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Personality Characteristics and the Decision to Hire*

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Abstract:

As the policy debate on entrepreneurship increasingly centers on firm growth in terms of job creation, it is important to understand whether the personality of entrepreneurs drives the first hiring in their firms. Using the German Socio-Economic Panel (SOEP), we analyze to what extent personality traits influence the probability of becoming an employer. Results indicate that personality matters. Risk tolerance unfolds the strongest influence on hiring, shortening the time until entrepreneurs hire their first employee; the effect size of a one-standard-deviation increase in risk tolerance is similar to that of having a university degree. Moreover, individuals who are more open to experience, more conscientious, and more trustful are more likely to hire upon establishing their business.

JEL classification: J22, J23, L26.

Keywords: Employer, entrepreneurship, business venturing, recruitment, firm growth, employment growth, personality.

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1 Introduction

When starting business activities, entrepreneurs face the decision of whether to hire one, if not more, employees. It is simultaneously an opportunity and a challenge. On the one hand, early stage hiring is an important decision for firm growth (Delmar and Wiklund, 2008) and profitability (Coad, 2010). On the other, hiring employees may also significantly increase the risk of business failure by substantially rising costs, far exceeding the wages of hired employees (Coad et al., 2017). At that moment, it might be uncertain whether earnings from future sales will cover these costs, precisely because the firm is newly founded. Moreover, compared to well established, typically larger, firms, entrepreneurs usually lack formal recruitment processes (Cardon and Stevens, 2004), emblematic of the systematic disadvantages confronting newly started businesses that are searching for staff on the labor market, i.e., the liabilities of smallness and of newness (Aldrich and Auster, 1986). Many potential employees may want to avoid the large risks associated with freshly started firms (Barrett and Mayson, 2008), as they are not easily able to assess the likelihood that the firm will survive (Williamson et al., 2002, Leung, 2003). Employees typically prefer stability and higher wages, both of which are more likely to be provided by established firms than by freshly founded firms, since every second new firm is closed down again within the first five years after foundation (Helmers and Rogers, 2010).

Given the challenges due to these demand side and supply side constraints, few business founders immediately hire employees upon establishing their business. Others choose to start without employees. There are several possible reasons: perhaps they are only experimenting with this occupational choice (Manso, 2016), or aiming to circumvent some of these constraints, or they do not see sufficient demand for their products or services to hire staff, or they simply prefer not to hire others (Hurst and Pugsley, 2011). After an interim period, some, but by far not all, entrepreneurs will decide to hire. Others remain solo for their complete self-employment spell, which may prevent their businesses from realizing their growth potential.[1]

[1] As we aim to analyze the first hiring decision, we use the most common measure of entrepreneurship in form of self-employment. For the rest of our paper, we will therefore term all individuals who start a business as "business founders" or as "entrepreneurs", those without employees as "solo entrepreneurs," and those who hire as "employers." Individuals are usually considered to be business founders for three to five years after business foundation (Parker 2018).

Existing research on hiring in newly created firms analyzes how human capital and demographic characteristics of entrepreneurs, like education, work experience, unemployment exposure, or self-employed parents, influence the decision to hire a first employee (see e.g. Burke et al., 2000, Henley, 2005, Coad et al., 2017, Fairlie and Miranda, 2017).[2] However, those business founders who aim to become employers face costly and risky decisions as well as complex and challenging tasks connected to the aforementioned demand- and supply-side related constraints that add responsibility to the individual who runs the firm. Several tasks, like bearing the additional business risk of hiring, like signaling reliability and entrepreneurial abilities to potential employees, or like interacting with these potential employees, are strongly related to the personality of the entrepreneur, who aims to select and manage employees in a productive way for the business. Therefore, the main aim of this paper is to investigate how the business founder's personality influences the hiring decision in a newly created firm. By doing so, we also aim to shed light on how the observation of low hiring rates among entrepreneurs is related to non-cognitive skills, as reflected in personality. To the best of our knowledge, our analysis is the first to investigate how the personality of the entrepreneur influences their first hiring decision.

We know from psychological and economic research that personality is an essential determinant influencing transitions to entrepreneurship (see e.g. Zhao et al., 2010). Building on the literature showing that various aspects of personality matter in the context of entrepreneurship, we analyze how personality influences the hiring decision. To do this, we use three concepts. First, we apply the "Big Five" personality model, which arranges a variety of personality variables into a concise personality construct (see Zhao et al., 2010). Second, in addition to the general traits approach, we employ information on a set of specific personality characteristics that previous research shows to be important for entrepreneurial processes, i.e. risk tolerance, locus of control, and trust (Rauch and Frese, 2007, Caliendo et al., 2014). Third, to investigate whether there are key personality prototypes explaining early stage hiring, we additionally apply a latent profile analysis (Asendorpf et al., 2001, Specht et al., 2014).

Moreover, as some business founders hire employees immediately upon venturing their business, others after having gained some experience as solo entrepreneur, our second research question examines whether personality unfolds differing influence on the first hiring decision, depending on whether the first hiring occurs immediately or after some time of working solo.

[2] Others investigate the influence of institutional factors (e.g., Carroll et al., 2000, Millán et al., 2013), the legal form of the firm (Åstebro and Tåg, 2017), industry characteristics (Mata, 1996), and changes in unemployment levels (Henley, 2005) on the hiring probability.

To address these two research questions, we empirically analyze, based on theoretical considerations, how personality affects the probability of hiring the first employee while controlling for a broad spectrum of variables that previous research showed to influence the hiring decision. These include variables like human capital, gender, parental entrepreneurship, and the industry a person is active in. With regard to the timing of hiring, we allow effects to differ between those coming from paid employment or non-employment and those who have been already solo entrepreneurs. For our analysis we use German Socio-Economic Panel (SOEP) data covering 2005 to 2018. SOEP is a rich dataset that includes, in addition to inventories of the Big Five traits and specific personality characteristics, information on demographics, socio-economic characteristics, and employment.

The relevance of our goal is underlined when we consider developments in entrepreneurship: self-employment is increasing substantially in many industrialized economies (OECD, 2018). In Germany, for instance, the number of self-employed individuals increased from 3 million in 1991 to over 4.3 million in 2011, before declining slightly thereafter (Statistisches Bundesamt, 2018). However, separating those entrepreneurs who hire from those who do not shows that solo entrepreneurs account for most of the increase. Their numbers doubled over this period, while the number of employers grew by only 15 percent (see Fritsch et al., 2015). Similarly, the OECD (2018) reports that increases in entrepreneurship in several other countries are mostly explained by rising numbers of solo entrepreneurs. Clearly, it is important that individuals create jobs for themselves when they become self-employed. However, when they create jobs for others, entrepreneurs exhibit greater growth ambitions and are more likely to be innovators, having a larger impact on the economy at the macro level (Haltiwanger et al., 2013). Given the limited increase in the number of employers since the 1990s, it is important to better understand what influences the decision to become an employer.

We contribute to the existing literature on understanding why some individuals hire and others refrain from doing so in three important ways. First, we identify those personality characteristics that influence the hiring decision and test the relationships empirically. We also discuss how the relevant characteristics might mitigate some of the aforementioned supply- and demand-side related constraints. Second, extant research analyzing the hiring decision addresses the timing of hiring the first employee in various ways. In some papers, the hiring decision is examined by pooling all observations, irrespective of the timing of the hiring (e.g., Henley, 2005). Others exclusively focus on individuals who hire after having gained some experience as a solo entrepreneur (e.g., Coad et al., 2017). We contribute to this literature by

differentiating those who hire employees immediately upon starting their business from those who start as solo entrepreneurs before hiring their first employee in subsequent years, as well as by analyzing whether personality unfolds similar or differing influences on the hiring decision at these different times. Third, building on the Big Five personality traits, we also apply the prototype approach proposed e.g. by Asendorpf et al. (2001) and investigate to what extent the three identified personality prototypes further explain the early stage hiring processes.

Our paper delivers four key results. First, personality traits matter for becoming an employer, even after controlling for other individual-level variables that are known to be relevant for the hiring decision. Second, individuals are more likely to hire a first employee, the higher they score in risk tolerance. This finding also holds among solo entrepreneurs, shortening the time until entrepreneurs hire. Third, other personality traits beyond risk tolerance matter among those who hire immediately upon venturing their business: higher scores in openness to experience and in conscientiousness, as well as higher levels of trust in others unfold a significantly positive influence on becoming an employer out of paid employment or non-employment. Fourth, applying the prototype related approach, our evidence further points to a higher propensity of more resilient individuals - one of the three prototypes - to immediately become employers at the time when they start their entrepreneurial activities.

The remainder of the paper is organized as follows. Section 2 reviews related research and provides the conceptual background. Section 3 presents data and summary statistics. In Section 4 we describe our empirical strategy and provide the estimation results. Section 5 discusses the findings and concludes the analysis.

2 Literature Review and Conceptual Background

2.1 Earlier Empirical Results on Hiring First Employees

A vigorous literature analyzes how individual characteristics influence the decision to start a business and a sizeable stream of research investigates how these variables influence entrepreneurial performance (Parker, 2018). Entrepreneurship research further emphasizes that personality captured through the Big Five traits (Zhao et al., 2010), but also through specific personality characteristics that are relevant in the context of entrepreneurship (Rauch and Frese 2007), systematically affects entrepreneurial decisions (Kerr et al., 2018). This includes central aspects of entrepreneurship like entrepreneurial entry (see e.g. Vereshchagina and Hopenhayn, 2009, Caliendo et al., 2009, 2012, 2014), survival in entrepreneurship (Ciavarella et al., 2004,

Caliendo et al., 2010, 2014), and entrepreneurial income (Levine and Rubinstein, 2017, Hamilton et al., 2018, de Meza et al., 2019). It is shown that the Big Five traits but also specific personality characteristic are relevant, the latter ones often to a stronger extent than the former ones (Caliendo et al., 2014). Runst and Thomä (2021) further link certain personality prototypes to entrepreneurial decisions. Research also emphasizes the importance of heterogeneity among entrepreneurs, but rarely differentiates between the sizes of the newly started businesses in terms of employment. A notable exception is the paper by Hurst and Pugsley (2011), who put the research question of this paper on center stage, as they document that many nascent entrepreneurs have no intention of growing. However, it has not been examined whether personality traits or certain personality prototypes of entrepreneurs influence the hiring decision.

Yet, a growing literature investigates what affects business founders in their decision to become an employer, concentrating on aspects of economic, demographic, and educational characteristics as well as access to capital. A significant issue in this literature is that few researchers account for the timing *when* employees are hired, whether upon venturing or in subsequent years, while in some approaches the data are pooled across all observations, thus making previous research on this question only partially comparable. For instance, van Praag and Cramer (2001), who use Dutch data, and Henley (2005), who uses British data, analyze data pooled over different times to hire and find that the hiring decision is positively influenced by higher education levels and having self-employed parents.[3] Coad et al. (2017), who use Danish data and consider those who hire as solo entrepreneurs, find such influence for higher education levels but cannot confirm the intergenerational link. Fairlie and Miranda (2017), who use US data and study the determinants of entrepreneurs hiring their first employee from a solo entrepreneur position, find no evidence that education levels influence the hiring decision.

Previous research further observes that the decision to hire a first employee is also positively related to business experience (Coad et al., 2014), work experience (Cowling et al., 2004), and experience from paid employment (Andersson and Wadensjö, 2007). Moreover, there is some evidence that individuals who had more exposure to unemployment or are starting a business from unemployment are less likely to hire (Caliendo et al., 2015b, Coad et al., 2017). For the age of the entrepreneur, which should be related to work experience if it is controlled for education and times of non-employment, research shows that middle-aged individuals are more likely to start the hiring process (Cowling et al., 2004, Henley, 2005). Bublitz et al. (2017)

[3] Burke et al. (2000) also observe the positive influence of education on job creation, while Lechmann and Wunder (2017) report a positive influence of self-employed parents on this outcome measure.

reveal why human capital matters for the hiring process, as they observe that entrepreneurs who have more education and work experience more likely attract better skilled employees.

As income from previous years might also be a rough proxy for unobservable abilities (Hamilton, 2000), it is interesting to review research with respect to this information. Coad et al. (2017) find that a higher income as solo entrepreneurs in the previous year increases the hiring probability. The results of Fairlie and Miranda (2017), who focus on previous year's business revenues, are consistent with this finding. Finally, it is important to note how gender influences the hiring probability. Research observes that men are more likely than women to hire employees in their firms (e.g., Burke et al., 2002, Cowling et al., 2004).

