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The Gender Gap in Entrepreneurship: Not Just a Matter of Personality

Abstract

Why do entrepreneurship rates differ so markedly by gender? Using data from a large, representative German household panel, we investigate to what extent personality traits, human capital, and the employment history influence the start-up decision and can explain the gender gap in entrepreneurship. Applying a decomposition analysis, we observe that the higher risk aversion among women explains a large share of the entrepreneurial gender gap. We also find an education effect contributing to the gender difference. In contrast, the Big Five model and the current employment state have effects in the opposite direction, meaning that the gender gap in entrepreneurial entry would be even larger if women had the same scores and the same employment status as men.

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1 Introduction

It is an almost worldwide phenomenon that there are fewer women involved in entrepreneurial activities than men (Kelley et al., 2013). And despite this phenomenon's persistence, it remains a puzzle as to why this gap exists. Research focusing on various personality characteristics reveals that women score different from men in characteristics such as fear of failure (Wagner, 2007), risk attitudes (Caliendo et al., 2009), self-confidence (Koellinger et al., 2013) or the willingness to compete (Bönte and Piegeler, 2013). The differing scores do partly account for the gender gap, but provide only modest explanation.

We also know from previous research that other personal variables beyond personality characteristics influence entrepreneurial decision making, among them important variables such as age, the labour market status or the level of human capital (Georgellis and Wall, 2005). Although research on the gender gap is increasing, not much focuses on the question of how much of the gender gap can be attributed to a comprehensive set of personality characteristics and to socio-demographic variables.

Moreover, to better understand the gap and to identify new leads on how to close it, it is necessary to analyse the entry decision into entrepreneurial activities. Similarly to the unequal shares of men and women in the stock of the self-employed¹ we find in most countries that the share of women starting a business each year is smaller than the share of men (see Global Entrepreneurship Monitor, 2005). Closing the gender gap in entrepreneurship will, however, be feasible only if the entry rates of women will become more similar to the entry rates of men. Increasing female entry rates into entrepreneurship might become a crucial policy target as entrepreneurs benefit economies through innovative activities, new job creation, increased productivity, and competition, or because they accelerate structural change. Economies with fewer females engaged in entrepreneurship have, therefore, untapped potential.

In this paper, we will turn the attention to the gap among the entries into self-employment. Using the German Socio-Economic Panel (SOEP), a large representative

¹According to the German microcensus, in Germany the number of self-employed women is about half the number of self-employed men (Piorkowsky et al., 2013).

household survey of the German population, for the years 2000 to 2009, we analyse in a first step how personality and socio-demographics influence the entry decision of men and women into self-employment. Based on these findings, we conduct a non-linear decomposition analysis to assess to what extent the gender gap in the entry rates into self-employment in Germany can be attributed to personality and to other variables. In contrast to previous research the main advantage of our data set is that it contains not only information on the socio-demographic background of the respondents, but also on a broad set of personality constructs that elicit the Big Five traits and several specific personality characteristics. To the best of our knowledge information on the Big Five approach has not been used to assess the gender gap in entrepreneurship. We are the first to simultaneously analyse the effects of the Big Five factors, risk aversion, locus of control, and the ability to trust others (Caliendo et al., 2012), as well as of a variety of variables controlling for human capital, employment status, and other socio-demographic factors on the gender specific decision to enter self-employment.

Our decomposition analysis reveals several surprising results. First of all, we show that personality traits help explain the gender gap in nuanced ways. While specific characteristics, in particular risk attitudes, are able to explain a substantial amount of the gender gap, the overall influence of the Big Five personality constructs point to the opposite direction. This means that if women were endowed with the same scores in the Big Five as men, the gap would be even larger. A second set of variables partly explaining the gender gap are differences in the education level. On average, working aged women in Germany are still less educated than men and are, therefore, less inclined to start a business. Thirdly, the current employment state has a strong effect into the opposite direction: If the share of women in wage employment were as high as the male share, holding everything else constant, their entry rate into self-employment would be much smaller. Interestingly, the overall explained gap is therefore negative meaning that if women exhibited in all observable variables the same parameter values as men, the entry rate of women would be even smaller than actually observed. This underlines the potential importance of unobservable

