105) | | -0.026 (0.062) | -0.044 (0.064) | | -0.122* (0.067) | -0.118* (0.068) |
| University degree | | 0.497*** (0.070) | 0.253*** (0.079) | | -0.267*** (0.048) | -0.202*** (0.055) | | -0.207*** (0.051) | -0.085 (0.056) |
| Founder age | | 0.001 (0.003) | -0.004 (0.003) | | -0.005** (0.003) | -0.006** (0.003) | | -0.013*** (0.003) | -0.014*** (0.003) |
| ln(employees) | | | 0.340*** (0.046) | | | 0.393*** (0.037) | | | -0.081* (0.044) |
| Team | | | 0.203*** (0.069) | | | 0.056 (0.054) | | | -0.000 (0.060) |
| ln(R&D) | | | 0.036*** (0.007) | | | -0.018*** (0.006) | | | 0.015** (0.006) |
| Profit | | | -0.579*** (0.073) | | | 0.122*** (0.046) | | | -0.135*** (0.051) |
| Exporter | | | 0.101 (0.075) | | | 0.109* (0.060) | | | 0.095 (0.066) |
| Firm age | | | -0.063** (0.026) | | | 0.083*** (0.016) | | | 0.018 (0.019) |
| Limited liability | | | 0.320*** (0.092) | | | -0.155*** (0.056) | | | -0.281*** (0.060) |
| East Germany | | | -0.015 (0.095) | | | 0.005 (0.066) | | | -0.034 (0.071) |
| Observations | 4,880 | 4,880 | 4,880 | 4,878 | 4,878 | 4,878 | 4,880 | 4,880 | 4,880 |
| Pseudo R-square | 0.099 | 0.139 | 0.239 | 0.027 | 0.045 | 0.106 | 0.007 | 0.037 | 0.058 |
| Joint significance of EO [chi ² (5)] | 231.85*** | 138.43*** | 25.46*** | 60.19*** | 31.61*** | 8.05 | 14.43** | 6.58 | 5.82 |

Notes: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain year fixed effects and a constant; models 3, 6, and 9 also contain the set of industry dummies.

4.2. Distinguishing the Rejection Decision

For the most part of our data, we cannot empirically distinguish the impact of founder personality on the self-selection and policymaker selection decisions separately as information on rejection is only available for two most recent years in our dataset. Since the analysis so far does not distinguish between the propensity to participate in public funding programs and the success probability conditional on application, we estimate the likelihood of a founder being rejected by public funders using some limited data for the two most recent years. We begin by looking descriptively at the rejection rate in the sample and across sectors (Table 9). The mean score for rejection of less than 3% suggests that the rejection rate for subsidies in our data is generally low, and that most start-ups that apply seem to be awarded subsidies once they incurred the direct and indirect application costs (e.g., time, effort, disclosure). There is, however, some variation across sectors with higher rejection rates in knowledge-intensive manufacturing sectors and software. This could be due to the greater levels of information asymmetries that typically characterise these sectors and hence leave more room for uncertainty on the side of the public funder. Alternatively, it could be due to greater numbers of applicants and thus, intensified competition for funding in these sectors.

Table 9: Rejection rates by sector

| Industry | rejection | | N | % |
|-------------------------|-----------|-------|-------|-------|
| | 0 | 1 | | |
| Cutting-edge tech | 87.84 | 12.16 | 74 | 2.74 |
| High-tech | 92.65 | 7.35 | 68 | 2.52 |
| Tech. services | 98.57 | 1.43 | 419 | 15.5 |
| Software | 94.06 | 5.94 | 202 | 7.47 |
| Low-tech | 98.06 | 1.94 | 258 | 9.54 |
| Knowledge-int. services | 100 | 0 | 285 | 10.54 |
| Other company services | 99.29 | 0.71 | 281 | 10.40 |
| Creative services | 98.11 | 1.89 | 212 | 7.84 |
| Other services | 99.52 | 0.48 | 210 | 7.77 |
| Construction | 99.96 | 1.04 | 385 | 14.24 |
| Trade | 97.09 | 2.91 | 309 | 11.43 |
| Total | 97.89 | 2.11 | 2,703 | 100 |

Turning to the models, when considering the likelihood of unsuccessfully applying for subsidy programs, we find that higher agreeableness predicts rejection, but none of the other baseline personality traits. Due to lack of survey questions on the full set of entrepreneurial orientation measures, we can only test for the measure of risk tolerance and find that it correlated positively, but statistically insignificantly, with the rejection likelihood before as well as after founder and firm characteristics are accounted for. While it should be noted that only very few firms report rejected application in our sample, the results suggest that founder personality does not seem to matter much in policymakers' decisions to reject or support an application.

4.3 Robustness Checks and Extensions

First, we check the robustness of our results by accounting for the interdependence of the different sources of financing. To allow for the possibility of multiple funding sources being used simultaneously, we estimate simultaneous equation models via a conditional mixed process estimator. The tests of correlation of errors across equations indicate that there is indeed interdependence between financing sources. These results with regard to personality are, however, very similar as can be seen in Table B.1 and B.2 in Appendix B.

Next, we test the robustness of the results to an alternative specification of the personality measures. In particular, we use the predicted factor scores as regressors in the simultaneous equation models and the results are quite similar indicating that the results discussed so far are not driven by how we utilize the item responses. See Table B.3 and B.4 in Appendix B.

Finally, we take into account that not all founders may seek external financing and hence estimate two-stage selection models. The first stage captures the decision to seek access to any type of external financing and the second stage focuses on the type of financing. Seeking

external financing is defined based on two types of information. First, we use information on whether the founder indicated to have experienced problems when trying to raise external financing. This provides us with information that the founder sought external financing also for those founders that do not report to have any. Second, we use the observed sources of external financing to create a binary indicator for seeking external financing. The outcome variable in the selection stage is therefore one if either the firm reported to have obtained some form of external financing or if it reported to have had problems raising external financing. The identification of the model requires at least one exclusion restriction that predicts the outcome variable in the first stage, but not in the second. Following Vaznyte and Andries (2019), we use the information of whether founders had previously been unemployed, in particular whether they received unemployment benefits, as exclusion restriction (ER). Founders coming out of unemployment should have fewer own funds and may therefore be more likely to seek external financing. The ER is indeed positive and statistically significant in the first stage.

The second stage results for the baseline personality traits are hardly impacted by the inclusion of the selection stage (see Table 11 and 12 and Tables B.5 and B.6 for the detailed results). Yet, we see that higher values for openness are associated with a higher propensity to seek external financing in the first place. It is, however, still negatively associated with bank financing in the second stage. Moreover, higher scores for neuroticism still positively predict the likelihood to borrow from family and friends. With regard to entrepreneurial orientation, we find that all factors – except autonomy – predict the likelihood to seek external financing positively. Still, innovativeness remains positive and significant in the second stage for grants and VC financing (and negative for bank financing) and competitiveness predicts participating in loan-based programs.

Table 10: Personality and Rejection Likelihood

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|--------------------------|---------------------------|---------------------------|---------------------------|-------------------------|-------------------------|-------------------------|
| Openness | 0.186 (0.114) | 0.209* (0.117) | 0.186 (0.131) | 0.180 (0.130) | | | |
| Conscientiousness | -0.038 (0.111) | 0.009 (0.116) | -0.006 (0.137) | -0.003 (0.139) | | | |
| Extraversion | -0.052 (0.117) | -0.080 (0.113) | -0.035 (0.113) | -0.043 (0.108) | | | |
| Agreeableness | 0.188* (0.104) | 0.212** (0.098) | 0.238** (0.105) | 0.243** (0.103) | | | |
| Neuroticism | 0.068 (0.108) | 0.059 (0.112) | 0.028 (0.126) | 0.036 (0.130) | | | |
| Risk tolerance | | | | 0.033 (0.064) | 0.020 (0.066) | 0.019 (0.060) | 0.033 (0.065) |
| Industry experience | | -0.024** (0.011) | -0.033*** (0.013) | -0.033*** (0.013) | | -0.024** (0.012) | -0.031*** (0.012) |
| Failure experience | | 0.073 (0.342) | 0.023 (0.371) | 0.021 (0.371) | | 0.150 (0.350) | 0.021 (0.375) |
| Serial entrepreneur | | -0.292 (0.215) | -0.420* (0.233) | -0.433* (0.230) | | -0.449** (0.209) | -0.416* (0.232) |
| Female | | -0.129 (0.236) | -0.143 (0.263) | -0.150 (0.259) | | -0.115 (0.228) | -0.055 (0.248) |
| Opportunity driven | | -0.164 (0.234) | -0.213 (0.228) | -0.207 (0.232) | | -0.101 (0.232) | -0.159 (0.234) |
| University degree | | 0.111 (0.183) | 0.132 (0.211) | 0.126 (0.210) | | 0.080 (0.173) | 0.092 (0.208) |
| Founder age | | -0.006 (0.008) | -0.003 (0.009) | -0.002 (0.009) | | -0.006 (0.008) | -0.002 (0.009) |
| ln(employees) | | | 0.512*** (0.122) | 0.509*** (0.122) | | 0.396*** (0.103) | 0.502*** (0.113) |
| ln(R&D) | | | 0.015 (0.021) | 0.015 (0.021) | | | 0.019 (0.022) |
| Limited liability | | | -0.362** (0.163) | -0.366** (0.163) | | | -0.417** (0.168) |
| Observations | 1,325 | 1,325 | 1,191 | 1,190 | 1,325 | 1,325 | 1,191 |
| Pseudo R-square | 0.021 | 0.065 | 0.225 | 0.225 | 0.000 | 0.076 | 0.207 |
| Joint significance of Big 5 [chi ² (5)] | 9.93* | 12.39** | 8.49 | - | - | - | - |
| Joint significance of Big 5 and risk tolerance [chi ² (6)] | - | - | - | 9.17 | - | - | - |

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All models contain a constant, exporter dummy, firm age, profit dummy and a location dummy (all statistically insignificant); models 3, 4, 6 and 7 also contain the set of industry dummies. Sector 6 and team dummy predict failure perfectly and 130 observations are not used in models 3, 4, 6 and 7.