Overall, most, but not all, previous empirical research confirms that entrepreneurs who are better endowed with various forms of human capital – variables that are known to be important determinants of entrepreneurial performance in general – are also more likely to hire staff in their newly ventured firms. Inconsistencies in results point to the issue that some of the earlier papers on the hiring decision diverge with respect to the question of how the occupational state previous to the hiring decision is treated. This makes clear that it is necessary to control for the previous employment status, identifying whether individuals hire at the time of venturing the businesses or whether they have already moved into the status of a solo entrepreneur, gaining initial experience in this status. Most importantly, however, earlier research remains silent with respect to the question of whether personality traits play any role in the hiring process. To that end, understanding why some individuals hire and others do not is incomplete.

2.2 Drivers of the Hiring Decision

Given the existing findings, in this section we discuss why personality traits, which are often unobservable in survey or administrative data, may be important for the hiring decision, in addition to other individual characteristics like human capital variables. Traits may describe part of what is usually paraphrased as entrepreneurial abilities to the extent that these abilities are not captured by traditional human capital measures (formal education, work experience, and unemployment exposure).

Generally, it is assumed that people select their occupation based on expected utility. Individuals become entrepreneurs when the expected utility from this choice exceeds the expected utility from being a paid employee or non-employed (see e.g. Evans and Jovanovic, 1989). Applying expected utility theory to job creation in the own business means that the decision of

hiring others is guided by the question of whether the expected increase in utility from employing one (additional) employee, primarily through higher expected revenue,[4] is larger than the expected marginal disutility, primarily through the wage cost paid to this employee (see Carroll et al., 2000) and through the additional effort of monitoring the employee. Based on this simple conceptualization, we consider how traits and personality characteristics may influence the expected utility on the revenue and the cost sides of the calculation.[5] In this context, the baseline models of entrepreneurship by Lucas (1978) and by Kihlstrom and Laffont (1979) provide a theoretical background. Lucas (1978) stresses that individuals need to have (unobservable) entrepreneurial talent to start an own firm successfully and characterizes the main talent as the ability to manage others more productively than do existing firms. We discuss which personality characteristics may influence this talent of how managerial tasks are handled as an entrepreneur, and, thus, influence the utility that can be derived from hiring staff in the business.

Individuals aiming to become employers face complex tasks that add substantial responsibility to the entrepreneur, in particular in the transition from no to one or more employees (Coad et al, 2017). Not only must they conduct the screening and selection processes when recruiting, but subsequently they must then simultaneously manage their employees, make them work productively, as well as cope with bureaucracy, e.g., make payroll and pay social insurance contributions. Moreover, entrepreneurs also have to signal their own general abilities to potential future employees, particularly when the firm is new. Such signals might make it easier to attract employees into a new venture given the asymmetric information about entrepreneurial abilities (see Bublitz et al., 2017). Thus, entrepreneurs, when they make the costly, challenging, and risky decision to start hiring, need a variety of competencies and abilities that are likely to be influenced by their personality, in addition to their human capital and related skills.

Against this background, we will discuss which personality traits may influence the managerial abilities of entrepreneurs seeking to have employees, and hypothesize how personality influences the hiring decision.[6] Approaches of measuring personality differentiate between

[4] It should be noted that hiring an employee may also increase an entrepreneurs' utility in other ways, e.g. when work tasks can be shared.

[5] Of course, there are further variables that influence the hiring decision. Beyond the individual variables whose influence we shortly discussed in Section 2.1, based on previous research, there are also other variables, for instance, the industry an individual is active in, or the economic environment such as the local demand or unemployment levels (e.g., Parker, 2018). In this paper, we control for socio-economic variables and industry, but refrain from discussing the influence of external regional variables on the entrepreneurial hiring decision, as we focus on the influence of personality characteristics.

[6] As we concentrate our analysis on the hiring decision, we will not propose hypotheses on the probability of *being* an employer, although we do include an empirical analysis on the influence of personality on this state.

broad traits such as the so-called "Big Five" model, which organizes a larger number of traits in a concise personality construct (Zhao et al., 2010), and specific personality characteristics that are closely related to the entrepreneurial process (Rauch and Frese, 2007), like risk tolerance, locus of control, need for achievement, or trust. Previous research shows the relevance of the Big Five traits and further personality characteristics for entrepreneurial decision making in general (see Section 2.1). Moreover, it is established in entrepreneurship research to analyze specific personality characteristics in parallel while controlling for the broad traits (see e.g. Obschonka and Stuetzer, 2017).

The Big Five model comprises five distinct traits: openness to experience, extraversion, conscientiousness, agreeableness, and neuroticism (see e.g. Zhao and Seibert, 2006). Individuals with higher scores in the Big Five factor of 'openness to experience' are creative, imaginative, and seek to explore novel ideas. As the founding of a business often requires creativity, such attributes are – as we also know from previous research (Caliendo et al., 2014) – crucial for becoming an entrepreneur (Schumpeter, 1942). If entrepreneurs plan larger businesses employing others in order to better exploit their novel ideas, the factor openness to experience should positively influence the hiring decision. Being open to experience also supports considerations of ideas by potential and freshly starting employees on how to grow the business, in which the entrepreneur and (potential) employees will jointly work.

'Conscientiousness' is a broad trait that unites various personality characteristics into one factor, the need for achievement and the willingness for hard work on the one hand and dependability and being well organized on the other. Both facets of this factor should help in the role of hiring employees. Conscientiousness may enable entrepreneurs to be methodical when managing others, hence enabling the entrepreneur to organize the work processes of the freshly hired employee(s), potentially improving their productivity in the firm. Being able to show dependability and the willingness to work hard as an entrepreneur may be a signal helping potential employees to trust that their future employer will commit all effort into the success of the growing firm. Potential employees will "select such entrepreneurs who they judge to be dependable… and to demonstrate the tendency to fulfill their commitments" (Zhao and Seibert 2006, p. 262).

The trait 'extraversion' describes individuals who are ambitious, assertive, communicative, as well as those who enjoy easily meeting people and at the same time seek leadership roles. This trait, thus, captures the ability to interact with other individuals, whether potential employees, business partners, or investors, simultaneously signaling their leadership abilities

(Zhao et al., 2010). As entrepreneurs need to attract employees into their new ventures at a time when potential employees may associate such new firms with high levels of uncertainty, being able to persuade potential employees to work for them will therefore be a supportive trait (Dencker et al., 2009). In the same context, this trait may further influence the hiring process, as extraverted entrepreneurs are able to signal their own ambitions. Extraverted entrepreneurs are also better able to engage in productive exchange and interactions with freshly hired employees through their communicative skills, which is important for providing the necessary information to the employees on how to work in the business.

High scores in 'agreeableness' characterize individuals as forgiving, altruistic, and flexible, while low scores in this trait indicate that people are interested in themselves, being hard bargainers in negotiations. In the context of an employer, low levels of agreeableness might improve the ability of employers to make difficult decisions towards employees (McClelland and Boyatzis, 1982) once employees are hired in the business. Thus, while this trait might be relevant at a later stage of running entrepreneurial businesses, we expect that this factor will not unfold any influence yet when the first employee is to be hired. The last Big Five trait, 'neuroticism', characterizes individuals as anxious, nervous, and worrying when they score high in this trait. By contrast, those who score low in neuroticism are described as relaxed, emotionally stable, and self-confident. Low levels of neuroticism may enable employers to calmly manage their employees in stressful and uncertain situations (Judge et al., 1999) or when they act and decide in an unstructured market environment. Similar to the factor agreeableness, this factor is also not expected to unfold any influence already at the hiring stage. Overall, we hypothesize that three of the Big Five traits matter for the hiring decision:

(H1) The probability of becoming an employer will be higher, the higher individuals score in the Big Five traits (a) openness to experience, (b) conscientiousness, and (c) extraversion.

While several of the Big Five traits may have separately identifiable effects on entrepreneurial decisions, synergies between traits may exist, which may remain unnoticed in a purely traits-based analysis. Person-oriented analysis (Asendorpf et al., 2001; Herzberg and Roth, 2006; Specht et al., 2014) finds that there are at least three prototypes among individuals that can be detected by means of cluster analysis. These prototypes are labelled resilient, over-controlled, and under-controlled. According to the literature, resilient individuals react in a flexible way to changing and stressful situations. They have relatively low scores in neuroticism and relatively high scores in the other four Big Five traits. Control refers to the ability to contain

versus express emotional impulses. Over-controllers tend to be inhibited, shy, lonely, and exhibit comparably low social self-esteem. They score comparably low on extraversion and high on conscientiousness and neuroticism. Under-controllers show a higher rate of antisocial behavior and lower popularity. They display low scores in conscientiousness and agreeableness (Asendorpf et al., 2001). The different personality prototypes may be more or less inclined to make certain entrepreneurial decisions (Runst and Thomä, 2021).

Among the three prototypes, entrepreneurs with the resilient profile inherently have more traits that may make them more likely to hire. Since resilient entrepreneurs have relatively low scores in neuroticism and relatively high scores in the other four Big Five traits, they also have high scores in the three traits identified above as relevant. Resilient entrepreneurs bring in the flexibility that an individual needs to address the changes in the demanding and stressful situation of a first hiring. In contrast, since under-controlled individuals score low in conscientiousness, they are expected to be less likely to hire. We hypothesize:

(H2) Resilient individuals will have a higher probability of becoming employers than under-controlled individuals.

In this context, one should also keep in mind that such approaches have limitations. While they may allow to analyze whether a certain profile can be identified as a key explanatory variable in the early stage hiring process, they may also hide important information that can only be revealed through the traits-based approach (see Konon and Kritikos, 2019).

Beyond the broad Big Five traits, there are several specific personality characteristics that are strongly related to entrepreneurial activities and not well captured by these traits, including risk tolerance, locus of control, and the willingness to trust others (while need for achievement is well captured in the Big Five trait conscientiousness). Various empirical studies show that a higher 'risk tolerance' increases the probability of entrepreneurial entry (see *inter alia* Caliendo et al., 2009, 2015a). As the hiring of employees is a particularly risky decision, we expect risk tolerance to play a significant role in the sense that more risk tolerant entrepreneurs are more likely to become an employer (Kihlstrom and Laffont, 1979). This is because more risk tolerant individuals will also derive a higher utility from a risky increase in expected profits that may result from employing others in the business than individuals who are less risk tolerant. We hypothesize:

(H3) The probability of becoming an employer will be higher, the higher individuals score in risk tolerance.

The personality characteristic 'locus of control' (Rotter, 1966) is widely studied, well beyond the context of entrepreneurship. Individuals with an internal locus of control are described as individuals who believe that they are able to control, or at least influence, future outcomes in their environment through their own actions. Individuals with an external locus of control believe that future outcomes are determined randomly or externally, but not by themselves.[7] As the decision to hire staff in the own business is strongly related to the future business outcomes, it is important that the hiring entrepreneurs have an internal locus of control. Scoring high in this characteristic means, that entrepreneurs believe to improve the subsequent outcomes of the business through the hiring decision. Therefore, a highly internal locus of control should be expected to be a relevant personality characteristic for the hiring decision. We hypothesize:

(H4) The probability of becoming an employer will be higher, the more internal the locus of control of these individuals is.

Last, but not least, the 'trust' characteristic captures an individual's ability to trust and rely on others when dealing with them. For entrepreneurs, trust is important as they need to be able to trust partners such as suppliers. As employers, it is critical that they are able to trust their employees (Mickiewicz and Rebmann, 2020), especially during recruitment and when they delegate tasks to their employees for the first time and expect them to work productively for the freshly started business. Employing others in the own business requires a certain amount of trust that freshly hired employees will support the new venture (Caliendo et al., 2012).

(H5) The probability of becoming an employer will be higher, the higher individuals score in trust in others.

Our research interest is to analyze how these broad personality variables – both measured traits-based as well as person-oriented – and specific personality characteristics influence the probabilities of becoming an employer, while controlling for the human capital of the individuals, such as their education levels, their work experience, and their unemployment exposure, as well as potential benefits from growing up in an entrepreneurial family.

[7] For further details on this concept and how it relates to entrepreneurial activities, see e.g. Rauch and Frese (2007).