influences on the gender gap such as discrimination by lenders and customers² or different gender roles that may act as invisible barriers to female entrepreneurship. The rest of the paper is organised as follows. Based on existing heuristics, in Section 2 we present the theoretical background and empirical evidence from the literature on variables influencing the occupational choice of men and women into entrepreneurial activities. In Section 3, we describe the representative panel data used in our analysis, present descriptive statistics of the data, and provide a short overview of the econometric approach. Section 4 is devoted to the presentation of the results and Section 5 concludes.

2 Theoretical Considerations

Why do men more often than women choose to become active in entrepreneurship? Occupational choice models assert that persons prefer entrepreneurship over wage employment or unemployment if the utility they face once entering self-employment is higher than the utility they had in their previous work status. In this section we briefly analyse in which direction specific variables, which we know from previous research to be crucial for entrepreneurial activities, influence entrepreneurial decisions. As we are particularly interested whether these determinants differ by gender, we discuss such differences where possible.³ More specifically, we will discuss the influence of human capital, of the employment status, of wealth effects, but also the influence of traits described by the Big Five Factor Model, and of the more specific personality characteristics risk preference and locus of control.⁴

Throughout all parts of their business, entrepreneurs need to have profound skills, good knowledge and abilities in a wide range of fields to choose the best or most efficient options amongst a wide range of services (Lazear, 2004). This holds from being innova-

²Cf. Borjas and Bronars (1989) and Fairlie (1999) in the context of African-American and white self-employment in the US.

³The factors leading to gender differences in self-employment, but also in dependent employment, can be grouped into two broad sets. On the one hand we can observe on an individual level characteristics, preferences, traits, abilities, and attitudes, which lead to a different engagement in self-employment by gender. On the other hand, external factors and constraints might influence an individual's decision process or might even regulate the entrepreneurial possibilities (Campa et al., 2011). Our analysis will primarily concentrate on the first, the individual level.

⁴In the analysis, we further consider the inclination to trust others (Caliendo et al., 2012).

tive to the production of a new product or service, the planning of financial investments and to representing the business to possible clients or investors. As a result, highly educated individuals are likely to have a higher propensity to enter self-employment, whereas individuals with low education levels are less likely to choose entrepreneurship.⁵ In this context, the distribution of education by gender has undergone a major change over the last decades. While older-aged men on average are higher educated than women, younger women have caught up. Today, even a higher share of women graduates from university in several developed economies. Nevertheless, working age women are on average still lower educated (Dustmann, 2005). Given a positive influence of education on the probability of entrepreneurial entry, Van Der Sluis et al. (2008) review the literature on the effect of education on entrepreneurship and find no significant difference of the effect between men and women.⁶ Therefore, the entrepreneurial gender gap might be partly explained by the gender difference in educational attainment which is still prevailing.

As to the influence of the employment status, individuals in wage employment may in general be less likely to start an own business due to the higher risk that is implied when starting a new business. Paid employees might be less affected by the macroeconomic situation or overall fluctuations in demand, while they might be inclined to trust on their regular monthly income and social insurance coverage. Related to gender differences, it is important to note that the lower labour force participation rate of women (Antecol, 2000) may play a specific role in the analysis of the gender gap in entrepreneurial entry rates. Rosti and Chelli (2005) show that in Italy, men typically enter self-employment out of wage work, while women enter out of inactivity. Georgellis and Wall (2005) argue that for women, self-employment may be a relatively close substitute for non-participation because of the flexibility it provides regarding the timing and location of work. Having a wage job increases the opportunity costs of self-employment and may therefore decrease the probability of entry, holding everything else (e.g., work experience, education, and the family situation) constant. Therefore it is important to control for the individual labour

⁵This holds true for most developed countries (Blanchflower, 2000).