Table 11: Big 5 personality traits and different sources of financing (selection model; joint estimation of second stage)

| | Selection Stage | Grant | Subsidized Loan | VC financing | Bank financing | Family & Friends |
|--------------------------|-----------------------------|--------------------------|--------------------------|---------------------------|-----------------------------|----------------------------|
| Openness | 0.075*** (0.027) | -0.010 (0.071) | -0.043 (0.064) | 0.115 (0.078) | -0.166*** (0.055) | 0.181*** (0.062) |
| Conscientiousness | -0.026 (0.032) | -0.016 (0.078) | -0.058 (0.070) | 0.106 (0.098) | -0.014 (0.069) | -0.047 (0.075) |
| Extraversion | <0.001 (0.027) | -0.044 (0.068) | -0.023 (0.066) | -0.032 (0.079) | 0.052 (0.055) | -0.013 (0.061) |
| Agreeableness | -0.033 (0.030) | -0.021 (0.074) | 0.006 (0.077) | -0.153* (0.090) | 0.061 (0.064) | -0.106 (0.073) |
| Neuroticism | 0.023 (0.026) | 0.085 (0.066) | -0.017 (0.062) | 0.017 (0.083) | -0.063 (0.056) | 0.152*** (0.058) |
| ER: Unemployed | 0.195** (0.094) | | | | | |
| Observations | 5,483 | | | | | |
| Log Likelihood | -5.3e+03 | | | | | |

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The model contains the full set of controls in both stages including year and sector fixed effects and a constant. See Table B.5 in the Appendix for the full table.

Table 12: EO personality and different sources of financing (selection model; joint estimation of second stage)

| | Selection Stage | Grant | Subsidized Loan | VC financing | Bank financing | Family & Friends |
|------------------------|----------------------------|---------------------------|---------------------------|----------------------------|----------------------------|--------------------------|
| Competitiveness | 0.053*** (0.010) | 0.007 (0.020) | 0.044** (0.020) | 0.037 (0.025) | 0.008 (0.019) | -0.026 (0.020) |
| Innovativeness | 0.024* (0.012) | 0.047** (0.023) | 0.004 (0.025) | 0.102*** (0.030) | -0.048** (0.023) | -0.003 (0.024) |
| Proactiveness | 0.040*** (0.013) | 0.022 (0.026) | 0.010 (0.027) | 0.014 (0.035) | 0.022 (0.024) | -0.017 (0.026) |
| Risk tolerance | 0.051*** (0.012) | -0.016 (0.022) | -0.009 (0.023) | 0.031 (0.028) | -0.013 (0.022) | 0.035 (0.023) |
| Autonomy | -0.007 (0.011) | -0.016 (0.022) | -0.017 (0.024) | 0.002 (0.031) | -0.006 (0.022) | 0.016 (0.023) |
| ER: Unemployed | 0.141** (0.064) | | | | | |
| Observations | 11,023 | | | | | |
| Log Likelihood | -1.3e+04 | | | | | |

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The model contains the full set of controls in both stages including year and sector fixed effects and a constant. See Table B.6 in the Appendix for the full table.

5. Conclusions

This paper provides new insights into the antecedents of start-up subsidies by examining whether and how founder personality shapes start-ups' participation in subsidy programmes. In doing so, this study contributes to the emerging research investigating start-up subsidies (Audretsch et al., 2020). Where current work has demonstrated their importance for alleviating financial constraints and driving start-up performance (e.g., Buffart et al., 2020; Hottenrott and Richstein, 2020), much remains unknown about what characteristics aid and inhibit start-ups to access this important source of finance. We contribute to this literature with novel evidence on the role of founders' personality. We theorise and demonstrate that founder entrepreneurial personality impacts start-ups use of subsidies and influences the *type* (grants or loans) of subsidies that start-ups seek and obtain. Start-ups with more entrepreneurially oriented founders seem better positioned to access subsidies, whereas those with less entrepreneurially oriented founders may not participate in such programmes. Particularly, founder innovativeness and competitiveness seem important for accessing start-up subsidies. Founder baseline Big 5-personality traits however seem not to play a role once we have controlled for other observable founder and firm-level characteristics. In providing the first evidence on personality, these results extend our understanding of entrepreneurial ventures' early-stage financing by showing that, over and above the observable characteristics presently studied in the literature, founder personality, can play a role in explaining start-ups access to subsidies. In doing so, we highlight the important role that unobservable characteristics can play in shaping start-ups ability to access subsidies. This is important to better inform policymakers, start-ups and academics on the enablers and barriers to accessing important subsidy programmes.

Our work also contributes to research on the evaluation of start-up subsidies. Evaluation studies often rely on research designs to identify the treatment effect that require a comprehensive understanding of the characteristics impacting access to subsidies. Our results

suggest that not capturing founder personality may result in an omitted variable bias, and thus, over- or under-estimate the effectiveness. Yet, our results also show that comprehensive coverage of observable founder and firm characteristics lessens the bias substantially by capturing some of the variance explained by personality, particularly in the case of baseline personality characteristics.

Second, we respond to calls for examinations of alternative predictors of start-up financing decisions (e.g., Hanssens et al., 2016) by comparing the role of personality in access to and use of private sources of finance to public subsidies. Our results demonstrate that founder personality shapes start-ups access to and use of private sources of finance, with entrepreneurial personality mattering most in venture capital, and baseline personality for family and friends. The results indicate that baseline personality traits matter more for private sources of early-stage finance than public subsidies. For entrepreneurial personality, while some characteristics play a similar role in the private sources and public subsidies, the results generally suggest that the role of entrepreneurial personality differs across sources of early-stage finance. This suggests that founder personality plays a critical role in explaining start-ups access to and use of the key sources of early-stage finance, and they may predispose their start-up to seeking certain forms of early-stage finance, and potentially restrict their access to others. Our insights contribute a more comprehensive understanding of the critical (unobservable) characteristics explaining start-ups financing decisions, and in turn, impacting their survival and performance. This overcomes deficits in existing theory that do not explain *how* and *why* personality shapes start-up performance and survival (Vaznyte and Andries, 2019; Yin et al., 2020) by demonstrating that one likely path is through their critical role in shaping start-ups access to early-stage finance. Moreover, by demonstrating the importance of founder entrepreneurial orientation in start-up financing decisions, we contribute to a broader understanding of its

system of effects beyond performance (Covin and Wales, 2019) and respond to Wales et al.'s (2020) call for greater attention to founder and top management entrepreneurial orientation.

Finally, we take a step toward distinguishing where in the subsidy process personality matters by exploiting some information on rejection within our dataset (Huergo and Trenado, 2010; Mina et al., 2021). The descriptive data suggests that the rejection rates of start-up subsidies are low (<3%). Some sectoral variation is observed with greater rejection rates in higher technology and software industries, but these remain generally low (<13%). Empirically our results provide little evidence for founder personality impacting policymakers' rejection decision. The descriptive and empirical evidence suggests that the role of founder personality for start-up subsidies may be more important in influencing their self-selection into subsidies, rather than policymaker award decisions. The selection model also provided support for this interpretation by demonstrating the significant role of personality in shaping whether start-ups seek any source of external finance.

These results have important implications for start-ups and policymakers. First, our results may be of interest to policymakers designing start-up subsidies by providing insights into the types of start-ups that they attract with their programmes. Our results on entrepreneurial personality suggest that it is largely more innovative and growth-oriented start-ups that are accessing their start-up subsidies. This is contrary to concerns that subsidies may sustain low-quality start-ups (Colombo et al., 2007) and reassuring by suggesting that start-ups with high entrepreneurial orientation founders - which typically are more innovative and growth oriented (Engelen et al., 2015; Rosenbusch et al, 2013) and thus, more likely to produce societal benefits - are more likely to make use of subsidies. Second, our results suggest that different founder personalities may favour seeking subsidies in the form of loans or grants. For policymakers, this suggests that the two instruments are targeting different founder profiles augmenting recent

insights that there is ‘task segmentation’ in the portfolio of start-up policy instruments (Giraud et al. 2019). Finally, our results suggest that baseline personality traits matter for firms’ access to private sources of finance, and thus, may act as an enabler or constraint on their access to VC, banks and family and friends.

Our study has several limitations that in turn, provide opportunities for future research. First, we have focused on two dominant configurations of founder personality in illustrating the importance of founder personality in shaping start-ups access to subsidies. A broad range of personality traits have been identified in the literature (Kerr et al, 2017), however, and we believe future research should consider the importance of other personality traits (such as altruism, cooperativeness, honesty, trust, or optimism/pessimism for example) in start-up access to subsidies and finance more generally. Second, we draw our data from a single advanced western country, namely, Germany. As innovation policy mixes and systems can vary significantly across countries (Magro and Wilson, 2019), we believe extending our insights to other countries and contexts is valuable in understanding their role within different innovation policy mixes and systems. Finally, while we take an important first step toward distinguishing the selection and award components of accessing subsidies, our data is limited in this respect as the information is only available two years and for entrepreneurial orientation, only the information for risk is available in these years. Thus, we believe an interesting avenue for future work is to explore this distinction and the role of founder personality– and other characteristics – in the application and award decisions.