3 Data and Descriptive Results

3.1 The Socio-economic Panel (SOEP)

For our analysis, we employ the German Socio-economic Panel (SOEP), a representative annual household panel survey of Germany (Goebel et al., 2019) that provides extensive information on individual characteristics. We use two different dependent variables in our estimations: a dummy variable that is one for employers and zero otherwise, and a dummy variable indicating a transition of an individual to employer between survey year *t* and survey year *t*+1. As we use the 2005-18 waves of the SOEP, in our estimations of transitions to employer, *t* ranges from 2005-17. Further, we use the 2003-04 waves to measure some of the personality characteristics.

Respondents indicating that their primary labor activity is self-employment are asked whether they have no employees (solo entrepreneurs), or 1-9, or 10 or more (employers). Business partners are not counted as employees, so entrepreneurs could have one or more co-founders, but we have no information on entrepreneurial teams in the data. In our sample, we only include individuals aged between 19 and 59, excluding individuals working for a self-employed family member, self-employed farmers, as well as persons in the military, civil service, or education, as these persons might be restricted in their occupational choices. We denote those who are unemployed or not participating in the labor market as non-employed.

Besides personality characteristics (which we describe in the following section in more detail), we use a large set of control variables that previous research finds to be relevant for the hiring decision (see Section 2.1). These include the socio-demographic variables of age, gender, children, marital status, migration background, disability, and residence in eastern Germany; human capital qualifications like education years and years of unemployment exposure; intergenerational transmission indicated by a self-employed father when the respondent was 15 years old; the duration of the current spell in solo entrepreneurship (or paid employment/non-employment, respectively); the sector an individual works in (a business-related characteristic in case of entrepreneurs); and a full set of year dummies. The final sample that we use to estimate the probability of being an employer, without missing values in the variables used in the main model, consists of 79,768 person-year observations.

3.2 Measuring Personality Characteristics

The SOEP includes short versions of established psychological inventories of traits and personality characteristics in several waves. This allows us to analyze the influence of a comprehensive set of traits and personality characteristics in a large representative sample while controlling for a rich set of socio-economic variables. In inventories of the Big Five, locus of control, and trust constructs, the respondents are asked how much they agree with different statements about themselves (on 7-point Likert scales). Fifteen items (identical over the years) assess the Big Five personality traits (three items capture one Big-Five factor), eight items measure locus of control,[8] and three questions elicit how much one is inclined to trust others. The personality constructs are obtained by averaging the scores from the respective items. Risk tolerance is measured over repeated survey waves by a single question about the general willingness to take risks on an 11-point scale.

Earlier factor analysis conducted *ex-post* as well as further tests confirm the validity and reliability of the instrument measuring the Big Five construct (see Lang et al., 2011, Caliendo et al., 2014, for details). Since personality traits are not elicited every year, we use these variables for subsequent observation years of the same individual when no more recent measure is available.[9] By imputing forward, i.e., only using values measured before potential transitions to an employer status occur, we alleviate potential reverse causality concerns when estimating the probability of becoming an employer. For the regressions, we standardize all personality scores to facilitate interpretation of the coefficients.

Definitions of the explanatory variables are provided in Table A1 in Appendix A. The correlations between the different personality scores (excluding the prototype dummy variables) are relatively small (see Table A2): the highest correlation is found between the Big Five factors openness and extraversion with a correlation coefficient of 0.36. This suggests that the personality scores can be included in our regressions simultaneously. We also calculate Variance Inflation Factors after the estimation of the probability of being an employer (Table A3) and find that they are all below 1.3, which further confirms that there are no multicollinearity issues.

[8] The SOEP questionnaire includes two additional items that are usually not used as they do not clearly load onto the latent factor in a factor analysis. See Caliendo et al. (2019) for the complete list of the items and more information on the factor analysis.

[9] The inventories eliciting the Big Five personality factors are included in the survey years 2005, 2009, 2013, and 2017; the question on the general willingness to take risk in 2004, 2006, and every year since 2008; locus of control is elicited in 2005, 2010, 2015, and 2016; and trust in 2003, 2008, and 2013.

3.3 Cluster Analysis of Personality Prototypes

To further examine whether there are certain personality attributes among entrepreneurs that jointly influence the hiring decision, we conduct, like Herzberg and Roth (2006), a hierarchical cluster analysis based on the Big Five traits followed by a nonhierarchical (*k*-means) cluster analysis to optimize the cluster solution.[10] Table 1 shows our three-cluster solution. The differences in the average Big Five traits between the clusters are all significant at the 1%-level (see rightmost column). Comparing the mean scores in the Big Five traits across the clusters and to the overall means in the leftmost column, the clusters are consistent with the previous literature. Individuals in Cluster 2 exhibit the lowest average scores in neuroticism and the highest average scores in the other four Big Five traits, so this Cluster reflects the resilient prototype. Cluster 1 has by far the lowest average scores in conscientiousness and agreeableness. This cluster can therefore be labelled as the under-controlled personality prototype. Cluster 3 is characterized by the lowest average score in extraversion and higher-than-average neuroticism and conscientiousness, which is consistent with the over-controlled prototype.

Reassuringly, the distribution of the specific personality characteristics in Table 1, not used for the cluster analysis, are also consistent with expectations. The resilient prototype exhibits the highest risk tolerance, the most internal locus of control, and the highest level of trust in others, whereas the over-controlled prototype has the lowest levels of risk tolerance and trust.

3.4 Summary Statistics

Table 2 provides a year-to-year transition matrix showing the numbers of observations that switch from one employment state to another between survey interviews in two subsequent years. Individuals counted on the diagonal remain in their current state. About 57% of all transitions to employer originate from solo entrepreneurs (318 of 557 transitions, as Table 2 shows), 36% from paid employment, and 7% from non-employment (unemployment or non-participation in the labor market). We provide descriptive statistics by current employment states in Table 3. Table 4 differentiates between individuals who transition immediately from paid employment or non-employment to the status of an employer in the following year, those who make the transition after being a solo entrepreneur for some time before they hire the first employee, as well as those who remain in their current states. In Table 3, we test for equal means of the variables among the employers in comparison to the other groups.

[10] We use single linkage instead of Ward's linkage for the hierarchical clustering because of the computational memory requirements for Ward's linkage that are prohibitive for our sample size.

Personality: When comparing sample means by employment states, employers differ with respect to all broad traits and personality characteristics from individuals in all other employment states (Table 3). For instance, they score higher than employees in openness, conscientiousness, and extraversion, as well as in risk tolerance, internal locus of control, and trust, but lower in agreeableness and neuroticism. Half of the employers belong to the resilient prototype, significantly more than the share of this prototype among the paid employees (38%) and the non-employed. 21% of the employers are over-controlled, this share is higher than among the solo entrepreneurs, but lower than among the paid employees or the non-employed.

Individuals transitioning from solo entrepreneurship to the status of an employer differ from those remaining solo entrepreneurs (Table 4) by scoring lower in the Big Five factors of openness to experience and agreeableness, but higher in conscientiousness. They also differ in their risk tolerance, in the sense that those who hire are more risk tolerant. More differences appear when comparing those who immediately become an employer with those who remain in the status of an employee (or non-employed). While 38% of the paid employees and non-employed belong to the resilient prototype, 44% of those who make an immediate transition to employer are resilient.

Socio-economic variables, employment experience, and industry characteristics: Research highlights that men are more often self-employed than women (e.g., Fairlie and Robb, 2009). Our differentiation between solo entrepreneurs and employers makes clear that gender is balanced among solo entrepreneurs (Tables 3 and 4). By contrast, among those who are in the employer status, only 28% are female. Moreover, among those who hire right away, 38% are women and among those who start hiring after being a solo entrepreneur for some time, 31% are women. Overall the hiring probability is significantly lower for women than for men.

Concerning human capital, employers have more formal education than employees in terms of education years, have accumulated less years of unemployment exposure, and, by far, are more likely to have a self-employed father (Table 3). When comparing those who hire with those who remain solo entrepreneurs (Table 4), these groups differ from each other only marginally in terms of education. Still there are some differences between the two groups. Those who hire are younger, are more likely to have a self-employed father, and had less unemployment exposure than those who remain solo entrepreneurs. There are also some industry specific differences. As can be expected, individuals hire more often in the manufacturing and the construction sectors as well as in trade and hospitality. By contrast, individuals in public and personal services remain solo entrepreneurs more often.

4 Multivariate Analysis

4.1 Estimation Methodology

The aim of our econometric analysis is to estimate the influence of personality on the probability of becoming an employer. In separate sets of estimations, we pursuit both the traits-based approach, using the individual scores in the Big Five personality traits, and the person-oriented approach, using the dummy variables indicating the three personality prototypes. In both cases, we follow Zhao and Seibert (2006) and Rauch and Frese (2007) and start presenting estimations only including the Big Five traits or the personality prototypes, and then proceed by adding the specific personality characteristics, to reveal their additional influence. We estimate the probability of an individual transition to employer from one year, *t*, to the next, *t*+1, conditional on the duration in the current state. We use the sample of current solo-entrepreneurs to estimate the time to hire the first employee for those who first gain some experience as solo-entrepreneurs, and we use the sample of current paid employees or non-employed individuals to estimate the probability of starting a business with the immediate hiring of at least one employee.

The dependent variable (becoming an employer) is binary. For individual *i,* in calendar year *t*, the propensity to become an employer between the current and the next year, conditional on the duration in the current state, is modelled using the latent index function

$$entry^*_{i,t+1} = \beta_0 + \sum_k \alpha_k p_{kit} + \beta' x_{it} + \theta d_{it} + \varepsilon_{it}, \quad (1)$$

where p_{kit} denote *K* personality variables, x_{it} is a vector of control variables, d_{it} is a vector of dummies[11] capturing the tenure in the current employment state (solo entrepreneur in the estimations of the time to hiring the first employee; paid employment or non-employment in the estimations of immediate transition to employer), and ε_{it} is the error term.

This model of the annual probability of transition to employer, conditional on a flexible functional form of the duration in the current state (baseline hazard), estimated based on the sample at risk of this transition in person-year format, represents a discrete time survival model (Jenkins, 1995; Sueyoshi, 1995).[12] In case of the model of hiring as solo entrepreneur, this means that we estimate the effects of the personality variables on the hazard of hiring the first employee conditional on the time elapsed since becoming self-employed, based on the sample

[11] We use five dummy variables indicating two, three, four, five, or six or more years of tenure, with one year being the omitted base category. In a robustness check, we use a second degree polynomial of tenure instead of the dummy variables and obtain similar results for the personality variables (available from the authors on request).
[12] We use annual data because interviews occur once a year, the covariates are not available at higher frequencies.

of person-year observations of current solo entrepreneurs. In case of an immediate hiring, we estimate the effect of the personality variables on the hazard of becoming an employer conditional on the spell duration in paid employment or non-employment; the sample at risk of becoming an employer is comprised of all person-year observations currently in paid employment or non-employment. Appendix B formally derives our estimation equation in Eq. (1) as a simple logit model, starting from a general notation of a survival model (cf. Caliendo et al., 2010). By estimating discrete time survival models, we avoid survivorship bias. Our estimations account for right-censoring of spells, as survival models generally do, as well as for left-censoring, because we recover an individual's tenure in the current employment state from the individual's retrospective employment history record in case of left-censored spells. Another advantage of our survival model is that it allows the independent variables to change over time within a spell, in contrast to the Cox model, for example. For comparison, we also estimate logit models of the probability of being an employer based on the full sample. In steady state, the share of employers in the population is determined by the rates of transitions to and from this state.

To assess whether selection into being a solo entrepreneur affects our estimation results for the model of hiring from the position of a solo entrepreneur, we use a selection correction in a robustness check. We implement the selection model for binary dependent variables suggested by van de Ven and van Praag (1981) with probit models both for the main equation of the probability of transition to employer (Eq. 1) and a selection equation for being a solo entrepreneur with the latent index function

$$solo\_entrepreneur_{it}^{*} = \beta_{s0} + \sum_k \alpha_{sk} p_{kit} + \beta_s' x_{it} + \vartheta' w_{it} + \theta' d_{it} + u_{it}, \qquad (2)$$

where the subscript *s* is used to distinguish the coefficients from the coefficients in the outcome equation, Eq. (1). Here, the error terms ε_{it} and u_{it} are modeled to follow the bivariate normal distribution with correlation. The two equations are estimated jointly by full information maximum likelihood. To facilitate identification, selection Eq. (2) includes additional independent variables w_{it}, which affect the probability of being a solo entrepreneur, but are assumed not to have a direct influence on the decision to hire employees, conditional on already being a solo entrepreneur. We include the secondary schooling levels of the respondent's father and mother in w_{it}. Parental schooling is expected to influence their offspring's choice to be self-employed (see Dunn and Holtz-Eakin, 2000, for the influence of the family background), but not directly the decision to hire employees once the offspring has decided to become self-employed as an

adult. Parental schooling levels are measured by dummy variables indicating if the parent obtained the "Abitur," the higher secondary school qualification for university admission in Germany.