⁶See also Furdas and Kohn (2010).

market status prior to a potential entry into self-employment, and to investigate if the effects differ by gender.

Blanchflower and Oswald (1998) note that wealth has a high explanatory power for the decision to enter self-employment as well. For instance, persons who received an inheritance are more likely to become an entrepreneur. Women may face more binding credit constraints than men due to discrimination by lenders (Georgellis and Wall, 2005). This may partly explain why female owned businesses employ less assets on average (Rosa et al., 1996); on the other hand, women may also be more active in businesses that require less capital input. Thus, it is an empirical question if and how capital contributes to the gender gap.

Previous research (e.g. Rauch and Frese, 2007) investigates how personality traits influence the self-employment status, but little is known whether these effects differ by gender. Since distributions of personality traits vary by gender (Borghans et al., 2008), gender differences in personality are potential candidates to explain parts of the entrepreneurial gender gap, and the effect of personality traits might also be gender specific.

We first consider the Big Five Factor Model of personality (McCrae and Costa, 2008), which describes the personality by the factors openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (or, reversely, emotional stability). Persons scoring high in openness to experience tend to be creative, innovative and curious, with all three of these features being necessary for and therefore positively related with entrepreneurial activity. Extraversion describes the abilities of being assertive, of seeking leadership, and of developing social networks; characteristics which are important with regard to self-employment. Individuals scoring high in conscientiousness are achievement oriented and hard workers. Agreeable persons are forgiving, altruistic, and cooperative. A higher score in neuroticism means that a person is emotionally less stable, less self-confident and less stress-resistant; characteristics also crucial during the start-up period of entrepreneurial activities. Zhao and Seibert (2006) report significant effects of all five factors on the probability of being an entrepreneur. Caliendo et al. (2014) find a posi-

tive effect of extraversion and openness (and to a limited extent of emotional stability) on the entry probability into self-employment. As women score higher in openness and extraversion,⁷ one would expect a higher probability of entry into entrepreneurship for women than for men, based on these personality traits alone. The literature does not provide much guidance with regard to potential roles of agreeableness and neuroticism in the entrepreneurial gender gap. Last but not least, competitiveness can be seen as one component of conscientiousness. Bönke and Pieger (2013) find that women score significantly lower in competitiveness and therefore have a lower probability of being an entrepreneur.

In addition to the Big Five factors, we also consider specific personality characteristics, such as risk aversion and locus of control, which the literature prominently identifies as relevant for entrepreneurial decisions. Self-employment involves more risk and uncertainty regarding survival of the business and monthly income than an employed position. Therefore, the level of risk aversion is deemed to play a crucial role. Individuals with a higher willingness to take risk are more likely to enter self-employment (see *inter alia* Cramer et al., 2002, Kan and Tsai, 2006, or Norton and Moore, 2006) and this holds true for both genders (Caliendo et al., 2009). As women are at the same time more risk-averse than men (see Croson and Gneezy, 2009, for an overview of several studies), we expect risk aversion to have explanatory power with respect to the gender gap in the transition to self-employment.⁸

In addition to risk preference, internal locus of control is thought to influence the entry decision into entrepreneurship (Evans and Leighton, 1989). Believing to determine future outcomes with one's own actions, will have a positive effect on the probability to become self-employed (cf. Caliendo et al., 2014). Literature on gender differences in the context of

⁷Schmitt et al. (2008) and Weisberg et al. (2011) analyse the distributions of the Big Five factors by gender and find that women score significantly higher in extraversion, neuroticism, and agreeableness. The distribution of openness varies with respect to the definition.