References

- Ahn, J.M., Minshall, T. and Mortara, L., 2017. Understanding the human side of openness: the fit between open innovation modes and CEO characteristics. *R&D Management*, 47(5), 727-740.
- Anderson, B.S., Kreiser, P.M., Kuratko, D.F., Hornsby, J.S. and Eshima, Y., 2015. Reconceptualizing entrepreneurial orientation. *Strategic Management Journal*, 36(10), 1579-1596.
- Antonelli, C. and Crespi, F., 2013. The "Matthew effect" in R&D public subsidies: The Italian evidence. *Technological Forecasting and Social Change*, 80(8), 1523-1534.
- Audretsch, D., Colombelli, A., Grilli, L., Minola, T. and Rasmussen, E., 2020. Innovative start-ups and policy initiatives. *Research Policy*, 49(10), 104027.
- Bernardino S, Santos J.F., 2016. Financing social ventures by crowdfunding: The influence of entrepreneurs' personality traits. *The International Journal of Entrepreneurship and Innovation* 17 (3), 173-183.
- Blanes, J.V. and Busom, I., 2004. Who participates in R&D subsidy programs? The case of Spanish manufacturing firms. *Research Policy*, 33(10), 1459-1476.
- Brandstätter, H., 2011. Personality aspects of entrepreneurship: A look at five meta-analyses. *Personality and Individual Differences*, 51(3), 222-230.
- Bruneel, J., Clarysse, B., Bobelyn, A. and Wright, M., 2020. Liquidity events and VC-backed academic spin-offs: The role of search alliances. *Research Policy*, 49(10), 104035.
- Buffart, M., Croidieu, G., Kim, P.H. and Bowman, R., 2020. Even winners need to learn: How government entrepreneurship programs can support innovative ventures. *Research Policy*, 49(10), 104052.
- Busom, I., Corchuelo, B. and Martínez-Ros, E., 2014. Tax incentives or subsidies for business R&D? *Small Business Economics*, 43(3), 571-596.
- Caggese, A., 2019. Financing constraints, radical versus incremental innovation, and aggregate productivity. *American Economic Journal: Macroeconomics* 11(2), 275-309.
- Caliendo, M., 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.
- Cantner, U. and Kösters, S., 2012. Picking the winner? Empirical evidence on the targeting of R&D subsidies to start-ups. *Small Business Economics*, 39(4), 921-936.
- Cassar, G., 2004. The financing of business start-ups. *Journal of Business Venturing*, 19(2), 261-283.
- Chapman, G. and Hewitt-Dundas, N., 2018. The effect of public support on senior manager attitudes to innovation. *Technovation*, 69, 28-39.
- Chapman, G., Lucena, A. and Afcha, S., 2018. R&D subsidies & external collaborative breadth: Differential gains and the role of collaboration experience. *Research Policy*, 47(3), 623-636.

- Chirico, F., Sirmon, D.G., Sciascia, S. and Mazzola, P., 2011. Resource orchestration in family firms: Investigating how entrepreneurial orientation, generational involvement, and participative strategy affect performance. *Strategic Entrepreneurship Journal*, 5(4), 307-326.
- Colombo, M.G., Grilli, L., and Verga, C. 2007. High-tech start-up access to public funds and venture capital: Evidence from Italy. *International Review of Applied Economics* 21(3), pp. 381-402.
- Colombo, M. G., Grilli, L. and Murtinu, S., 2011. R&D subsidies and the performance of high-tech start-ups. *Economics Letters* 112(1), 97 – 99.
- Colombo, M. G., Giannangeli, S. and Grilli, L., 2012. Public subsidies and the employment growth of high-tech start-ups: assessing the impact of selective and automatic support schemes. *Industrial and Corporate Change* 22(5), 1273–1314.
- Conti, A., 2018. Entrepreneurial finance and the effects of restrictions on government R&D subsidies. *Organization Science* 29(1), 134–153.
- Covin, J.G. and Lumpkin, G.T., 2011. Entrepreneurial orientation theory and research: Reflections on a needed construct. *Entrepreneurship Theory and Practice* 35(5), 855-872.
- Covin, J. G., & Slevin, D. P. 1988. The influence of organization structure on the utility of an entrepreneurial top management style. *Journal of Management Studies*, 25, 217–234.
- Covin, J.G. and Slevin, D.P., 1989. Strategic management of small firms in hostile and benign environments. *Strategic Management Journal* 10(1), 75-87.
- Covin, J.G. and Slevin, D.P., 1991. A conceptual model of entrepreneurship as firm behavior. *Entrepreneurship Theory and Practice* 16(1), 7-26.
- Covin, J. G. (1991). Entrepreneurial versus conservative firms: A comparison of strategies and performance. *Journal of Management Studies*, 28, 439–462.
- Covin, J.G. and Wales, W.J., 2012. The measurement of entrepreneurial orientation. *Entrepreneurship Theory and Practice* 36(4), 677-702.
- Covin, J.G. and Wales, W.J., 2019. Crafting high-impact entrepreneurial orientation research: Some suggested guidelines. *Entrepreneurship Theory and Practice* 43(1), pp.3-18.
- Covin, J.G., Rigtering, J.C., Hughes, M., Kraus, S., Cheng, C.F. and Bouncken, R.B., 2020. Individual and team entrepreneurial orientation: Scale development and configurations for success. *Journal of Business Research*, 112, 1-12.
- de Jong, A., Song, M. and Song, L.Z., 2013. How lead founder personality affects new venture performance: The mediating role of team conflict. *Journal of Management* 39(7), 1825-1854.
- Dencker, J.C. and Gruber, M., 2015. The effects of opportunities and founder experience on new firm performance. *Strategic Management Journal* 36(7), 1035-1052.
- Denes, M., Howell, S.T., Mezzaanotti, F., Wang, X. and Xu, T., 2020. Investor tax credits and entrepreneurship: Evidence from U.S. states. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3596342. Accessed: 24/02/2021.
- Dimos, C. and Pugh, G., 2016. The effectiveness of R&D subsidies: A meta-regression analysis of the evaluation literature. *Research Policy* 45(4), 797-815.

- Engelen, A., Gupta, V., Strenger, L. and Brettel, M., 2015. Entrepreneurial orientation, firm performance, and the moderating role of transformational leadership behaviours. *Journal of Management* 41(4), 1069-1097.
- Falk, R., 2007. Measuring the effects of public support schemes on firms' innovation activities: Survey evidence from Austria. *Research Policy*, 36(5), pp.665-679.
- Fryges, H., Gottschalk, S. and Kohn, K. (2009), The KfW/ZEW start-up panel: design and research potential, ZEW-Centre for European Economic Research Discussion Paper (09-053).
- Gavetti, G. and Levinthal, D., 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly* 45(1), 113-137.
- Giraud, E. Giudici, G. and Grilli, L., (2019), Entrepreneurship policy and the financing of young innovative companies: Evidence from the Italian Startup Act. *Research Policy* 48(9), 103801.
- George, J.M. and Zhou, J., 2001. When openness to experience and conscientiousness are related to creative behaviour: an interactional approach. *Journal of Applied Psychology* 86(3), 513.
- Gruber, M., MacMillan, I.C. and Thompson, J.D., 2013. Escaping the prior knowledge corridor: What shapes the number and variety of market opportunities identified before market entry of technology start-ups? *Organization Science* 24(1), 280-300.
- Haeussler, C., Harhoff, D. and Mueller, E., 2014. How patenting informs VC investors—The case of biotechnology. *Research Policy* 43(8), 1286-1298.
- Hahn, D., Minola, T. and Eddleston, K.A., 2019. How do Scientists Contribute to the Performance of Innovative Start-ups? An Imprinting Perspective on Open Innovation. *Journal of Management Studies* 56(5), 895-928.
- Halder, S., Roy, A. and Chakraborty, P.K., 2017. The influence of personality traits on information seeking behaviour of students. *Malaysian Journal of Library & Information Science* 15(1), 41-53.
- Haltiwanger, J., Jarmin, R. S. and Miranda, J., 2013. Who creates jobs? Small versus large versus young. *The Review of Economics and Statistics* 95(2), 347–361.
- Hanssens, J., Deloof, M. and Vanacker, T., 2016. The evolution of debt policies: New evidence from business startups. *Journal of Banking & Finance* 65, 120-133.
- Hayward, M.L.A., Shepherd, D.A., & Griffin, D. 2006. A hubris theory of entrepreneurship. *Management Science*. 52(2), pp. 160-172.
- Heinström, J., 2003. Five personality dimensions and their influence on information behaviour. *Information Research* 9(1), 9-1.
- Hottenrott, H. and Peters, B., 2012. Innovative capability and financing constraints for innovation: more money, more innovation? *Review of Economics and Statistics* 94(4), 1126-1142.
- Hottenrott, H. and Lopes-Bento, C., 2014. (International) R&D collaboration and SMEs: The effectiveness of targeted public R&D support schemes. *Research Policy* 43(6), 1055-1066.
- Hottenrott, H., Lins, E., and Lutz, E., 2018. Public subsidies and new ventures' use of bank loans. *Economics of Innovation and New Technology* 27, 786-808.

- Hottenrott, H. and Richstein, R., 2020. Start-up subsidies: Does the policy instrument matter?', *Research Policy* 49(1), 103888.
- Hottenrott, H., Lopes-Bento, C. and Veugelers, R., 2017. Direct and cross scheme effects in a research and development subsidy program. *Research Policy* 46(6), 1118-1132.
- Howell, S. T., 2017. Financing innovation: Evidence from R&D grants, *American Economic Review* 107(4), 1136–64.
- Hsu, D.H. and Lim, K., 2014. Knowledge brokering and organizational innovation: Founder imprinting effects. *Organization Science* 25(4), 1134-1153.
- Huergo, E. and Trenado, M., 2010. The application for and the awarding of low-interest credits to finance R&D projects. *Review of Industrial Organization*, 37(3), 237-259.
- Hughes, M. and Morgan, R.E., 2007. Deconstructing the relationship between entrepreneurial orientation and business performance at the embryonic stage of firm growth. *Industrial Marketing Management*, 36(5), 651-661.
- Humphreys, M.S. and Revelle, W., 1984. Personality, motivation, and performance: a theory of the relationship between individual differences and information processing. *Psychological Review* 91(2), 153.
- Hurtz, G.M. and Donovan, J.J., 2000. Personality and job performance: The Big Five revisited. *Journal of Applied Psychology* 85(6), 869.
- Kerr, S.P., Kerr, W.R., and Xu, T. 2017. Personality traits of entrepreneurs: A review of recent literature. Available from: https://www.nber.org/system/files/working_papers/w24097/w24097.pdf. Accessed: 11/12/2020.
- Krueger, N. and Sussan, F., 2017. Person-level entrepreneurial orientation: clues to the 'entrepreneurial mindset'? *International Journal of Business and Globalisation* 18(3), 382-395.
- Laursen, K. and Salter, A., 2006. Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal* 27(2), 131-150.
- Lumpkin, G.T. and Dess, G.G., 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review* 21(1), 135-172.
- Lumpkin, G.T., Cogliser, C.C. and Schneider, D.R., 2009. Understanding and measuring autonomy: An entrepreneurial orientation perspective. *Entrepreneurship Theory and Practice* 33(1), 47-69.
- Magro, E. and Wilson, J.R., 2019. Policy-mix evaluation: Governance challenges from new place-based innovation policies. *Research Policy* 48(10), 103612.
- Mai, J.E., 2016. *Looking for information: A survey of research on information seeking, needs, and behavior*. Emerald Group Publishing.
- Matz S., Chan Y.W.F., Kosinski M. (2016) Models of Personality. In: Tkalčič M., De Carolis B., de Gemmis M., Odić A., Košir A. (eds) *Emotions and Personality in Personalized Services*. Human–Computer Interaction Series. Springer, Cham. https://doi.org/10.1007/978-3-319-31413-6_3.