Besides the personality variables p_{kit}, we include the control variables mentioned in Section 3.1 in x_{it}. Still, we should emphasize that our data are not perfect, as we are not fully able to control for the quality of the entrepreneurial ideas. These are not randomly distributed and those with better ideas are more likely to hire immediately. This is not a threat to identification as long as our observed variables influence the business ideas or the entrepreneurial abilities and, subsequently, these influence the hiring decision. In this case, we are still able to estimate the causal (reduced form) effects of those individual factors we are able to observe. Although we control for a large set of individual characteristics, our approach would become problematic in the case of reversed causality – i.e., that the business idea or entrepreneurial abilities influence our observed characteristics – or if an unobserved factor influenced both the business idea and our observed variables. If this scenario is relevant, our aims would be more moderate: we would then only be able to assess whether the personality and other characteristics of the business founder are associated with the hiring decision.

4.2 Main Estimation Results

Table 5 provides the results from the estimations using the traits-based approach. After we report regressions including the Big Five traits and control variables, we then proceed with regressions additionally including the specific personality characteristics. The table shows average marginal effects. Columns 1 and 2 refer to the logit probability model of being an employer, Columns 3 and 4 to the transition from solo entrepreneur to employer, and Columns 5 and 6 to the transition from paid employment or non-employment to employer.

Probability of being an entrepreneur: Before we discuss our main estimations of the probability of becoming an employer, we first describe the results from estimating the probability of being an employer in Columns 1 and 2. Concerning the Big Five personality traits, when not controlling specific personality characteristics in Column 1, we find that individuals who are open to experiences, conscientious, extraverted, and less agreeable, are more likely to be employers. The marginal effects range from 0.44 to 0.79 percentage points changes (in absolute terms) in the probability of being an employer as a result of a one-standard-deviation increase in one of the traits. This corresponds to about 10-17% of the baseline employer rate of 4.5% in the sample (as indicated at the bottom of the table). In Column 2, where we add specific

personality characteristics, risk tolerance and an internal locus of control have even larger positive marginal effects, neuroticism is positively associated with being an employer, and openness to experience becomes insignificant. The insight from these estimations is that personality matters for being an employer. To investigate more specifically which traits influence the decision to become an employer, we turn to the transition models.

Influence of traits on the probability of hiring a first employee: The coefficients of the Big Five personality traits are jointly significant in the model of becoming an employer out of paid employment or non-employment (p-value < 0.001 in the estimation in Column 6), but not in the model of transition from solo entrepreneur to employer (p-value: 0.30 in the model in Column 4). Some specific personality characteristics have significant partial effects in both models. Therefore, following Zhao and Seibert (2006), the more comprehensive model should be preferred over the model only including the Big Five (and control variables).

Starting with the Big Five construct, we observe that openness to experience has a significantly positive effect on the conditional probability of becoming an employer immediately out of paid employment or non-employment, but not on the hiring probability among solo entrepreneurs, thus partly confirming hypothesis H1a. A one-standard-deviation higher score in openness increases the probability of immediately becoming an employer from one year to the next by 0.058 percentage points in Column 6. Relative to the baseline annual probability of becoming an employer from paid employment or non-employment of 0.37%, this corresponds to a relative increase of 15.6%. The point estimate of the effect of openness is larger when not including the specific personality characteristics in Column 5, but the confidence intervals overlap. Conscientiousness has a positive effect on immediately becoming an employer of similar size (14.6% relative to the baseline probability in Column 6, and similar in Column 5), partly confirming H1b. The other three traits among the Big Five do not influence the immediate transition to employer. Thus, we find no support for H1c that expected a positive influence of extraversion on the hiring decision.

Turning to the influence of the specific personality characteristics, while controlling for the Big Five factors, we observe that both risk tolerance and trust in others influence the hiring decision. An increase in risk tolerance by one standard deviation raises the annual probability of becoming an employer immediately out of paid employment or non-employment by 0.12 percentage points, corresponding to a strong relative effect of 34%. The annual probability of hiring as a solo entrepreneur is increased by 1.3 percentage points; relative to the larger annual baseline probability of this transition of 8.9%, the effect is 14.4%. This indicates that a larger

risk tolerance shortens the time solo entrepreneurs take to hiring their first employee, and H3 is fully confirmed. Higher scores in trust are found to increase the probability of immediately becoming an employer – at 0.07 percentage points, the effect size of a one-standard-deviation increase in trust is about half as large as the effect size of risk tolerance, partly confirming H5. Locus of control does not have a significant effect on the hiring decision in these models, not confirming H4.

To put our estimated effect sizes into perspective, we compare them with the better-known positive effect of education on the probability of hiring. Coad et al. (2017) estimate that a college degree increases the probability of hiring by 0.8 percentage points (their Table 2, Model 2), this corresponds to 11% of the baseline probability of hiring in their Danish sample. With our German data, we estimate that one year of education increases the annual probability of immediately becoming an employer by 0.029 percentage points (Table 5, Column 6), so a 5-year university degree increases the probability by 0.146 percentage points or 39% of the baseline probability in our sample. Thus, the effect sizes of the personality variables are comparable to those of formal education: a one standard deviation increase in openness increases the probability of immediately becoming an employer by 40% of the effect size of a university degree, in conscientiousness by 37%, in risk tolerance by 85%, and in trust by 48%.

Influence of control variables: Among the previously investigated variables, which we control for in our setting, we observe that individuals who grew up in a household with a self-employed father, as well as those with a larger amount of formal education, are more likely to become employers out of paid employment or non-employment, but there is no significant effect on hiring for individuals who are already solo entrepreneurs. As to work experience and the employment history, we observe that individuals are more likely to become employers, independent of when they hire people, if they had less unemployment exposure (measured in years). Moreover, the relationship between age and becoming an employer is inversely U-shaped: middle-aged individuals are more likely to hire than younger or older individuals, with the peak reached at about 40 years for those who hire as solo entrepreneurs and slightly later for those who hire immediately when starting entrepreneurial activities, as shown in Figure A1 in Appendix A (based on the linear and squared terms of age included in the estimations referred to in Columns 4 and 6 of Table 5). This finding can be interpreted as a general work experience effect, as we control for education and the time spent in unemployment. Figure A2 shows the baseline hazards in the estimated survival models (based on the estimated coefficients of the spell duration dummies). The figure reveals that the effect of tenure in the current employment

status on the conditional annual probability of becoming an employer decreases with time in paid employment or non-employment, but remains largely constant with time in solo entrepreneurship considering the confidence intervals (note the different scales in the two figures). The decreasing hazard of becoming an employer for paid employees could be due to habituation and increased opportunity cost of self-employment after a longer career in paid employment.

Influence of personality prototypes: In alternative models, as discussed above, we consider the person-based approach by including dummy variables indicating the resilient and over-controlled personality prototypes, with the under-controlled prototype as the omitted base category. The results appear in Table 6. Starting again with the estimations of the probability of being an employer, we observe that over-controlled individuals are less likely to be employers in comparison to under-controlled individuals. In Column 2, the difference in the employer rate between the two prototypes is one percentage point, that is 22% of the average share of employers in the sample. This effect is similar when omitting the specific personality characteristics in Column 1. The effect of being resilient becomes significantly positive in this model, indicating that resilient individuals are 1.5 percentage points more likely than under-controlled individuals to be employers. When added, risk tolerance and locus of control have positive marginal effects, which are very similar in size to the estimates in Table 5, confirming the robustness of these findings. In addition, the negative marginal effect of trust on being an employer becomes significant in this model.

Turning to the transition models, we observe that the resilient prototype is significantly more likely to immediately become an employer out of paid employment or non-employment in comparison to the under-controlled prototype (Column 5), thus partly confirming H2, but only when not controlling for the specific personality characteristics. The effect size relative to the baseline probability is 31.9%. When we include the specific personality characteristics, risk tolerance, an internal locus of control, and trust all have positive and significant marginal effects on immediately becoming an employer. These are similar in size to what we obtain in Table 5, although locus of control is statistically significant only here in conjunction with the prototypes. An increase of internal locus of control by one standard deviation elevates the probability of becoming an employer by 0.055 percentage points or 14.9% relative to the baseline probability. Only risk tolerance is significantly related to the hiring as a solo entrepreneur, confirming what we observed in Table 5, and with a similar marginal effect size. Overall, the estimated marginal effects of the specific personality characteristics are not very sensitive to whether we control the Big Five traits or the personality prototypes.

Table 7 summarizes the results of our hypotheses tests. H3 concerning the positive effect of risk tolerance on the annual conditional probability of becoming an employer is fully confirmed, both for individuals who are already solo entrepreneurs and individuals who are not. H1a, H1b and H5 regarding openness to experience, conscientiousness, and trust are partially confirmed, as the positive effects of these variables are significant for those in paid employment or non-employment. With regard to H2 and H4 about resilience and internal locus of control, we do not find significant effects in our preferred models, but positive and significant effects for those in paid employment or non-employment in supplemental models.

4.3 Robustness Checks

In this section, we assess the robustness of our results, starting from the preferred survival model including the Big Five traits and the specific personality characteristics. In Table 8, we use the selection correction method outlined in Section 4.1 to control selection into the sample of solo entrepreneurs in our estimation of the transition probability from solo entrepreneur to employer. The variables used as exclusion restrictions, father's and mother's education, increase the probability of being a solo entrepreneur (selection equation), they are jointly significant at the 1% level (p-value: 0.0033). The estimated correlation of the error terms u_{it} and ε_{it} is positive and significant (see ρ at the bottom of the table). The estimated marginal effects on the probability of hiring as a solo entrepreneur remain similar to the results in Table 5, Column 4: risk tolerance remains statistically significant, positively influencing the hiring decision of solo entrepreneurs. The point estimate of the marginal effect of risk tolerance increases somewhat, but the confidence intervals overlap. In sum, the main results are not sensitive to modelling selection.

Next, since earlier studies (Caliendo et al., 2010) report a non-linear effect of risk tolerance on entrepreneurial performance measures, we explore potential non-linear effects in the most flexible way by using dummy variables for each of the 11 possible levels of risk tolerance as measured in the survey. Apart from that, we estimate the same model as in Column 6 of Table 5. Figure 1 shows the predicted probabilities when we evaluate the estimated models at different levels of risk tolerance and at the mean values of the other explanatory variables. The positive association of risk tolerance with the probability of transition to employer (even controlling for the Big Five) is visible in both graphs, although the 95% confidence intervals are fairly wide when estimating the ten coefficients of the risk tolerance dummies. The simple linear function of risk tolerance within the logit function used in the baseline model is not rejected and is a reasonable and more efficient approximation.

Finally, we assess the sensitivity of the results to modelling unobserved heterogeneity in our survival models, so these become frailty models. We model a normally distributed random effect at the person level. The results appear in Table A4 in Appendix A. Although the estimated variance of the panel-level random effect is significantly different from zero, the estimated marginal effects of the personality variables change very little in comparison to Column 6 of Table 5. Some coefficients become statistically more significant. We conclude that the results are robust to modelling unobserved heterogeneity.

5 Discussion and Conclusion

The decision to hire the first employee is not just of crucial importance in an entrepreneur's life in terms of long-term success but also for society in terms of job creation. In this paper, we analyze how personality influences the hiring decision, controlling for individual characteristics of entrepreneurs that are shown in the existing literature to affect the hiring decision as well. To do so, we use the Big-Five approach, as a broad measure of personality, as well as several specific personality characteristics that are particularly relevant for entrepreneurial decision making. We also examine whether personality unfolds a differing influence depending on whether individuals hire for the first time right when they start their business or after having experienced a certain amount of time as being a solo entrepreneur.

Our analysis provides four main results. First, the personality matters for the hiring decision and helps predict who becomes an employer. Second, among those who hire right at the time when they start their entrepreneurial activity, individuals are more likely to become employers, the higher they score in risk tolerance, trust, openness to experience, and conscientiousness. Third, among those who hire after having gained some experience as solo entrepreneurs, risk tolerance remains the only personality variable influencing the hiring decision, shortening the time until entrepreneurs hire their first employee. Fourth, using the prototype related approach, we find some evidence pointing in the direction that more resilient individuals are more likely to become employers out of paid employment or non-employment. However, this influence fades once we control for the further specific personality characteristics.