⁸This expectation is supported by prior research. Verheul et al. (2012) find that differences in risk tolerance explain a part of the gender gap in the preference for self-employment. Fossen (2012) estimates a structural microeconomic model of self-employment transitions. The estimated risk aversion parameter is larger for women, and the difference is responsible for a small part of the gender gap in the entry rate into self-employment. Using individual data from the Flash Eurobarometer, Entrepreneurship 2009, Bönke and Pieger (2013) also find evidence that a large part of the entrepreneurial gender gap can be explained by the lower risk tolerance of women.

locus of control suggest that women score lower on internal and higher on external locus of control than men (Sherman et al., 1997). While no direct analysis of locus of control and entrepreneurial gender differences is available in the literature, Koellinger et al. (2013) report that fear of failure, which can be related to locus of control, plays a significant role explaining the gender gap in nascent entrepreneurship.⁹ We therefore expect a higher entry rate for men than for women due to the gender specific distribution of locus of control.

In summary, our expectations are that the gender gap in entrepreneurial entry may be explained by gender differences in education, employment status, capital assets, and personality as measured by the Big Five factors as well as, more specifically, risk attitude and locus of control.

3 Data and Methodological Approach

3.1 Representative Survey Data

We obtain our data from the German Socio Economic Panel (SOEP). The SOEP is a large, representative household panel survey that collects information on over 22,000 individuals in approximately 12,000 households in Germany on an annual basis. It provides comprehensive information on socio-demographics, employment history and further labour market information on the individual and household levels (cf. Wagner et al., 2007). Additionally, the SOEP includes inventories of personality characteristics (see Section 3.2).

We operationalize entrepreneurship as self-employment, with persons being defined as self-employed if they state self-employment as their primary labour activity. Entry into self-employment is defined as a shift of the employment status from wage employment, unemployment or non-participating status to self-employment between the interviews in years t and $t + 1$. It is worth noting that 42 percent of the men in our sample who are in their first year of self-employment already report having at least one employee, but only 21 percent of the women. For our analysis, we use the survey waves 2000-2010, although the information of the year 2010 is only used to observe whether an individual enters

⁹The paper is based on the Global Entrepreneurship Monitor (GEM). A nascent entrepreneur is defined as an individual who is actively participating in start-up activities.

self-employment between 2009 and 2010. Furthermore, we exclude individuals working for a self-employed family member, farmers, as well as persons in civil service, the military, or still in education. We argue that these persons are more restricted in terms of their occupational choice. Although the official retirement age in Germany is 65, we only include persons aged 59 and younger in our sample, due to flexible pension schemes and early retirement decisions. The sample also only includes people who are 25 years or older, because the personality of younger persons may still be developing (see Cobb-Clark and Schurer, 2012).¹⁰

Since we analyse the decision to enter self-employment, the relevant estimation sample consists of all observations of persons currently not self-employed, a total of 60,313 person-years, without missing values in the relevant variables, including 59,609 observations not entering self-employment and 704 observations of entry into self-employment. Table A.1 in Appendix A further splits the observations by gender and employment status in t . The annual rate of entry into self-employment is 1.35 percent for men, and 1.01 percent for women, constituting the gender gap (the difference is significant at the 1 percent-level). For both genders, the entry rate is higher for those currently unemployed or not participating in the labour market than for paid employees, presumably because of the higher opportunity costs of the latter. The step into self-employment may be easier than finding wage employment for persons currently not employed. This may hold, for instance, for married women after having raised children at home, especially in case of part-time self-employment, which we count as self-employment as long as it is reported as the primary work activity.

3.2 Personality Inventories

As mentioned above, the SOEP includes short versions of established psychological inventories of personality characteristics in several waves.¹¹ This allows us to analyse the

¹⁰The results are similar if only persons above 29 years of age are included in the sample.

¹¹General tests on the validity and on the reliability of the instrument measuring the Big Five factors are provided by Lang et al. (2011, pp. 553-554). They report that the questionnaire used “is a reasonable, short instrument designed to measure the Big Five personality factors in large surveys”.

influence of a comprehensive set of personality traits in a large representative sample. 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 assess the Big Five personality traits (3 items for each trait), ten items measure internal and external locus of control, 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; factor analysis confirms the validity of the constructs (see Caliendo et al., 2014, for details). Risk aversion is measured in repeated survey waves by a single question about the general willingness to take risks on an 11-point scale. The wording of the single items can be found in Table A.2 in Appendix A.