- McAdams, D.P., 1992. The five-factor model in personality: A critical appraisal. *Journal of Personality* 60(2), 329-361.
- McCrae, R. R., & Costa, P. T. (1997). Conceptions and correlates of openness to experience. In R.Hogan, J.Johnson, & S.Briggs (Eds.), *Handbook of Personality Psychology* (pp. 825–847). San Diego, CA: Academic Press.
- McCrae, R.R. and John, O.P., 1992. An introduction to the five-factor model and its applications. *Journal of Personality* 60(2).
- McKenny, A.F., Aguinis, H., Short, J.C. and Anglin, A.H., 2018. What doesn't get measured does exist: Improving the accuracy of computer-aided text analysis. *Journal of Management* 44(7), 2909-2933.
- Mina, A., Di Minin, A., Martelli, I., Testa, G. and Santoleri, P., 2021. Public funding of innovation: Exploring applications and allocations of the European SME Instrument. *Research Policy* 50(1), 104131.
- Mousa, F.T., Wales, W.J. and Harper, S.R., 2015. When less is more: EO's influence upon funds raised by young technology firms at IPO. *Journal of Business Research* 68(2), 306-313.
- Ostgaard, T. A. and Birley, S., 1994. Personal networks and firm competitive strategy—a strategic or coincidental match? *Journal of Business Venturing* 9(4), 281–305.
- Pearce, J.A., Fritz, D.A. and Davis, P.S., 2010. Entrepreneurial orientation and the performance of religious congregations as predicted by rational choice theory. *Entrepreneurship Theory and Practice* 34(1), 219-248.
- Pianesi, F., Mana, N., Cappelletti, A., Lepri, B. and Zancanaro, M., 2008, October. Multimodal recognition of personality traits in social interactions. In Proceedings of the 10th international conference on Multimodal interfaces, 53-60.
- Putniņš, T.J. and Sauka, A., 2020. Why does entrepreneurial orientation affect company performance? *Strategic Entrepreneurship Journal* 14(4), 711-735.
- Rauch, A., & Frese, A. 2000. *Psychological approaches to entrepreneurial success: A general model and an overview of findings*. In C. L. Cooper & I. T. Robertson (Eds.), *International review of industrial and organizational psychology* (pp. 100–135). Chichester Sussex: Wiley.
- Rauch, A. and Frese, M., 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.
- Rauch, A., Wiklund, J., Lumpkin, G.T. and Frese, M., 2009. Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future. *Entrepreneurship Theory and Practice* 33(3), 761-787.
- Roccas, S., Sagiv, L., Schwartz, S.H. and Knafo, A., 2002. The big five personality factors and personal values. *Personality and Social Psychology Bulletin* 28(6), 789-801.
- Rojas, F. and Huergo, E., 2016. Characteristics of entrepreneurs and public support for NTBFs. *Small Business Economics* 47(2), 363-382.
- Roodman, D. 2011. Estimating fully observed recursive mixed-process models with cmp. *Stata Journal* 11(2), 159-206.

- Rosenbusch, N., Rauch, A. and Bausch, A., 2013. The mediating role of entrepreneurial orientation in the task environment–performance relationship: A meta-analysis. *Journal of Management* 39(3), 633-659.
- Santamaría, L., Barge-Gil, A. and Modrego, A., 2010. Public selection and financing of R&D cooperative projects: Credit versus subsidy funding. *Research Policy* 39(4), 549-563.
- Saucier, G. and Goldberg, L.R., 1998. What is beyond the Big Five?. *Journal of Personality* 66, 495-524.
- Shane, S. and Stuart, T., 2002. Organizational endowments and the performance of university start-ups. *Management Science* 48(1), 154-170.
- Short, J. C., Broberg, J. C., Coglisier, C. C., & Brigham, K. H. (2010). Construct validation using computer-aided text analysis (CATA): An illustration using entrepreneurial orientation. *Organizational Research Methods* 13, 320–347.
- Smith, M.B., Hill, A.D., Wallace, J.C., Recendes, T. and Judge, T.A., 2018. Upsides to dark and downsides to bright personality: A multidomain review and future research agenda. *Journal of Management* 44(1), 191-217.
- Söderblom, A., Samuelsson, M., Wiklund, J. and Sandberg, R. 2015. Inside the black box of outcome additionality: Effects of early-stage government subsidies on resource accumulation and new venture performance. *Research Policy* 44(8), 1501 – 1512.
- State of European Tech. 2020. Investments by Geography & Industry. Available from: <https://2020.stateofeuropeantech.com/chapter/investments/article/investments-geo-industry/>. Accessed (04/01/2021).
- van Praag, C. M. and Versloot, P. H., 2007. What is the value of entrepreneurship? A review of recent research. *Small Business Economics* 29, 351–382.
- Vaznyte, E. and Andries, P., 2019. Entrepreneurial orientation and start-ups' external financing. *Journal of Business Venturing* 34(3), 439-458.
- Wales, W.J., Covin, J.G. and Monsen, E., 2020. Entrepreneurial orientation: The necessity of a multilevel conceptualization. *Strategic Entrepreneurship Journal* 14, 639– 660.
- Wennekers, S. and Thurik, R., 1999. Linking entrepreneurship and economic growth. *Small Business Economics* 13(1), 27-56.
- Winter, D. G., John, O. P., Stewart, A. J., Klohnen, E. C., & Duncan, L. E., 1998. Traits and motives: Toward and integration of two traditions in personality research. *Psychological Review* 105, 230-250.
- Yin, M., Hughes, M. and Hu, Q., 2020. Entrepreneurial orientation and new venture resource acquisition: why context matters. *Asia Pacific Journal of Management*, 1-30.
- Zhao, B. and Ziedonis, R., 2020. State governments as financiers of technology start-ups: Evidence from Michigan's R&D loan program, *Research Policy* 49(4), 103926.
- Zhao, H. and Seibert, S.E., 2006. The big five personality dimensions and entrepreneurial status: A meta-analytical review. *Journal of Applied Psychology* 91(2), 259.

Zhao, H., Seibert, S.E. and Lumpkin, G.T., 2010. The relationship of personality to entrepreneurial intentions and performance: A meta-analytic review. *Journal of Management* 36(2), 381-404.

Appendix A:

Table A.1: Personality survey questions Big 5 measures (OCEAN)

| |
|---|
| <i>Openness</i> |
| Item 1: I am someone who is original and who brings up new ideas. |
| Item 2: I am someone who values artistic experiences. |
| Item 3: I am someone who has vivid fantasies and a good imagination. |
| <i>Conscientiousness</i> |
| Item 4: I am someone who works thoroughly. |
| Item 5: I am someone who is rather lazy. |
| Item 6: I am someone who gets things done effectively and efficiently. |
| <i>Extraversion</i> |
| Item 7: I am someone who is communicative and talkative |
| Item 8: I am someone who can get out and be sociable. |
| Item 9: I am someone who is reserved. |
| <i>Agreeableness</i> |
| Item 10: I am someone who is at times a little rude to others. |
| Item 11: I am someone who can forgive. |
| Item 12: I am someone who is considerate and kind to others. |
| <i>Neuroticism</i> |
| Item 13: I am someone who worries often. |
| Item 14: I am someone who gets nervous easily. |
| Item 15: I am someone who is relaxed and can handle stress well. |
| Note: Original questions presented in German. Likert scale from 1 to 5 [1: does not apply to me at all, and 5: fully applies to me]; items 5, 9, 10, 15 enter the analysis in reversed scale. |

Table A.2: Entrepreneurial Orientation survey questions

| | | |
|--|--|--|
| <i>Risk tolerance</i> | | |
| Item 1: In order to achieve corporate goals even in uncertain situations, my company proceeds... | a)...rather cautiously, in a wait and see approach, in order to avoid wrong decisions. | b) ...rather bravely and aggressively so as not to miss any business opportunities. |
| Item 2: My company has a strong inclination for projects with... | a)...low risk and thus normal but secure returns. | b)...high risk and thus opportunities for very high returns. |
| <i>Proactiveness</i> | | |
| Item 3: In dealing with the competition, my company pursues the strategy... | a)... of reacting to the actions of competitors. | b)... of taking the initiative itself, to which competitors must then react. |
| Item 4: When introducing new products or services, business processes or technologies, in my market environment... | a)... I do not necessarily want to be one of the first with my company. | b)... I want to be one of the first with my company |
| <i>Autonomy</i> | | |
| Item 5: I generally believe that the best results come about when ... | a) ... employees have a say in which business ideas and projects are pursued. | b)... as Managing Director, I alone decide which business ideas and projects are pursued. |
| Item 6: In my company ... | a) ... employees make decisions on their own without constantly checking back with me. | b)... Employees must always check with me when making decisions. |
| <i>Innovativeness</i> | | |
| Item 7: My strategy is to make changes to my products or services ... | a)... in a small and incremental way. | b)... that are as far-reaching and fundamental. |
| Item 8: My company focuses on... | a)... marketing proven products or services. | b)... innovation, technology leadership and research and development. |
| <i>Competitiveness</i> | | |
| Item 9: My company ... | a)... does not make any specific efforts to win sales from competitors. | b)... is very aggressive and competitive. |
| Item 10: My company ... | a)... avoids conflicts with competitors whenever possible and follows the motto "live and let live". | b)... does not shy away from conflict in order to challenge competitors' market positions. |

Note: Original questions presented in German. Likert scale from 1 to 5 [1: completely a), 2: rather a), 3: undecided, 4: rather b), 5: completely b].