These findings are remarkable for several reasons. They reinforce the importance of risk tolerance as a crucial variable for growing the own business (as suggested by Kihlstrom and Laffont, 1979) and reveal that this variable is particularly important for the hiring decision – a decision that increases business risk considerably. Risk tolerance is not only relevant when

comparing entrepreneurs with individuals in other employment forms but also among entrepreneurs, with the effect size of a one-standard-deviation increase in risk tolerance on the probability of becoming an employer about as large as the influence of having gained a university degree. Still, we should emphasize that this outcome describes a subjective decision when entrepreneurs, depending on their risk tolerance, positively assess their ability of hiring an employee to increase the own benefits from their entrepreneurial activities. At this stage, it is not possible to provide an objective assessment of this decision.

It is also remarkable that other personality traits beyond risk tolerance matter only among those who hire immediately at the time when the business is ventured, clarifying that personality plays partly the same, partly a differing role when related to the hiring decisions at different stages. For those who start their entrepreneurial activities as employers, the results show that, besides risk tolerance, having trust in others is a fundamental characteristic for being able to do so. Trust enables entrepreneurs to believe that they can count on their future team of freshly hired employee(s) to fulfill the expectations put upon them. This observation might also explain why, in countries or regions with generally low trust levels, firms tend to remain small and often hire family members. Moreover, two of the Big Five traits affect becoming employers immediately, openness to experience and conscientiousness. The observed positive influence of openness to experience among those who hire right at the beginning of their entrepreneurial activities could be interpreted in the sense that these entrepreneurs aim to realize an innovative idea at a larger scale. The influence of conscientiousness on the decision to hire immediately could be interpreted in two ways. First, conscientious entrepreneurs might be able to signal their dependability to their future employees (Bublitz et al., 2017) and, therefore, attract employees into their freshly started entrepreneurial activities. Second, it could also mean that individuals who are well-organized and methodical are better able to structure the demanding process of hiring a first employee at the time of starting a business.

Overall, our results allow for the interpretation that individuals with high scores in risk tolerance, trust, conscientiousness, and openness to experience might be better able to address some of the demand- and supply-side related constraints of becoming an employer – as mentioned in the introduction. Still we should emphasize that the data do not allow disentangling effects of personality on labor demand (concerning the willingness and ability of the entrepreneur to hire) from effects on labor supply (concerning the attraction of employees to the entrepreneurial business) in our analysis; this is left to future research. The finding that beyond risk tolerance the influence of the other personality traits on the hiring decision fade as individuals

gain experience as solo entrepreneurs, could be interpreted in several ways. This could mean for instance that employees put less weight on the entrepreneurial personality once these entrepreneurs have established their solo businesses for a certain time and thereby reduced uncertainty about their business. It could also mean that those individuals who hire right away constitute a different "type" of entrepreneur than individuals who start as solo entrepreneur.

Reflecting these results on entrepreneurial teams – for whom we have no information in the data – our findings suggest that complementary effects may exist between team members: If one person's strength lies in, for example, conscientiousness and another person is strong at, for example, openness, the joint strength could help to hire the first employee in the firm. Of course, the opposite could also be true: consensus will be difficult if one team member scores high on a specific personality characteristic (in particular on risk tolerance or trust) and another scores low on the same characteristic, thus undermining the potential success of the firm. At the same time, it is questionable whether individuals with such differing personality characteristics will self-select into one entrepreneurial team. To that end more research is needed.

We should emphasize that our analysis has some limitations and raises additional research questions. First, and foremost, we use a household survey collecting individual-level data. Therefore, our analysis with respect to firm characteristics is limited to industries. Further, the characteristics of the hired employees and the local environment, such as labor availability or local demand for products and services, are not available in our data, which is why we can only speculate how the influence of the personality on the hiring decision addresses constraints in the hiring process.[13] As we have no information on the workforce composition, the contract types, or on the productivity of workers in the firm, access to data that includes such information would allow for extending research toward the analysis of firm productivity and employer survival.[14] Moreover, although we only use previously measured personality traits to estimate the probability of becoming an employer, we cannot fully exclude potential issues of reverse causality. Individuals may have experienced one or more spells as employers in previous years, which may have influenced their personality to the extent that personality still changes among adults. This is a limitation of our analysis that should be addressed in future research using data

[13] With respect to the latter point and its influence on the hiring decision, parallel research provides first results. While there is evidence of countercyclical effects of the regional economic environment on business entry (Konon et al., 2018), it remains unclear how changes in this environment affect the hiring decision. For more details see Lee and Mukoyama (2015) and Sedlácek and Sterk (2017).

[14] For example, parallel research suggests that better educated entrepreneurs are able to attract more talented employees increasing the survival probability of the firms (Dahl and Klepper, 2015) and that the survival of employers then again depends on the turnover of their employees (Gjerløv-Juel and Guenther, 2019).

spanning the entire careers of individuals. Last, but not least, comparisons between countries or policy regimes could shed light on how institutional factors, such as labor market and business regulations, influence the hiring decision of entrepreneurs, and whether the influence of personality characteristics on the transition to the status of an employer differs across institutional environments.

To the extent that personality captures one part of entrepreneurial abilities, our analysis helps understanding these abilities, which are usually unobservable. Being equipped with the aforementioned personality characteristics may enable entrepreneurs to hire staff in their firms, thus increasing the utility that entrepreneurs might be able to derive from hiring. These findings allow for some policy conclusions. As the policy debate centers more and more on business growth, our analysis enhances the understanding of what characteristics influence the decision of becoming an employer and why many solo entrepreneurs refrain from this transition. Our findings should thus be considered when designing public policy instruments. For instance, when measures are introduced to support entrepreneurs in their aim to grow their businesses, such as job creation programs, it is important that these offers require a holistic approach. Having demonstrated the importance of personality, coaching at the point of the hiring decision may identify potential individual strengths that can be further supported and developed, as well as address potential deficits of individuals who aim to become employers. Moreover, should public administrations aim to increase hiring among business founders and given the strong influence of risk tolerance on the hiring decision, policy measures that address the high risks and costs associated with hiring the first employee could be considered.

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Tables and Figure

Table 1: Cluster solution for personality prototypes

	Overall	Cluster 1: under-controlled	Cluster 2: resilient	Cluster 3: over-control.	Differences
	Mean	Mean	Mean	Mean	*p*-value
Personality scores:					
openness	4.50	4.31	5.29	3.68	0.000
conscientiousness	5.92	5.06	6.38	6.17	0.000
extraversion	4.86	4.66	5.65	4.03	0.000
agreeableness	5.36	4.52	5.74	5.67	0.000
neuroticism	3.82	4.13	3.39	4.06	0.000
risk tolerance	4.68	4.78	5.08	4.06	0.000
locus of control	4.91	4.70	5.13	4.83	0.000
trust	2.34	2.33	2.39	2.30	0.000
Socio-economic variables:					
tenure	11.0	10.9	10.9	11.3	0.000
female	0.54	0.47	0.59	0.53	0.000
education years	12.6	12.8	12.7	12.3	0.000
married	0.65	0.63	0.64	0.68	0.000
no. of children	0.64	0.64	0.64	0.64	0.712
unemploym. expo.	1.11	1.17	1.01	1.18	0.000
migration backgr.	0.12	0.11	0.13	0.12	0.000
disability degree	3.38	3.66	2.87	3.77	0.000
east	0.24	0.22	0.24	0.25	0.000
father entrepreneur	0.08	0.09	0.08	0.07	0.000
age	43.6	42.8	43.8	44.2	0.000
father high school	0.13	0.14	0.14	0.10	0.000
mother high school	0.07	0.08	0.07	0.06	0.000
Industry:					
manufact. & agri.	0.22	0.24	0.20	0.24	0.000
construction	0.05	0.05	0.04	0.05	0.001
trade & hospitality	0.13	0.12	0.13	0.13	0.001
transp. & commun.	0.04	0.05	0.04	0.05	0.000
financial service	0.04	0.05	0.04	0.04	0.000
business service	0.09	0.09	0.09	0.09	0.003
public & pers. serv.	0.26	0.23	0.29	0.24	0.000
Observation years	79768	23808	31389	24571	79768

Notes: Means for the overall sample and by cluster. The rightmost column displays results from regression-based *F*-tests of equal means in the three clusters (*p*-values). The personality variables are shown before standardization. Father's and mother's high school degrees (not used in the main analysis) are based on fewer observations because of missing values. Table A1 in Appendix A provides variable definitions. Source: Authors' calculations based on SOEP, 2005-2018 (with some variable values from 2003/04).

Table 2: Matrix of transitions between employment and entrepreneurship states

		Columns: state in *t*+1				
Rows: state in *t*		(1)	(2)	(3)	(4)	Total
(1) Non-employment	Obs.	7489	2370	202	39	10100
	%	74.1	23.5	2.0	0.4	100.0
(2) Paid employment	Obs.	2212	51754	269	200	54435
	%	4.1	95.1	0.5	0.4	100.0
(3) Solo entrepreneurs	Obs.	138	276	2830	318	3562
	%	3.9	7.7	79.4	8.9	100.0
(4) Employers	Obs.	43	167	294	2706	3210
	%	1.3	5.2	9.2	84.3	100.0
Total	Obs.	9882	54567	3595	3263	71307
	%	13.9	76.5	5.0	4.6	100.0

Notes: The transition matrix shows the numbers of observations that switch from one employment status to another between the survey interviews in two subsequent years. Observations on the diagonal remain in the current state. Source: Authors' calculations based on SOEP, 2005-2018.

Table 3: Descriptive statistics by employment state

	Employers		Solo entrepreneurs			Paid employees			Non-employed		
	M	SD	M	SD	Diff.	M	SD	Diff.	M	SD	Diff.
Personality scores:											
openness	4.78	1.16	5.08	1.14	0.000	4.45	1.15	0.000	4.46	1.19	0.000
conscientiousness	6.05	0.87	5.89	0.92	0.000	5.93	0.86	0.000	5.84	0.94	0.000
extraversion	5.05	1.15	5.12	1.12	0.009	4.83	1.13	0.000	4.83	1.15	0.000
agreeableness	5.25	0.99	5.36	0.97	0.000	5.34	0.96	0.000	5.45	0.97	0.000
neuroticism	3.52	1.20	3.68	1.19	0.000	3.78	1.20	0.000	4.14	1.19	0.000
risk tolerance	5.71	2.26	5.45	2.16	0.000	4.63	2.16	0.000	4.34	2.33	0.000
locus of control	5.33	0.82	5.03	0.83	0.000	4.93	0.81	0.000	4.64	0.90	0.000
trust	2.44	0.57	2.49	0.57	0.001	2.35	0.53	0.000	2.22	0.54	0.000
Personality prototypes (shares in each subsample):											
under-controlled	0.29		0.30		0.391	0.30		0.237	0.30		0.095
resilient	0.50		0.52		0.125	0.38		0.000	0.37		0.000
over-controlled	0.21		0.18		0.004	0.32		0.000	0.33		0.000
Socio-economic variables:											
tenure	10.6	8.14	8.33	7.36	0.000	12.4	9.10	0.000	4.93	4.67	0.000
female	0.28		0.47		0.000	0.52		0.000	0.75		0.000
education years	14.2	3.13	13.7	2.88	0.000	12.6	2.64	0.000	11.7	2.51	0.000
married	0.69		0.60		0.000	0.65		0.000	0.66		0.005
no. of children	0.68	0.95	0.56	0.87	0.000	0.59	0.88	0.000	0.90	1.13	0.000
unemploym. expo.	0.33	0.86	1.01	2.19	0.000	0.76	1.87	0.000	3.21	4.48	0.000
migration backgr.	0.09		0.09		0.671	0.11		0.000	0.17		0.000
disability degree	2.21	10.9	1.47	8.63	0.001	3.24	13.2	0.000	5.14	16.9	0.000
east	0.21		0.24		0.000	0.23		0.000	0.26		0.000
father entrepreneur	0.20		0.12		0.000	0.07		0.000	0.07		0.000
age	46.1	7.65	45.5	8.61	0.000	43.5	9.26	0.000	42.9	10.4	0.000
father high school	0.20		0.24		0.000	0.12		0.000	0.10		0.000
mother high school	0.12		0.13		0.078	0.06		0.000	0.06		0.000
Industry:											
manufact. & agri.	0.12		0.11		0.156	0.28		0.000			
construction	0.13		0.08		0.000	0.05		0.000			
trade & hospitality	0.20		0.11		0.000	0.15		0.000			
transp. & commun.	0.03		0.03		0.534	0.05		0.000			
financial service	0.03		0.05		0.000	0.05		0.000			
business service	0.24		0.22		0.178	0.09		0.000			
public & pers. serv.	0.22		0.34		0.000	0.30		0.000			
Observation years	3603		3971			60519			11675		

Notes: Means (M) and standard deviations (SD) by employment state and Welch's *t*-tests of equal means (Diff.) in the samples of the employment state at hand and employers (*p*-values). No SD are shown for binary variables. The personality variables are shown before standardization. Father's and mother's high school degrees (not used in the main analysis) are based on fewer observations because of missing values. Table A1 in Appendix A provides variable definitions. Source: Authors' calculations based on SOEP, 2005-2018 (with some variable values from 2003/04).