Table A.3: Factor analysis personality traits (Big 5)

| Factor | Eigenvalue | Difference | Proportion | Cumulative |
|----------------|--------------|--------------|--------------|--------------|
| Factor1 | 2.803 | 1.150 | 0.187 | 0.187 |
| Factor2 | 1.653 | 0.018 | 0.110 | 0.297 |
| Factor3 | 1.635 | 0.239 | 0.109 | 0.406 |
| Factor4 | 1.396 | 0.275 | 0.093 | 0.499 |
| Factor5 | 1.121 | 0.236 | 0.075 | 0.574 |
| Factor6 | 0.885 | 0.070 | 0.059 | 0.633 |
| Factor7 | 0.815 | 0.096 | 0.054 | 0.687 |
| Factor8 | 0.719 | 0.046 | 0.048 | 0.735 |
| Factor9 | 0.673 | 0.037 | 0.045 | 0.780 |
| Factor10 | 0.636 | 0.045 | 0.042 | 0.822 |
| Factor11 | 0.592 | 0.039 | 0.040 | 0.862 |
| Factor12 | 0.553 | 0.011 | 0.037 | 0.899 |
| Factor13 | 0.542 | 0.038 | 0.036 | 0.935 |
| Factor14 | 0.504 | 0.032 | 0.034 | 0.969 |
| Factor15 | 0.472 | . | 0.032 | 1.000 |

Note: LR test: independent vs. saturated: $\chi^2(105) = 13,000$ Prob> $\chi^2 = 0.000$.

Table A.4: Rotated factor loadings (pattern matrix) and unique variances

| Variable | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Uniqueness |
|------------------|--------------|--------------|--------------|--------------|--------------|------------|
| Openness 1 | 0.063 | 0.732 | 0.082 | -0.118 | -0.117 | 0.411 |
| Openness 2 | -0.156 | 0.713 | -0.175 | 0.136 | 0.076 | 0.487 |
| Openness 3 | 0.053 | 0.796 | -0.021 | -0.097 | -0.031 | 0.367 |
| Conscientiousnes | -0.092 | -0.049 | 0.820 | 0.054 | 0.076 | 0.340 |
| Conscientiousnes | 0.054 | -0.181 | 0.662 | -0.016 | -0.046 | 0.567 |
| Conscientiousnes | -0.003 | 0.060 | 0.787 | -0.112 | -0.066 | 0.384 |
| Extraversion 1 | 0.774 | 0.068 | 0.022 | 0.160 | 0.067 | 0.332 |
| Extraversion 2 | 0.791 | 0.024 | -0.004 | 0.131 | 0.100 | 0.355 |
| Extraversion 3 | 0.738 | -0.124 | -0.092 | -0.241 | -0.134 | 0.389 |
| Agreeableness 1 | -0.018 | -0.155 | -0.089 | 0.786 | -0.162 | 0.404 |
| Agreeableness 2 | 0.148 | 0.139 | -0.034 | 0.483 | -0.033 | 0.694 |
| Agreeableness 3 | 0.109 | 0.055 | 0.104 | 0.735 | 0.068 | 0.361 |
| Neuroticism 1 | 0.004 | 0.025 | 0.134 | 0.023 | 0.751 | 0.419 |
| Neuroticism 2 | 0.025 | -0.009 | -0.069 | -0.019 | 0.779 | 0.391 |
| Neuroticism 3 | 0.057 | -0.160 | -0.109 | -0.228 | 0.641 | 0.490 |

Table A.5: Factor analysis entrepreneurial orientation

| Factor | Eigenvalue | Difference | Proportion | Cumulative |
|----------------|--------------|--------------|--------------|--------------|
| Factor1 | 2.512 | 1.274 | 0.251 | 0.251 |
| Factor2 | 1.238 | 0.143 | 0.124 | 0.375 |
| Factor3 | 1.095 | 0.144 | 0.110 | 0.485 |
| Factor4 | 0.951 | 0.089 | 0.095 | 0.580 |
| Factor5 | 0.863 | 0.069 | 0.086 | 0.666 |
| Factor6 | 0.793 | 0.054 | 0.079 | 0.745 |
| Factor7 | 0.739 | 0.062 | 0.074 | 0.819 |
| Factor8 | 0.677 | 0.108 | 0.068 | 0.887 |
| Factor9 | 0.569 | 0.008 | 0.057 | 0.944 |
| Factor10 | 0.561 | . | 0.056 | 1.000 |

Note: LR test: independent vs. saturated: $\chi^2(45) = 1.2e+04$ Prob> $\chi^2 = 0.000$.

Table A.6: Rotated factor loadings (pattern matrix) and unique variances (entrepreneurial orientation)

| Variable | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Uniqueness |
|-------------------|--------------|--------------|--------------|--------------|--------------|------------|
| Proactiveness 1 | 0.003 | -0.028 | 0.054 | 0.921 | 0.007 | 0.148 |
| Proactiveness 2 | 0.593 | 0.092 | -0.147 | 0.349 | 0.022 | 0.444 |
| Innovativeness 1 | 0.786 | -0.102 | 0.036 | 0.052 | -0.054 | 0.375 |
| Innovativeness 2 | 0.691 | 0.031 | 0.174 | -0.217 | 0.034 | 0.436 |
| Competitiveness 1 | -0.065 | 0.847 | -0.017 | 0.064 | -0.004 | 0.291 |
| Competitiveness 2 | -0.021 | 0.859 | 0.018 | -0.126 | -0.003 | 0.295 |
| Risk tolerance 1 | -0.047 | 0.093 | 0.776 | 0.146 | -0.007 | 0.320 |
| Risk tolerance 2 | 0.288 | -0.003 | 0.687 | -0.072 | 0.019 | 0.358 |
| Autonomy 1 | -0.111 | -0.065 | 0.238 | 0.025 | 0.796 | 0.317 |
| Autonomy 2 | 0.119 | 0.066 | -0.296 | -0.015 | 0.744 | 0.357 |

Table A.7: Description of variables

| Name | Unit of Measurement | Description |
|---------------------------------------|----------------------------|--|
| <i>Subsidy Indicators</i> | | |
| Any subsidy | Binary (yes/no) | Takes the value one if firm received a public grant, subsidized loan or loan guarantees |
| Grant | Binary (yes/no) | Takes the value one if firm received a public grant |
| Subsidized Loan | Binary (yes/no) | Takes the value one if firm received a subsidized loan or loan guarantees |
| <i>Other financing sources</i> | | |
| Venture Capital | Binary (yes/no) | Takes the value one if the firm received some form of venture capital in the reference year |
| Bank financing | Binary (yes/no) | Takes the value one if the firm finances its business activities (at least partly) with commercial bank loans |
| Family & Friends | Binary (yes/no) | Takes the value one if the firm finances its business activities (at least partly) with money borrowed from family members or friends |
| <i>Controls</i> | | |
| Profit | Binary (yes/no) | Takes the value one if the firm is at least at break even or makes profits in the reference year. Zero in case of a financial loss. |
| Experience | Years | Number of years founder has worked in the same industry as the startup |
| ln(R&D expenditures) | Euros | Amount spent on R&D in the reference year |
| Failure experience | Binary (yes/no) | Takes the value one if founder had a previous firm that closed due to liquidation or bankruptcy |
| Restarter | Binary (yes/no) | Takes the value one if founder had previously founded a firm |
| ln(employees) | Head count | Total number of employees (excluding members of the founding team) |
| Female | Binary (yes/no) | Takes the value one if at least one person in the founding team is female |
| Opportunity driven | Binary (yes/no) | Takes the value one if the founder indicated to have founded the firm to pursue a specific business idea, to exploit opportunity of higher earnings, or to pursue the opportunity to work independently and self-determined. |
| Academic | Binary (yes/no) | Takes the value one if at least one the founders has a university degree |
| Founder age | Years | Average founder age in the firm |
| Team | Binary (yes/no) | Takes the value one if the firm was founded by more than one person |
| Exporter | Binary (yes/no) | Takes the value one if the firm has sales outside of Germany |
| East Germany | Binary (yes/no) | Takes the value one if the firm's location is in one of the five eastern German states |
| Cohort (firm age) | Years | Founding year 2017 takes the value 1 and the earliest year takes the value eight |
| Limited liability | Binary (yes/no) | Takes the value one if the firm is a limited liability company |
| Industry indicators | Binary (yes/no) | Distinguishes between 11 different sectors of activity. See Table A7 below for details. |

Table A.8: Pairwise correlations (Big 5 Sample)

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| (1) Extraversion | 1.000 | | | | | | | | | | | | | | | | | |
| (2) Conscientiousness | 0.156 | 1.000 | | | | | | | | | | | | | | | | |
| (3) Openness | 0.221 | 0.074 | 1.000 | | | | | | | | | | | | | | | |
| (4) Neuroticism | -0.122 | -0.070 | -0.026 | 1.000 | | | | | | | | | | | | | | |
| (5) Agreeableness | 0.097 | 0.207 | 0.176 | -0.128 | 1.000 | | | | | | | | | | | | | |
| (6) Industry experience | -0.070 | 0.030 | -0.024 | 0.009 | 0.003 | 1.000 | | | | | | | | | | | | |
| (7) ln(R&D) | -0.005 | -0.097 | 0.128 | -0.088 | -0.035 | 0.011 | 1.000 | | | | | | | | | | | |
| (8) Failure experience | 0.010 | 0.002 | 0.031 | -0.008 | -0.023 | -0.025 | -0.038 | 1.000 | | | | | | | | | | |
| (9) Serial entrepreneur | 0.012 | -0.102 | 0.066 | -0.053 | -0.039 | 0.106 | 0.172 | 0.217 | 1.000 | | | | | | | | | |
| (10) ln(employees) | 0.040 | -0.034 | -0.020 | -0.002 | -0.034 | 0.081 | 0.222 | -0.062 | 0.111 | 1.000 | | | | | | | | |
| (11) Female | 0.050 | 0.059 | 0.052 | 0.072 | 0.071 | -0.061 | -0.068 | -0.040 | -0.043 | 0.005 | 1.000 | | | | | | | |
| (12) Opportunity driven | 0.046 | 0.009 | 0.039 | -0.061 | 0.027 | -0.086 | 0.063 | -0.002 | 0.079 | 0.032 | 0.020 | 1.000 | | | | | | |
| (13) University degree | -0.052 | -0.139 | 0.006 | -0.098 | -0.038 | -0.024 | 0.264 | -0.022 | 0.169 | 0.096 | 0.052 | 0.050 | 1.000 | | | | | |
| (14) Founder age | -0.091 | -0.037 | 0.009 | -0.014 | 0.030 | 0.570 | 0.079 | -0.007 | 0.267 | 0.065 | 0.055 | -0.085 | 0.206 | 1.000 | | | | |
| (15) Team | -0.032 | -0.076 | 0.006 | -0.018 | 0.024 | 0.082 | 0.190 | -0.094 | 0.218 | 0.307 | 0.180 | 0.054 | 0.275 | 0.191 | 1.000 | | | |
| (16) Profit | 0.008 | 0.064 | -0.100 | -0.028 | -0.017 | 0.100 | -0.161 | -0.040 | -0.098 | 0.034 | -0.030 | -0.050 | -0.069 | -0.032 | -0.044 | 1.000 | | |
| (17) Exporter | -0.009 | -0.071 | 0.027 | -0.048 | -0.063 | 0.018 | 0.294 | -0.052 | 0.078 | 0.164 | -0.034 | 0.017 | 0.198 | 0.093 | 0.129 | 0.021 | 1.000 | |
| (18) East Germany | -0.009 | 0.003 | -0.021 | 0.031 | -0.005 | -0.022 | -0.003 | -0.007 | 0.001 | 0.007 | 0.000 | 0.010 | -0.023 | -0.025 | -0.014 | 0.022 | -0.053 | 1.000 |
| (19) Limited liability | -0.046 | -0.122 | 0.010 | -0.105 | -0.046 | 0.060 | 0.333 | -0.013 | 0.302 | 0.281 | -0.036 | 0.058 | 0.340 | 0.208 | 0.276 | -0.187 | 0.228 | -0.063 |

Table A.9: Pairwise correlations (EO sample)

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| (1) Competitiveness | 1.000 | | | | | | | | | | | | | | | | | |
| (2) Innovativeness | 0.207 | 1.000 | | | | | | | | | | | | | | | | |
| (3) Proactiveness | 0.249 | 0.346 | 1.000 | | | | | | | | | | | | | | | |
| (4) Risk tolerance | 0.284 | 0.374 | 0.281 | 1.000 | | | | | | | | | | | | | | |
| (5) Autonomous | -0.013 | -0.098 | -0.095 | -0.085 | 1.000 | | | | | | | | | | | | | |
| (6) Industry experience | -0.051 | -0.060 | -0.063 | -0.114 | 0.023 | 1.000 | | | | | | | | | | | | |
| (7) ln(R&D) | 0.128 | 0.452 | 0.254 | 0.247 | -0.090 | -0.006 | 1.000 | | | | | | | | | | | |
| (8) Failure experience | 0.000 | 0.006 | 0.017 | 0.027 | -0.008 | -0.021 | -0.021 | 1.000 | | | | | | | | | | |
| (9) Serial entrepreneur | 0.046 | 0.169 | 0.111 | 0.134 | -0.033 | 0.101 | 0.176 | 0.295 | 1.000 | | | | | | | | | |
| (10) ln(employees) | 0.151 | 0.092 | 0.131 | 0.117 | -0.042 | 0.106 | 0.216 | -0.050 | 0.115 | 1.000 | | | | | | | | |
| (11) Female | -0.031 | -0.052 | -0.003 | -0.039 | 0.018 | -0.036 | -0.069 | -0.011 | -0.019 | 0.036 | 1.000 | | | | | | | |
| (12) Opportunity driven | 0.058 | 0.104 | 0.078 | 0.098 | -0.020 | -0.111 | 0.085 | 0.012 | 0.114 | 0.058 | 0.013 | 1.000 | | | | | | |
| (13) University degree | 0.088 | 0.220 | 0.136 | 0.180 | -0.105 | -0.047 | 0.259 | -0.041 | 0.187 | 0.121 | 0.063 | 0.083 | 1.000 | | | | | |
| (14) Founder age | -0.005 | 0.041 | 0.012 | -0.045 | -0.012 | 0.587 | 0.115 | -0.009 | 0.269 | 0.118 | 0.068 | -0.086 | 0.214 | 1.000 | | | | |
| (15) Team | 0.084 | 0.132 | 0.110 | 0.109 | -0.023 | 0.041 | 0.176 | 0.012 | 0.258 | 0.331 | 0.203 | 0.092 | 0.305 | 0.176 | 1.000 | | | |
| (16) Profit | -0.098 | -0.171 | -0.099 | -0.136 | 0.023 | 0.126 | -0.150 | -0.031 | -0.119 | 0.062 | -0.037 | -0.069 | -0.107 | -0.019 | -0.081 | 1.000 | | |
| (17) Exporter | 0.092 | 0.165 | 0.110 | 0.111 | -0.044 | 0.028 | 0.305 | -0.015 | 0.088 | 0.164 | -0.028 | 0.029 | 0.169 | 0.090 | 0.114 | 0.031 | 1.000 | |
| (18) East Germany | -0.031 | -0.035 | -0.026 | -0.050 | 0.050 | 0.006 | -0.018 | -0.002 | -0.011 | -0.003 | -0.002 | -0.013 | -0.023 | -0.010 | -0.024 | 0.013 | -0.058 | 1.000 |
| (19) Limited liability | 0.155 | 0.270 | 0.176 | 0.190 | -0.098 | 0.015 | 0.330 | 0.011 | 0.296 | 0.295 | -0.004 | 0.102 | 0.375 | 0.219 | 0.314 | -0.192 | 0.222 | -0.055 |

Table A.10: Subsidy status by industry (left panels: Big 5 sample, right panels: EO sample)

| Industry Classification | Big 5 sample | | | EO sample | | |
|---------------------------------|--------------|--------|--------|-----------|--------|--------|
| | subsidy | | | subsidy | | |
| | 0 | 1 | Total | 0 | 1 | Total |
| Cutting-edge tech manufacturing | 622 | 197 | 819 | 209 | 78 | 287 |
| | 75.95 | 24.05 | 100.00 | 72.82 | 27.18 | 100.00 |
| | 6.85 | 10.17 | 7.43 | 4.27 | 13.24 | 5.23 |
| High-tech manufacturing | 508 | 182 | 690 | 229 | 49 | 278 |
| | 73.62 | 26.38 | 100.00 | 82.37 | 17.63 | 100.00 |
| | 5.59 | 9.40 | 6.26 | 4.68 | 8.32 | 5.07 |
| Tech. services | 1975 | 341 | 2316 | 928 | 103 | 1031 |
| | 85.28 | 14.72 | 100.00 | 90.01 | 9.99 | 100.00 |
| | 21.74 | 17.60 | 21.01 | 18.96 | 17.49 | 18.80 |
| Software | 828 | 200 | 1028 | 419 | 76 | 495 |
| | 80.54 | 19.46 | 100.00 | 84.65 | 15.35 | 100.00 |
| | 9.11 | 10.33 | 9.33 | 8.56 | 12.90 | 9.03 |
| Low-tech manufacturing | 934 | 277 | 1211 | 453 | 79 | 532 |
| | 77.13 | 22.87 | 100.00 | 85.15 | 14.85 | 100.00 |
| | 10.28 | 14.30 | 10.99 | 9.26 | 13.41 | 9.70 |
| Knowledge-int. services | 924 | 130 | 1054 | 517 | 21 | 538 |
| | 87.67 | 12.33 | 100.00 | 96.10 | 3.90 | 100.00 |
| | 10.17 | 6.71 | 9.56 | 10.56 | 3.57 | 9.81 |
| Other company services | 762 | 134 | 896 | 406 | 27 | 433 |
| | 85.04 | 14.96 | 100.00 | 93.76 | 6.24 | 100.00 |
| | 8.39 | 6.92 | 8.13 | 8.30 | 4.58 | 7.90 |
| Creative services | 573 | 121 | 694 | 389 | 24 | 413 |
| | 82.56 | 17.44 | 100.00 | 94.19 | 5.81 | 100.00 |
| | 6.31 | 6.25 | 6.30 | 7.95 | 4.07 | 7.53 |
| Other services | 363 | 37 | 400 | 344 | 32 | 376 |
| | 90.75 | 9.25 | 100.00 | 91.49 | 8.51 | 100.00 |
| | 4.00 | 1.91 | 3.63 | 7.03 | 5.43 | 6.86 |
| Construction | 983 | 217 | 1200 | 531 | 46 | 577 |
| | 81.92 | 18.08 | 100.00 | 92.03 | 7.97 | 100.00 |
| | 10.82 | 11.20 | 10.89 | 10.85 | 7.81 | 10.52 |
| Trade | 614 | 101 | 715 | 469 | 54 | 523 |
| | 85.87 | 14.13 | 100.00 | 89.67 | 10.33 | 100.00 |
| | 6.76 | 5.21 | 6.49 | 9.58 | 9.17 | 9.54 |
| Total | 9086 | 1937 | 11023 | 4894 | 589 | 5483 |
| | 82.43 | 17.57 | 100.00 | 89.26 | 10.74 | 100.00 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