Table 4: Mean characteristics by initial employment state and transition

Status in *t*	Solo entrepreneurs			Paid employees and non-employed		
Transition between *t* and *t*+1	No transition	Transition to employer		No transition	Transition to employer	
	Mean	Mean	Difference (*p*-value)	Mean	Mean	Difference (*p*-value)
Personality scores:						
openness	5.11	4.95	0.022	4.45	4.78	0.000
conscientiousness	5.88	5.98	0.057	5.92	6.01	0.098
extraversion	5.12	5.11	0.868	4.83	4.97	0.036
agreeableness	5.38	5.28	0.099	5.36	5.35	0.809
neuroticism	3.68	3.68	0.942	3.84	3.57	0.001
risk tolerance	5.41	5.88	0.000	4.57	5.63	0.000
locus of control	5.03	5.06	0.492	4.88	5.14	0.000
trust	2.49	2.48	0.732	2.33	2.51	0.000
Personality prototypes (shares in each subsample):						
under-controlled	0.29	0.31	0.669	0.30	0.27	0.374
resilient	0.53	0.49	0.257	0.38	0.44	0.057
over-controlled	0.18	0.20	0.353	0.32	0.28	0.222
Socio-economic variables:						
tenure	8.33	8.62	0.490	11.3	6.64	0.000
female	0.49	0.31	0.000	0.55	0.38	0.000
education years	13.8	13.4	0.009	12.5	13.6	0.000
married	0.60	0.63	0.236	0.66	0.67	0.773
no. of children	0.56	0.55	0.910	0.64	0.85	0.001
unemploym. expo.	1.07	0.55	0.000	1.14	0.53	0.000
migration backgr.	0.09	0.10	0.303	0.12	0.13	0.577
disability degree	1.30	1.86	0.352	3.41	2.11	0.102
east	0.25	0.20	0.078	0.24	0.17	0.005
father entrepreneur	0.12	0.15	0.080	0.07	0.18	0.000
age	45.7	44.8	0.042	43.5	41.3	0.000
father highschool	0.24	0.14	0.000	0.12	0.22	0.000
mother highschool	0.14	0.09	0.016	0.06	0.14	0.001
Industry:						
manufact. & agri.	0.11	0.15	0.042	0.24	0.16	0.002
construction	0.08	0.11	0.079	0.04	0.09	0.013
trade & hospitality	0.11	0.17	0.003	0.13	0.18	0.031
transp. & commun.	0.03	0.03	0.657	0.05	0.04	0.775
financial services	0.05	0.06	0.693	0.04	0.03	0.513
business services	0.22	0.21	0.690	0.08	0.13	0.024
public & pers. serv.	0.36	0.25	0.000	0.26	0.19	0.009
Observations	3244	318		64296	239	

Notes: Mean characteristics and Welch's *t*-tests (*p*-values) of equal means between those who make a transition to an employer in the subsequent year and those who do not in each subsample defined by the initial employment state. The personality variables are shown before standardization. Father's and mother's high school degrees (not used in the main analysis) are based on fewer observations because of missing values. Table A1 in Appendix A provides variable definitions. Source: Authors' calculations based on SOEP, 2005-2018 (with some variable values from 2003/04).

Table 5: Logit probability models of being and becoming an employer (marginal effects) *with Big Five*

Dependent var.	Being an employer		Becoming an employer			
Sample	Full sample		Sample of solo entrepreneurs		Sample of paid employees and non-employed	
	(1)	(2)	(3)	(4)	(5)	(6)
openness	0.00507***	0.00295	-0.00367	-0.00609	0.000787**	0.000577*
	(0.00194)	(0.00185)	(0.00629)	(0.00640)	(0.000320)	(0.000312)
conscientiousn.	0.00643***	0.00402**	0.00647	0.00701	0.000517*	0.000540*
	(0.00191)	(0.00186)	(0.00577)	(0.00581)	(0.000309)	(0.000317)
extraversion	0.00790***	0.00437**	0.00347	0.00205	0.000110	-0.000123
	(0.00202)	(0.00197)	(0.00594)	(0.00604)	(0.000282)	(0.000283)
agreeableness	-0.00440***	-0.00350**	-0.00421	-0.00350	-0.000142	-0.000104
	(0.00166)	(0.00160)	(0.00570)	(0.00572)	(0.000272)	(0.000270)
neuroticism	-0.00163	0.00333**	0.00589	0.00838	-0.000338	0.0000528
	(0.00170)	(0.00167)	(0.00580)	(0.00589)	(0.000279)	(0.000290)
risk tolerance		0.0123***		0.0129**		0.00124***
		(0.00158)		(0.00603)		(0.000314)
locus of control		0.0148***		0.00156		0.000483
		(0.00176)		(0.00573)		(0.000323)
trust		-0.00245		0.00474		0.000695**
		(0.00164)		(0.00536)		(0.000327)
female	-0.0453***	-0.0400***	-0.0543***	-0.0517***	-0.00372***	-0.00320***
	(0.00434)	(0.00417)	(0.0133)	(0.0132)	(0.000731)	(0.000675)
education years	0.00578***	0.00548***	-0.00244	-0.00254	0.000363***	0.000292**
	(0.000751)	(0.000760)	(0.00228)	(0.00229)	(0.000114)	(0.000117)
married	-0.00617	-0.00547	0.0207	0.0229*	0.0000671	0.000129
	(0.00413)	(0.00405)	(0.0129)	(0.0129)	(0.000648)	(0.000644)
no. of children	0.00405**	0.00353*	-0.0120	-0.0120	0.000244	0.000150
	(0.00198)	(0.00193)	(0.00737)	(0.00734)	(0.000304)	(0.000292)
unempl. expos.	-0.0103***	-0.00909***	-0.0168***	-0.0152***	-0.00102***	-0.000926***
	(0.00180)	(0.00174)	(0.00546)	(0.00544)	(0.000329)	(0.000314)
migrat. backgr.	0.00783	0.00768	0.0155	0.0144	0.000344	0.000483
	(0.00604)	(0.00590)	(0.0196)	(0.0195)	(0.000788)	(0.000779)
disability deg.	-0.000180	-0.000152	0.00114	0.00113	-0.00000928	-0.00000655
	(0.000144)	(0.000141)	(0.000753)	(0.000771)	(0.0000407)	(0.0000392)
east	-0.00118	-0.00143	-0.0152	-0.0162	-0.00104	-0.000927
	(0.00458)	(0.00453)	(0.0141)	(0.0140)	(0.000733)	(0.000722)
father entrep.	0.0347***	0.0337***	0.0197	0.0202	0.00290***	0.00280***
	(0.00493)	(0.00490)	(0.0165)	(0.0162)	(0.000751)	(0.000730)
age	0.00121***	0.00120***	-0.00217***	-0.00224***	-0.00000622	-0.00000842
	(0.000209)	(0.000203)	(0.000652)	(0.000655)	(0.0000301)	(0.0000297)
Duration dum.			Yes	Yes	Yes	Yes
Observations	79768	79768	3562	3562	64535	64535
Log likelihood	-12003.7	-11680.5	-999.9	-996.3	-1406.2	-1388.6
Mean dep. var.	0.0452	0.0452	0.0893	0.0893	0.00370	0.00370

Notes: Estimated average marginal effects from logit models of being and becoming an employer. The models include linear and squared terms of age, five industry dummies, a full set of year dummies and a constant. Cluster robust standard errors in parentheses. */**/***: Significant difference from 0 at the 10%/5%/1% level. Source: Authors' calculations based on SOEP, 2005-2018.

Table 6: Logit prob. models of being and becoming an employer (marginal effects) *with prototypes*

Dependent var.	Being an employer		Becoming an employer			
Sample	Full sample		Sample of solo entrepreneurs		Sample of paid employees and non-employed	
	(1)	(2)	(3)	(4)	(5)	(6)
resilient	0.0148***	0.00445	-0.00534	-0.00822	0.00118*	0.000531
	(0.00346)	(0.00342)	(0.0121)	(0.0123)	(0.000641)	(0.000655)
over-controlled	-0.0107***	-0.0100**	-0.00151	0.00193	0.000438	0.000661
	(0.00405)	(0.00395)	(0.0146)	(0.0146)	(0.000717)	(0.000709)
risk tolerance		0.0127***		0.0122**		0.00136***
		(0.00162)		(0.00600)		(0.000322)
locus of control		0.0145***		0.00153		0.000551*
		(0.00176)		(0.00566)		(0.000308)
trust		-0.00350**		0.00236		0.000643**
		(0.00163)		(0.00525)		(0.000323)
female	-0.0446***	-0.0379***	-0.0521***	-0.0490***	-0.00376***	-0.00304***
	(0.00426)	(0.00406)	(0.0131)	(0.0131)	(0.000725)	(0.000654)
education years	0.00559***	0.00532***	-0.00345	-0.00350	0.000383***	0.000301***
	(0.000724)	(0.000738)	(0.00212)	(0.00214)	(0.000108)	(0.000113)
married	-0.00601	-0.00509	0.0215*	0.0237*	0.0000207	0.000100
	(0.00414)	(0.00405)	(0.0129)	(0.0129)	(0.000656)	(0.000648)
no. of children	0.00395**	0.00341*	-0.0123*	-0.0121*	0.000211	0.000105
	(0.00198)	(0.00193)	(0.00734)	(0.00733)	(0.000302)	(0.000287)
unempl. expos.	-0.0106***	-0.00919***	-0.0170***	-0.0158***	-0.00106***	-0.000949***
	(0.00181)	(0.00175)	(0.00546)	(0.00549)	(0.000333)	(0.000315)
migrat. backgr.	0.00831	0.00809	0.0151	0.0134	0.000427	0.000584
	(0.00605)	(0.00590)	(0.0197)	(0.0198)	(0.000792)	(0.000783)
disability deg.	-0.000196	-0.000140	0.00114	0.00113	-0.0000119	-0.00000593
	(0.000144)	(0.000140)	(0.000756)	(0.000774)	(0.0000407)	(0.0000388)
east	-0.000823	-0.00111	-0.0126	-0.0135	-0.00106	-0.000908
	(0.00457)	(0.00454)	(0.0139)	(0.0139)	(0.000741)	(0.000730)
father entrep.	0.0357***	0.0344***	0.0210	0.0213	0.00298***	0.00285***
	(0.00491)	(0.00488)	(0.0161)	(0.0160)	(0.000761)	(0.000734)
age	0.00121***	0.00121***	-0.00210***	-0.00214***	0.00000254	0.000000533
	(0.000208)	(0.000202)	(0.000647)	(0.000649)	(0.0000301)	(0.0000293)
Duration dum.			Yes	Yes	Yes	Yes
Observations	79768	79768	3562	3562	64535	64535
Log likelihood	-12068.1	-11710.9	-1001.8	-998.8	-1413.8	-1392.5
Mean dep. var.	0.0452	0.0452	0.0893	0.0893	0.00370	0.00370

Notes: Estimated average marginal effects from logit models of being and becoming an employer. The models include linear and squared terms of age, five industry dummies, a full set of year dummies and a constant. Cluster robust standard errors in parentheses. */**/***: Significant difference from 0 at the 10%/5%/1% level. Source: Authors' calculations based on SOEP, 2005-2018.

Table 7: Summary of hypotheses tests

Hypothesis	Variable	Hypothesized	Estimated effect on the prob. of becoming an employer	
			from solo-entrepreneur-ship	from paid employment and non-employment
H1a	Openness to exp.	+	not significant	+16%
H1b	Conscientiousness	+	not significant	+15%
H1c	Extraversion	+	not significant	not significant
H2	Resilience	+	not significant	not significant; +32%*
H3	Risk tolerance	+	+14%	+34%
H4	Int. locus of control	+	not significant	not significant; +15%**
H5	Trust in others	+	not significant	+19%

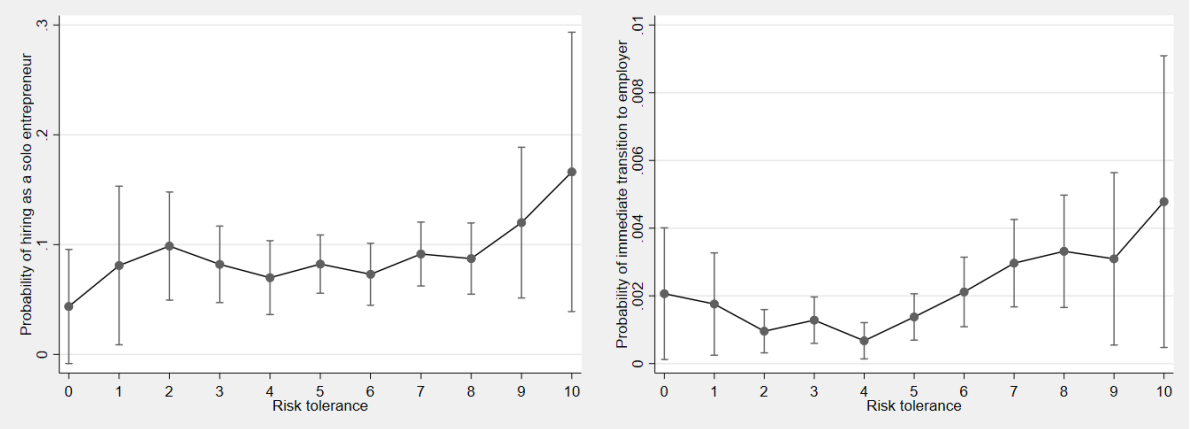
The estimated effects refer to the marginal effects of an increase in the independent variable by one standard deviation on the annual conditional probability of becoming an employer relative to the average probability, based on the estimated model in Column 6 of Table 5. In case of H2, "not significant" refers to no significant effect of being resilient versus under-controlled based on the estimated model in Column 6 of Table 6.
*: Significant effect of being resilient versus under-controlled on the annual conditional probability of becoming an employer relative to the average probability *when not controlling for the specific personality characteristics* in Column 5 of Table 6.
**: Significant effect of an increase in internal locus of control by one standard deviation on the annual conditional probability of becoming an employer relative to the average probability in the model *with the personality prototypes instead of the Big Five* in Column 6 of Table 6.

Table 8: Probit model of transition from solo entrepreneur to employer with selection (marginal effects)

Dependent variable	Being a solo entrepreneur	Becoming an employer
Sample	Full sample (selection)	Sample of solo entrepreneurs
openness	0.0165***	-0.0132
	(0.00193)	(0.00905)
conscientiousness	-0.00337**	0.00629
	(0.00171)	(0.00777)
extraversion	0.00337*	0.00375
	(0.00182)	(0.00814)
agreeableness	-0.000339	-0.00250
	(0.00168)	(0.00734)
neuroticism	0.00161	0.0111
	(0.00169)	(0.00786)
risk tolerance	0.0100***	0.0138*
	(0.00145)	(0.00792)
locus of control	0.00150	0.00373
	(0.00170)	(0.00751)
trust	0.00510***	0.00536
	(0.00162)	(0.00686)
female	-0.0187***	-0.0621***
	(0.00386)	(0.0170)
education years	0.00129*	-0.00221
	(0.000698)	(0.00318)
married	-0.00733**	0.0368*
	(0.00373)	(0.0190)
no. of children	-0.00332*	-0.0160*
	(0.00188)	(0.00972)
unemployment exposure	-0.000721	-0.0211**
	(0.000756)	(0.00836)
migration background	-0.00310	0.0233
	(0.00565)	(0.0263)
disability degree	-0.000722***	0.00156**
	(0.000133)	(0.000706)
east	0.00500	-0.0213
	(0.00426)	(0.0194)
father entrepreneur	0.0103*	0.0351*
	(0.00560)	(0.0205)
age	0.00142***	-0.00279***
	(0.000209)	(0.00101)
father high school	0.0113**	
	(0.00505)	
mother high school	0.00962	
	(0.00590)	
ρ		0.998***
		(0.00193)
Duration dummies	Yes	Yes
Observations		73977
Log likelihood		-12604.9
Mean dependent variable		0.00784

Notes: Estimated average marginal effects from two probit models with sample selection. Column 1 shows the probit model of selection into being a solo entrepreneur and Column 2 the probit model of becoming an employer, conditional on being a solo entrepreneur. ρ is the estimated correlation between the error terms in the two equations. The models include linear and squared terms of age, five industry dummies, a full set of year dummies and a constant. Cluster robust standard errors in parentheses. */**/***: Significant difference from 0 at the 10%/5%/1% level. Source: Authors' calculations based on SOEP, 2005-2018.

Figure 1: Nonlinear effect of risk tolerance on the probability of becoming an employer



Note: Predicted mean annual probabilities of becoming an employer conditional on risk tolerance, evaluated at the mean values of the other explanatory variables. The left panel shows the probability of transition from solo entrepreneur to employer, the right panel the probability of transition from paid employment or non-employment to employer. The vertical lines show 95% confidence intervals. In the left panel, tenure is the duration in solo entrepreneurship. *Source*: Authors' calculations based on SOEP, 2005-2018.

Appendix A: Supplementary Tables and Figures

Table A1: Description of the explanatory variables

Variable	Definition
tenure	Tenure in the current employment state (solo entrepreneur, paid employment, non-employment). For left-censored spells, we use the retrospectively elicited duration since the last job change.
education years	Standard years of schooling required to obtain the highest degree obtained by the respondent.
married	Dummy for a married and not separated person.
no. of children	Number of children under 17 in the household.
unemployment expo.	Years of unemployment exposure.
migration background	Born outside Germany or without German citizenship, or at least one parent was born outside Germany or has no German citizenship.
disability degree	Officially assessed and certified degree of disability in percent.
east	Dummy for a person living in the area of former East Germany or Berlin.
father entrepreneur	Dummy for a person whose father was self-employed when the respondent was 15 years old.
openness, conscientiousness, extraversion, agreeableness, neuroticism	Scores in the Big Five personality traits. For each of the 5 traits, respondents are asked how much they agree with 3 different statements about themselves on 7-point Likert scales, then we take the averages and standardize. See Caliendo et al. (2014) for more details on the measurement of the personality characteristics and the wording of the items.
under-controlled, resilient, over-controlled	Mutually exclusive and exhaustive dummy variables indicating the personality prototype of an individual, as estimated using cluster analysis based on the Big Five traits.
risk tolerance	Respondents are asked how much they are generally willing to take risks on a scale from 0 to 10.
locus of control	A high score indicates an internal and a low score an external locus of control. Elicited using 8 items.
trust	A high score indicates a high willingness to trust others. Elicited using 3 items.
primary & secondary sectors	Dummy for a person working in agriculture, forestry, fishing, mining and quarrying, manufacturing, energy and water supply, or whose industry classification is missing. Omitted base category.
construction	Working in the construction industry.
trade & hospitality	Working in hotels, restaurants, wholesale, commission or retail trade, or repair.
transport & communic.	Working in transport, travel agencies, or post and telecommunications.
financial services	Working in financial intermediation, insurance and pension funding, or real estate.
business services	Working in renting, information technology, research & development, or other business activities.
public & personal services	Working in public administration, education, health and social work, sewage and waste disposal, activities of membership organizations, recreational and sports activities, or other service activities.
father high school	Dummy for a person whose father obtained a high school degree qualifying for university entrance.
mother high school	Dummy for a person whose mother obtained a high school degree qualifying for university entrance.

Notes: Dummy variables equal 1 if the condition holds and 0 otherwise.

Table A2: Correlation coefficients between personality variables

	open.	consc.	extrav.	agree.	neurot.	risk	loc	trust	und-c.	resil.
openness	1.000									
conscientiousn.	0.142	1.000								
extraversion	0.359	0.188	1.000							
agreeableness	0.124	0.285	0.088	1.000						
neuroticism	-0.065	-0.100	-0.149	-0.107	1.000					
risk tolerance	0.186	0.003	0.182	-0.085	-0.178	1.000				
locus of control	0.106	0.175	0.182	0.122	-0.306	0.125	1.000			
trust	0.088	-0.080	0.044	0.072	-0.189	0.062	0.150	1.000		
under-controlled	-0.108	-0.642	-0.111	-0.565	0.171	0.030	-0.160	-0.012	1.000	
resilient	0.547	0.420	0.563	0.324	-0.287	0.148	0.211	0.062	-0.525	1.000
over-controlled	-0.471	0.192	-0.485	0.217	0.135	-0.187	-0.065	-0.054	-0.435	-0.537

Notes: The table shows the coefficients of correlation between the personality variables in the sample used to estimate the probability of being an employer (Column 2 of Table 5, N=79,768). All correlation coefficients are significantly different from zero at the 1%-level except for the correlation between conscientiousness and risk tolerance (*p*-value: 0.42).

Table A3: Variance Inflation Factors for personality variables

Variable	Variance Inflation Factor
openness	1.24
conscientiousness	1.21
extraversion	1.27
agreeableness	1.17
neuroticisim	1.24
risk tolerance	1.18
locus of control	1.22
trust	1.16

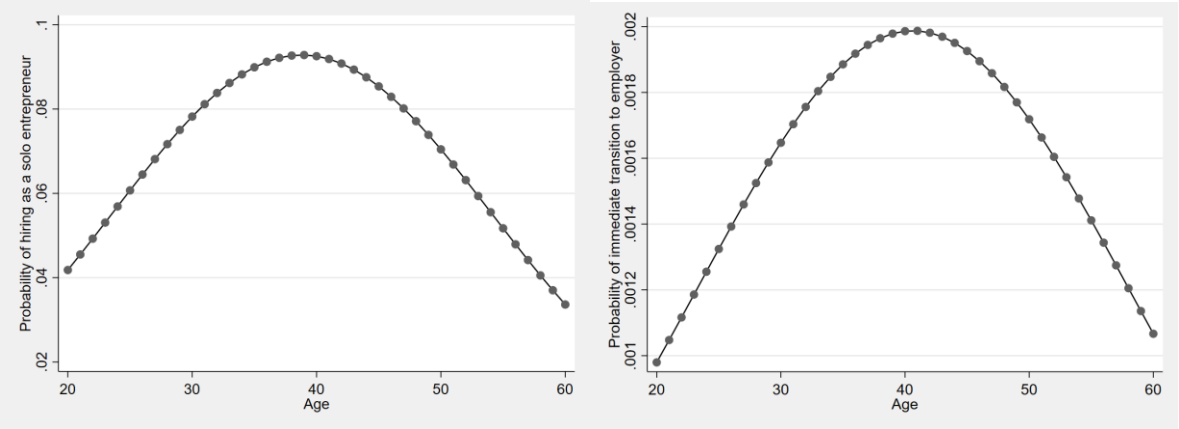
Notes: The table shows the Variance Inflation Factors for the personality variables in the sample used to estimate the probability of being an employer (Column 2 of Table 5, N=79,768).