First row has *frequencies*; second row has *row percentages* and third row has *column percentages*

Appendix B:

Table B.1: Big 5 personality traits (joint estimation of all equations)

| | Grant | Subsidized Loan | VC Financing | Bank financing | Family & Friends |
|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|----------------------------|
| Openness | 0.018 (0.041) | 0.041 (0.045) | 0.115 (0.071) | -0.081* (0.047) | 0.199*** (0.056) |
| Conscientiousness | -0.028 (0.049) | -0.069 (0.053) | 0.045 (0.082) | -0.034 (0.056) | -0.057 (0.064) |
| Extraversion | -0.001 (0.042) | 0.026 (0.046) | 0.022 (0.069) | 0.039 (0.048) | 0.005 (0.055) |
| Agreeableness | -0.006 (0.046) | -0.016 (0.050) | -0.129* (0.076) | 0.053 (0.054) | -0.077 (0.061) |
| Neuroticism | -0.004 (0.040) | -0.034 (0.044) | 0.034 (0.068) | -0.026 (0.045) | 0.138*** (0.051) |
| Industry experience | 0.004 (0.004) | 0.003 (0.004) | -0.012** (0.005) | 0.007* (0.004) | -0.001 (0.005) |
| Failure experience | 0.164 (0.168) | 0.247 (0.157) | 0.105 (0.240) | -0.136 (0.177) | -0.083 (0.185) |
| Serial entrepreneur | -0.143** (0.068) | -0.228*** (0.080) | -0.008 (0.110) | 0.050 (0.080) | 0.068 (0.093) |
| ln(employees) | 0.378*** (0.044) | 0.359*** (0.051) | 0.426*** (0.071) | 0.263*** (0.054) | -0.034 (0.067) |
| Female | -0.092 (0.087) | 0.021 (0.090) | -0.325** (0.154) | -0.129 (0.096) | 0.057 (0.105) |
| Opportunity driven | -0.040 (0.086) | -0.102 (0.089) | 0.310 (0.198) | -0.160* (0.096) | -0.174 (0.110) |
| University degree | 0.134* (0.072) | 0.121 (0.078) | -0.007 (0.117) | -0.242*** (0.079) | 0.177* (0.092) |
| Founder age | -0.012*** (0.004) | -0.013*** (0.004) | -0.003 (0.005) | -0.013*** (0.004) | -0.023*** (0.005) |
| Team | 0.113 (0.082) | -0.012 (0.112) | 0.250* (0.132) | 0.004 (0.108) | -0.101 (0.133) |
| ln(R&D) | 0.062*** (0.007) | 0.033*** (0.009) | 0.051*** (0.011) | -0.019** (0.009) | 0.004 (0.010) |
| Profit | -0.294*** (0.064) | -0.227*** (0.070) | -0.786*** (0.124) | 0.312*** (0.073) | -0.077 (0.084) |
| Exporter | -0.005 (0.075) | -0.057 (0.091) | -0.172 (0.125) | -0.019 (0.095) | 0.176 (0.110) |
| Firm age | -0.112*** (0.020) | -0.183*** (0.023) | -0.069** (0.035) | 0.086*** (0.022) | -0.026 (0.027) |
| Limited liability | 0.008 (0.078) | -0.336*** (0.082) | 0.437*** (0.154) | -0.087 (0.083) | -0.250*** (0.096) |
| East Germany | 0.797*** (0.070) | 0.283*** (0.083) | 0.112 (0.142) | 0.010 (0.098) | -0.031 (0.115) |
| atanhrho_12 | | | 0.619*** (0.061) | | |
| atanhrho_13 | | | 0.193** (0.079) | | |
| atanhrho_14 | | | 0.150** (0.060) | | |
| atanhrho_15 | | | -0.076 (0.069) | | |
| atanhrho_23 | | | 0.083 (0.091) | | |
| atanhrho_24 | | | 0.164*** (0.057) | | |
| atanhrho_25 | | | -0.041 (0.068) | | |
| atanhrho_34 | | | -0.137* (0.078) | | |
| atanhrho_35 | | | 0.254*** (0.079) | | |
| atanhrho_45 | | | -0.103* (0.056) | | |
| Observations | | | 5,473 | | |
| Log Likelihood | | | -3916.21 | | |

Notes: Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The model contains sector and year fixed effects and a constant; atanhrho indicates the correlations of errors in the corresponding equations.

Table B.2: Entrepreneurial Orientation (joint estimation of all equations)

| | Grant | Subsidized Loan | VC Financing | Bank Financing | Family & Friends |
|------------------------|----------------------------|----------------------------|----------------------------|---------------------------|---------------------------|
| Competitiveness | 0.011 (0.013) | 0.064*** (0.014) | 0.049** (0.022) | 0.019 (0.016) | -0.012 (0.018) |
| Innovativeness | 0.027* (0.015) | -0.010 (0.017) | 0.076*** (0.026) | -0.038* (0.020) | -0.004 (0.022) |
| Proactiveness | 0.047*** (0.016) | 0.034* (0.018) | 0.015 (0.032) | 0.041** (0.021) | 0.002 (0.023) |
| Risk preference | 0.005 (0.015) | 0.020 (0.016) | 0.051** (0.025) | -0.006 (0.018) | 0.045** (0.020) |
| Autonomy | -0.008 (0.014) | -0.018 (0.016) | 0.010 (0.026) | 0.001 (0.018) | 0.020 (0.020) |
| Industry experience | -0.002 (0.002) | 0.002 (0.002) | -0.009*** (0.003) | 0.008*** (0.003) | -0.004 (0.003) |
| Failure experience | 0.296*** (0.071) | 0.064 (0.080) | -0.378*** (0.140) | 0.139 (0.087) | 0.071 (0.095) |
| Serial entrepreneur | -0.291*** (0.041) | -0.191*** (0.047) | 0.053 (0.068) | -0.036 (0.052) | -0.044 (0.059) |
| ln(employees) | 0.297*** (0.028) | 0.279*** (0.032) | 0.342*** (0.048) | 0.392*** (0.035) | -0.080* (0.043) |
| Female | 0.035 (0.046) | -0.001 (0.052) | -0.066 (0.080) | -0.048 (0.058) | 0.099 (0.063) |
| Opportunity driven | -0.087* (0.046) | 0.007 (0.053) | 0.055 (0.103) | -0.035 (0.061) | -0.117* (0.067) |
| University degree | 0.096** (0.041) | -0.091** (0.046) | 0.248*** (0.075) | -0.205*** (0.052) | -0.086 (0.057) |
| Founder age | -0.004* (0.002) | -0.010*** (0.002) | -0.004 (0.003) | -0.006** (0.003) | -0.014*** (0.003) |
| Team | 0.035 (0.041) | 0.124*** (0.046) | 0.199*** (0.066) | 0.049 (0.052) | -0.001 (0.060) |
| ln(R&D) | 0.038** (0.004) | 0.011** (0.005) | 0.036*** (0.007) | -0.018*** (0.006) | 0.015** (0.006) |
| Profit | -0.205*** (0.037) | -0.195*** (0.041) | -0.577*** (0.071) | 0.112** (0.046) | -0.137*** (0.051) |
| Exporter | 0.107** (0.044) | 0.104** (0.052) | 0.107 (0.073) | 0.109* (0.059) | 0.093 (0.066) |
| Firm age | -0.074*** (0.012) | -0.120*** (0.015) | -0.068*** (0.026) | 0.083*** (0.016) | 0.018 (0.019) |
| Limited liability | -0.121*** (0.043) | -0.229*** (0.048) | 0.321*** (0.093) | -0.155*** (0.054) | -0.281*** (0.060) |
| East Germany | 0.558*** (0.043) | 0.080 (0.054) | -0.015 (0.087) | 0.002 (0.062) | -0.033 (0.069) |
| atanhrho_12 | 0.480*** (0.032) | | | | |
| atanhrho_13 | 0.107** (0.044) | | | | |
| atanhrho_14 | 0.095*** (0.033) | | | | |
| atanhrho_15 | 0.044 (0.036) | | | | |
| atanhrho_23 | 0.066 (0.047) | | | | |
| atanhrho_24 | 0.253*** (0.032) | | | | |
| atanhrho_25 | 0.014 (0.037) | | | | |
| atanhrho_34 | 0.053 (0.043) | | | | |
| atanhrho_35 | 0.087* (0.048) | | | | |
| atanhrho_45 | -0.066* (0.034) | | | | |
| Observations | 11,017 | | | | |
| Log Likelihood | -11,221.53 | | | | |

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The model contains year and sector fixed effects and a constant; atanhrho indicates the correlations of errors in the corresponding equations.

Table B.3: Big 5 personality traits and different sources of financing (predicted scores from factor analysis; joint estimation)

| | Grant | Subsidized Loan | VC financing | Bank financing | Family & Friends |
|---------------------------------------|--------------------------|--------------------------|---------------------------|---------------------------|----------------------------|
| Factor Score Openness | 0.021 (0.033) | 0.037 (0.036) | 0.095* (0.057) | -0.063* (0.038) | 0.145*** (0.045) |
| Factor Score Conscientiousness | -0.018 (0.032) | -0.045 (0.036) | 0.026 (0.055) | -0.018 (0.037) | -0.051 (0.043) |
| Factor Score Extraversion | -0.001 (0.032) | 0.016 (0.035) | 0.005 (0.053) | 0.034 (0.036) | -0.009 (0.042) |
| Factor Score Agreeableness | -0.011 (0.031) | -0.034 (0.034) | 0.034 (0.052) | -0.017 (0.035) | 0.119*** (0.039) |
| Factor Score Neuroticism | -0.022 (0.030) | -0.002 (0.033) | -0.090* (0.050) | 0.042 (0.036) | -0.057 (0.042) |
| Observations | 5,431 | | | | |
| Log Likelihood | -3,894.03 | | | | |

Standard errors in parentheses. * $p < 0.10$, ** $p < .05$, *** $p < 0.01$. The model contains the same set of variables as in the full joint estimations presented in Table B.1.

Table B.4: EO personality and different sources of financing (predicted scores from factor analysis; joint estimation)

| | Grant | Subsidized Loan | VC financing | Bank financing | Family & Friends |
|-------------------------------------|----------------------------|----------------------------|----------------------------|---------------------------|--------------------------|
| Factor Score Competitiveness | 0.013 (0.018) | 0.093*** (0.020) | 0.068** (0.031) | 0.033 (0.023) | -0.007 (0.025) |
| Factor Score Innovativeness | 0.047** (0.020) | 0.006 (0.023) | 0.112*** (0.035) | -0.047* (0.025) | 0.020 (0.028) |
| Factor Score Proactiveness | 0.052*** (0.018) | 0.026 (0.020) | 0.000 (0.035) | 0.052** (0.023) | -0.002 (0.025) |
| Factor Score Risk tolerance | 0.011 (0.018) | 0.018 (0.020) | 0.063** (0.031) | -0.007 (0.023) | 0.032 (0.025) |
| Factor Score Autonomy | -0.007 (0.017) | -0.021 (0.019) | 0.010 (0.031) | 0.003 (0.021) | 0.021 (0.024) |
| Observations | 11,017 | | | | |
| Log Likelihood | -11,222.086 | | | | |

Standard errors in parentheses. * $p < 0.10$, ** $p < .05$, *** $p < 0.01$. The model contains the same set of variables as in the full joint estimations presented in Table B.2.

Table B.5: Big5 personality traits and different sources of financing (selection model; joint estimation of second stage)

| | Selection Stage | Grant | Subsidized Loan | VC financing | Bank financing | Family & Friends |
|--------------------------|----------------------------------|---------------------------------|---------------------------------|----------------------------------|------------------------------------|-----------------------------------|
| Openness | 0.075*** (0.027) | -0.010 (0.071) | -0.043 (0.064) | 0.115 (0.078) | -0.166*** (0.055) | 0.181*** (0.062) |
| Conscientiousness | -0.026 (0.032) | -0.016 (0.078) | -0.058 (0.070) | 0.106 (0.098) | -0.014 (0.069) | -0.047 (0.075) |
| Extraversion | 0.000 (0.027) | -0.044 (0.068) | -0.023 (0.066) | -0.032 (0.079) | 0.052 (0.055) | -0.013 (0.061) |
| Agreeableness | -0.033 (0.030) | -0.021 (0.074) | 0.006 (0.077) | -0.153* (0.090) | 0.061 (0.064) | -0.106 (0.073) |
| Neuroticism | 0.023 (0.026) | 0.085 (0.066) | -0.017 (0.062) | 0.017 (0.083) | -0.063 (0.056) | 0.152*** (0.058) |
| Profit | -0.567*** (0.042) | -0.194* (0.109) | -0.114 (0.112) | -0.833*** (0.138) | 0.364*** (0.091) | -0.107 (0.101) |
| Industry experience | -0.007*** (0.002) | 0.007 (0.006) | 0.012** (0.006) | -0.016*** (0.006) | 0.010** (0.005) | -0.001 (0.006) |
| ln(R&D) | 0.029*** (0.005) | 0.059*** (0.012) | 0.026** (0.013) | 0.056*** (0.011) | -0.024** (0.010) | 0.006 (0.011) |
| Failure experience | 0.105 (0.107) | 0.263 (0.249) | 0.115 (0.222) | -0.093 (0.269) | -0.223 (0.216) | -0.195 (0.204) |
| ln(employees) | 0.243*** (0.032) | 0.304*** (0.071) | 0.201*** (0.077) | 0.360*** (0.081) | 0.156** (0.063) | -0.170** (0.075) |
| Opportunity driven | 0.086 (0.085) | 0.155 (0.159) | 0.063 (0.131) | 0.400* (0.219) | -0.061 (0.115) | -0.121 (0.126) |
| Founder age | -0.004 (0.002) | -0.011* (0.007) | -0.015** (0.007) | 0.003 (0.006) | -0.007 (0.005) | -0.021*** (0.006) |
| Female | 0.008 (0.055) | -0.014 (0.140) | 0.101 (0.133) | -0.348** (0.149) | -0.140 (0.107) | 0.064 (0.121) |
| University degree | -0.061 (0.047) | 0.234** (0.118) | 0.296** (0.116) | 0.064 (0.124) | -0.240** (0.093) | 0.228** (0.105) |
| Team | -0.050 (0.059) | 0.085 (0.131) | -0.213 (0.168) | 0.237* (0.143) | -0.097 (0.119) | -0.199 (0.151) |
| Serial entrepreneur | 0.016 (0.045) | -0.330*** (0.114) | -0.114 (0.118) | 0.070 (0.121) | 0.112 (0.090) | 0.138 (0.109) |
| Exporter | 0.068 (0.053) | -0.105 (0.127) | -0.114 (0.137) | -0.223 (0.142) | -0.068 (0.111) | 0.132 (0.122) |
| East Germany | 0.073 (0.056) | 0.782*** (0.122) | 0.367*** (0.122) | 0.103 (0.159) | -0.043 (0.108) | -0.181 (0.129) |
| Firm age | -0.074*** (0.013) | -0.102*** (0.032) | -0.179*** (0.036) | -0.099*** (0.038) | 0.072*** (0.026) | -0.040 (0.030) |
| Limited liability | -0.056 (0.048) | 0.072 (0.121) | -0.339*** (0.125) | 0.513*** (0.161) | -0.047 (0.103) | -0.241** (0.113) |
| ER: Unemployed | 0.195** (0.094) | | | | | |
| Observations | 5,483 | | | | | |
| Log Likelihood | -5.3e+03 | | | | | |

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The model contains year and sector fixed effects and a constant; atanhrho indicating the correlations of errors in the corresponding equations are omitted from this table.

Table B.6: EO personality and different sources of financing (selection model; joint estimation of second stage)

| | Selection Stage | Grant | Subsidized Loan | VC financing | Bank financing | Family & Friends |
|------------------------|----------------------------------|---------------------------|---------------------------|----------------------------|----------------------------|--------------------------|
| Competitiveness | 0.053** (0.010) | 0.007 (0.020) | 0.044** (0.020) | 0.037 (0.025) | 0.008 (0.019) | -0.026 (0.020) |
| Innovativeness | 0.024* (0.012) | 0.047** (0.023) | 0.004 (0.025) | 0.102*** (0.030) | -0.048** (0.023) | -0.003 (0.024) |
| Proactiveness | 0.040** (0.013) | 0.022 (0.026) | 0.010 (0.027) | 0.014 (0.035) | 0.022 (0.024) | -0.017 (0.026) |
| Risk tolerance | 0.051*** (0.012) | -0.016 (0.022) | -0.009 (0.023) | 0.031 (0.028) | -0.013 (0.022) | 0.035 (0.023) |
| Autonomy | -0.007 (0.011) | -0.016 (0.022) | -0.017 (0.024) | 0.002 (0.031) | -0.006 (0.022) | 0.016 (0.023) |
| Profit | -0.548*** (0.029) | -0.141** (0.061) | -0.067 (0.066) | -0.570*** (0.081) | 0.199*** (0.057) | -0.083 (0.061) |
| Industry experience | -0.003* (0.002) | 0.002 (0.003) | 0.007* (0.004) | -0.009** (0.004) | 0.010*** (0.003) | -0.004 (0.004) |
| ln(R&D) | 0.023*** (0.004) | 0.029*** (0.007) | 0.001 (0.007) | 0.028*** (0.008) | -0.023*** (0.007) | 0.010 (0.007) |
| Failure experience | 0.070 (0.058) | 0.361*** (0.106) | 0.006 (0.112) | -0.492*** (0.161) | 0.165 (0.105) | -0.013 (0.109) |
| ln(employees) | 0.260*** (0.023) | 0.182*** (0.045) | 0.198*** (0.049) | 0.237*** (0.053) | 0.325*** (0.043) | -0.263*** (0.051) |
| Opportunity driven | 0.024 (0.056) | -0.092 (0.072) | 0.015 (0.078) | 0.140 (0.116) | -0.011 (0.073) | -0.108 (0.076) |
| Founder age | -0.004** (0.002) | -0.004 (0.003) | -0.011*** (0.004) | -0.003 (0.004) | -0.004 (0.003) | -0.015*** (0.004) |
| Female | 0.012 (0.038) | 0.004 (0.073) | -0.089 (0.077) | -0.048 (0.093) | -0.089 (0.070) | 0.119 (0.076) |
| University degree | -0.021 (0.034) | 0.207*** (0.065) | -0.025 (0.069) | 0.284*** (0.087) | -0.188*** (0.064) | -0.052 (0.066) |
| Team | -0.006 (0.033) | 0.125* (0.065) | 0.139** (0.069) | 0.216*** (0.078) | 0.016 (0.063) | -0.028 (0.068) |
| Serial entrepreneur | 0.016 (0.032) | -0.381*** (0.066) | -0.243*** (0.067) | 0.111 (0.074) | 0.005 (0.063) | -0.008 (0.067) |
| Exporter | 0.031 (0.037) | 0.016 (0.072) | 0.075 (0.072) | 0.130 (0.083) | 0.065 (0.069) | 0.110 (0.073) |
| East Germany | 0.022 (0.040) | 0.590*** (0.070) | 0.113 (0.080) | -0.024 (0.106) | -0.017 (0.076) | -0.079 (0.080) |
| Firm age | -0.058*** (0.010) | -0.080*** (0.020) | -0.137*** (0.022) | -0.105*** (0.028) | 0.042** (0.018) | -0.012 (0.021) |
| Limited liability | -0.192*** (0.034) | -0.067 (0.069) | -0.137* (0.073) | 0.421*** (0.099) | -0.055 (0.067) | -0.210*** (0.071) |
| ER: Unemployed | 0.141** (0.064) | | | | | |
| Observations | 11,023 | | | | | |
| Log Likelihood | -1.3e+04 | | | | | |

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The model contains year and sector fixed effects and a constant; atanhrho indicating the correlations of errors in the corresponding equations are omitted from this table.