Table A4: Logit prob. models of becoming an employer (marg. effects) *with unobserved heterogeneity*

Dependent variable	Becoming an employer			
Sample	Sample of solo entrepreneurs		Sample of paid employees and non-employed	
	(1)	(2)	(3)	(4)
openness	-0.00575	-0.00859	0.000993***	0.000785**
	(0.00712)	(0.00714)	(0.000364)	(0.000359)
conscientiousness	0.00940	0.00956	0.000624*	0.000688*
	(0.00671)	(0.00674)	(0.000353)	(0.000362)
extraversion	0.00735	0.00490	0.000234	-0.00000130
	(0.00741)	(0.00742)	(0.000336)	(0.000337)
agreeableness	-0.000822	0.000327	-0.000223	-0.000213
	(0.00669)	(0.00669)	(0.000323)	(0.000328)
neuroticism	0.00765	0.00949	-0.000315	0.0000690
	(0.00689)	(0.00692)	(0.000322)	(0.000339)
risk tolerance		0.0174**		0.00119***
		(0.00691)		(0.000331)
locus of control		0.00206		0.000415
		(0.00701)		(0.000371)
trust		0.00162		0.000993***
		(0.00627)		(0.000367)
female	-0.0722***	-0.0669***	-0.00369***	-0.00319***
	(0.0163)	(0.0162)	(0.000780)	(0.000755)
education years	-0.00288	-0.00268	0.000473***	0.000387***
	(0.00259)	(0.00263)	(0.000140)	(0.000142)
married	0.0221	0.0239	0.000638	0.000713
	(0.0159)	(0.0158)	(0.000762)	(0.000753)
no. of children	-0.0156*	-0.0153*	0.0000394	-0.0000297
	(0.00862)	(0.00852)	(0.000366)	(0.000360)
unemployment exposure	-0.0206***	-0.0193***	-0.000823***	-0.000740***
	(0.00632)	(0.00626)	(0.000290)	(0.000280)
migration background	0.0197	0.0170	0.000599	0.000776
	(0.0239)	(0.0238)	(0.000941)	(0.000935)
disability degree	0.00135*	0.00136*	-0.0000424	-0.0000395
	(0.000801)	(0.000813)	(0.0000368)	(0.0000362)
east	-0.0131	-0.0149	-0.00121	-0.00112
	(0.0176)	(0.0175)	(0.000845)	(0.000839)
father entrepreneur	0.0113	0.0115	0.00375***	0.00368***
	(0.0205)	(0.0204)	(0.000972)	(0.000973)
age	-0.00266***	-0.00268***	-0.0000448	-0.0000457
	(0.000820)	(0.000826)	(0.0000341)	(0.0000339)
Duration dummies	Yes	Yes	Yes	Yes
σ	1.622***	1.637***	2.397***	2.377***
	(0.1944)	(0.1964)	(0.2204)	(0.2289)
Observations	3562	3562	64535	64535
Log likelihood	-967.0	-963.2	-1357.0	-1343.9
Mean dependent variable	0.0893	0.0893	0.00370	0.00370

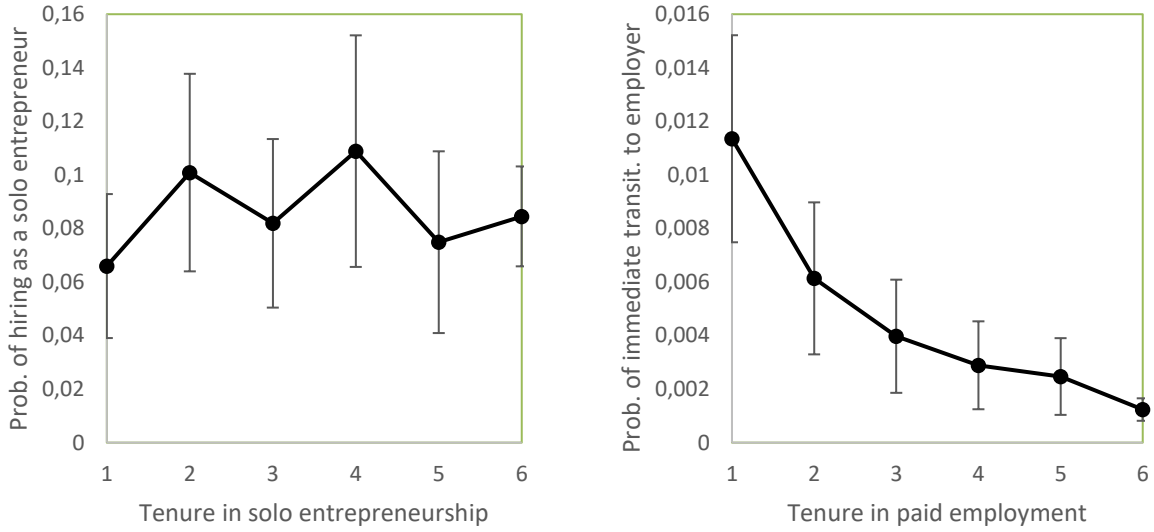
Notes: Estimated average marginal effects from logit models of being and becoming an employer. σ is the estimated standard deviation of the panel-level variance component. The models include linear and squared terms of age, five industry dummies, a full set of year dummies and a constant. Cluster robust standard errors in parentheses. */**/***: Significant difference from 0 at the 10%/5%/1% level. Source: Authors' calculations based on SOEP, 2005-2018.

Figure A1: Nonlinear effects of age on the probability of becoming an employer



Note: Predicted mean annual probabilities of becoming an employer conditional on age (in years), evaluated at the mean values of the other explanatory variables based on the estimated model in Columns 4 and 6 of Table 5. The left panel shows the probability of transition from solo entrepreneur to employer, the right panel the probability of transition from paid employment or non-employment to employer. *Source*: Authors' calculations based on SOEP, 2005-2018.

Figure A2: Nonlinear effects of tenure on the conditional probability of becoming an employer



Note: Predicted mean annual probabilities of becoming an employer conditional on the tenure (in years) in the current employment state, evaluated at the mean values of the other explanatory variables based on the estimated model in Columns 4 and 6 of Table 5. The vertical lines show 95% confidence intervals. In the left panel, tenure is the duration in solo entrepreneurship. In the right panel, tenure is the duration in paid employment or non-employment. On the horizontal axes, 6 refers to 6 or more years of tenure. *Source*: Authors' calculations based on SOEP, 2005-2018.

Appendix B: Survival Model

This Appendix describes the survival model used to estimate the hazard of becoming an employer conditional on the duration of the current state, analogous to Caliendo et al. (2010). A spell refers to a spell as solo entrepreneur in the model of transitions from solo entrepreneur to employer or to a spell in paid employment or non-employment in the model of transitions from these states to employer. Respondents may experience multiple spells during the observation period. We use the discrete non-negative random variable T_{ik} to describe the duration of the *k*-th spell of individual *i*. When a spell terminates in year *t* (measured from the beginning of the spell), T_{ik} takes on a value of *t*. The hazard rate $\lambda_{ik}(t)$ is defined as the probability that spell *k* of person *i* ends in period *t* (i.e., a transition occurs) conditional on survival until the beginning of *t*:

$$\lambda_{ik}\left(t\middle|X_{ik}(t)\right)=P\left(T_{ik}=t\middle|T_{ik}\geq t,X_{ik}(t)\right). \tag{B1}$$

where $X_{ik}(t)$ is a vector of the characteristics of individual *i* in interval *t* of spell *k*. The probability of remaining in the current state in period *t* ("survival"), conditional on having survived until the beginning of *t*, is the complementary probability

$$P\left(T_{ik}>t\middle|T_{ik}\geq t,X_{ik}(t)\right)=1-\lambda_{ik}\left(t\middle|X_{ik}(t)\right). \tag{B2}$$

The survivor function, which represents the unconditional probability of remaining in the current spell until the end of period *t*, can be written as the product of the survival probabilities in all periods before and in *t*:

$$S\left(t\middle|X_{ik}\right)=P\left(T_{ik}>t\middle|X_{ik}\right)=\prod_{\tau=1}^{t}\left(1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right). \tag{B3}$$

Consequently, the unconditional probability of a transition in period *t* is the probability of survival until the beginning of period *t*, multiplied by the hazard rate in period *t*:

$$P\left(T_{ik}=t\middle|X_{ik}\right)=\lambda_{ik}\left(t\middle|X_{ik}(t)\right)\prod_{\tau=1}^{t-1}\left(1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right). \tag{B4}$$

The model is estimated using the maximum likelihood method, which takes into account completed spells as well as both left-censored and right-censored spells. For a fully observed spell completed with an exit from the current employment state to the state of employer, the contribution to the likelihood function is given by equation (B4). For a right-censored spell the likelihood contribution is given by the survivor function (B3). Transitions to other states, for example when a solo entrepreneur transitions to paid employment, are treated as right-censored.

Combining these two cases, the likelihood contribution of a spell k of an individual i can be written as

$$L_{ik}^{\,not\,left-censored}\left(\,parameters\middle|c_i, X_{ik}\right)=\left[\frac{\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}{1-\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}\right]^{c_{ik}}\prod_{\tau=1}^{t_{ik}}\left(1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right) \qquad \text{(B5)}$$

where c_{ik} is a censoring indicator defined such that $c_{ik} = 1$ if a spell is completed and 0 if a spell is right-censored.

If a spell is left-censored in the SOEP, because person i enters the panel after spell k has already lasted u_{ik} years, conditioning on survival up to the end of period u_{ik} means dividing expression (B5) by $S(u_{ik})$. Then the likelihood contribution of the spell is

$$\begin{aligned} L_{ik}\left(\,parameters\middle|c_i, X_{ik}\right) &= \left[\frac{\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}{1-\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}\right]^{c_{ik}}\frac{\prod_{\tau=1}^{t_{ik}}\left(1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right)}{\prod_{\tau=1}^{u_{ik}}\left(1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right)} \\ &= \left[\frac{\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}{1-\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}\right]^{c_{ik}}\prod_{\tau=u_{ik}+1}^{t_{ik}}\left(1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right) \end{aligned} \qquad \text{(B6)}$$

Note that this more general notation includes equation (B5) for spells that are not left-censored ($u_{ik} = 0$). In the SOEP, retrospective employment history questions enable us to recover the spell durations u_{ik} and thereby deal with left-censoring.

The overall likelihood contribution of an individual i equals the product of the likelihood contributions of the K_i spells the person experienced in the observation period. The sample likelihood function is the product of the individual likelihood contributions:

$$L\left(\,parameters\middle|c, X\right)=\prod_{i=1}^{N}\prod_{k=1}^{K_i}L_{ik} \qquad \text{(B7)}$$

The log-likelihood function is

$$\begin{aligned} &\log L\left(\,parameters\middle|c, X\right)=\sum_{i=1}^{N}\sum_{k=1}^{K_i}\log L_{ik} \\ &=\sum_{i=1}^{N}\sum_{k=1}^{K_i}c_{ik}\log\left[\frac{\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}{1-\lambda_{ik}\left(t_{ik}\middle|X_{ik}(t_{ik})\right)}\right]+\sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{\tau=u_{ik}+1}^{t_{ik}}\log\left[1-\lambda_{ik}\left(\tau\middle|X_{ik}(\tau)\right)\right] \end{aligned} \qquad \text{(B8)}$$

Define a new binary transition indicator variable $y_{ik\tau} = 1$ if person i completes spell k in period τ, and 0 otherwise. The $y_{ik\tau}$ correspond to dummy variables that equal 1 if a transition to employer is observed between τ and $\tau + 1$, and 0 otherwise. Effectively adding some zeros to the sum, it can be written

$$\log L\left(\textit{parameters}\middle| y, X\right)$$

$$= \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{\tau=u_{ik}+1}^{t_{ik}} y_{ik\tau}\log\left[\frac{\lambda_{ik}\left(\tau\middle| X_{ik}(\tau)\right)}{1-\lambda_{ik}\left(\tau\middle| X_{ik}(\tau)\right)}\right] + \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{\tau=u_{ik}+1}^{t_{ik}} \log\left[1-\lambda_{ik}\left(\tau\middle| X_{ik}(\tau)\right)\right] \tag{B9}$$

$$= \sum_{i=1}^{N}\sum_{k=1}^{K_i}\sum_{\tau=u_{ik}+1}^{t_{ik}} \left(y_{ik\tau}\log\left[\lambda_{ik}\left(\tau\middle| X_{ik}(\tau)\right)\right] + (1-y_{ik\tau})\log\left[1-\lambda_{ik}\left(\tau\middle| X_{ik}(\tau)\right)\right]\right)$$

The last expression has exactly the same form as the standard log-likelihood function for a binary regression model in which $y_{ik\tau}$ is the dependent variable and the data are organized in person-period format, where τ is measured from the beginning of the current spell and thus measures its duration (cf. Jenkins, 1995). We specify the functional form of the hazard rate as a logistic hazard model:

$$\lambda_{ik}\left(\tau\middle| X_{ik}(\tau)\right) = \frac{\exp\left(f(\tau) + X_{ik}(\tau)\beta\right)}{1+\exp\left(f(\tau) + X_{ik}(\tau)\beta\right)}, \tag{B10}$$

where the function $f(\tau)$ represents the dependence of the hazard rate on the spell duration τ (baseline hazard), flexibly specified using dummy variables for spell durations (1, 2, 3, 4, 5, and 6 or more years). It follows that, by estimating Eq. (1) as a logit model based on our person-year panel data, we estimate a discrete time survival model accounting for right-censoring as well as left-censoring.