Although the personality items are not included in every survey wave, literature suggests that personality traits are stable over time. Cobb-Clark and Schurer (2012, 2013) and Dohmen et al. (2007) provide evidence for the stability of personality traits and risk preferences of working-aged individuals. Hence, we use the individual information on personality provided in certain waves also in other waves. To facilitate the interpretation of the estimation results, all personality variables, except for the willingness to take risk, are mean standardised using the estimation sample of individuals not being self-employed.

In our data risk tolerance is positively correlated with openness to experience and extraversion and negatively with neuroticism and agreeableness, and as expected, the correlation between internal and external locus of control is negative. The correlations do not lead to a problem of multicollinearity amongst the regressors in the analysis; the variance inflation factors calculated after a linear regression of the self-employment indicator on all explanatory variables are all below 5.¹²

3.3 Mean Gender Differences

Table 1 shows mean characteristics of men and women, in the full estimation sample of all persons not being self-employed and for the sub-sample of individuals who we observe just

¹²See Caliendo et al. (2014) for a detailed correlation analysis, further validity checks of the personality constructs, and a factor analysis. The latter also shows that it makes sense to use distinct indicators for internal and external locus of control.

before entering self-employment. On average, women score significantly higher than men in all Big Five personality traits. They are more open to experience, more conscientious, extraverted, and agreeable¹³, but also emotionally less stable. There are also significant mean differences by gender in some specific personality characteristics. Men are more risk tolerant and exhibit a more internal and less external locus of control. Trust is the only personality variable that does not differ by gender.

< Insert Table 1 about here >

The socio-demographic variables confirm expectations. Men and women in the sample are of the same average age, but men have accumulated 3.5 more years of work experience. 19 percent of the women are not participating in the labour market, while this holds only for 1 percent of the men.¹⁴ Moreover, in our sample of working-aged persons, women still have a significantly lower education than men. Only 25 percent of them possess a high-school degree that qualifies them for university entrance (*Abitur*), as opposed to 30 percent of the men, and only 20 percent of the women earned a university degree, in contrast to 25 percent of the men.¹⁵

In the sub-sample of nascent entrepreneurs (entry sample), the significant gender differences in the personality traits point to the same directions as in the full sample (only for conscientiousness, the difference is no longer statistically significant). Both men and women who enter into self-employment are more risk tolerant than those who do not enter. Furthermore, men and women, who enter self-employment have on average less work experience and more unemployment experience than those who do not enter; consistently, they are unemployed or not participating in the labour market more often as well. Entrants of both genders are better educated than non-entrants: They more often possess a high-school degree qualifying for university entrance and a university degree, but less

¹³See Pan and Houser (2011) on gender differences in pro-sociality.

¹⁴Milligan (2014) concludes from his empirical analysis that the gender gap in parental employment stayed high in Germany in comparison to the USA, the UK, and Canada, until Germany expanded public childcare provision in the 2000s.

¹⁵The dummy variables for schooling are not mutually exclusive; somebody may have a high-school degree, vocational training and a university degree at the same time, for example.

often finished vocational training. Average capital income is also higher for the entrants of both genders.¹⁶

Table A.3 in the Appendix shows which industries men and women choose when they enter entrepreneurship, i.e., the industries the new entrants report in their first year of self-employment. The most significant difference is that 13 percent of the male, but only 2 percent of the female start-ups are in the construction industry. Furthermore, men more often start businesses in the manufacturing and private services industries (financial intermediation, personal and business services), whereas women more often choose the public and social services sector (education, health).

3.4 Decomposition

To analyse the gender gap in the rate of entrepreneurial entry, we first estimate logit models for the probability of becoming self-employed, separately for men and women.¹⁷ The binary outcome variable $entry_{(i,t+1)}$ equals 1 if individual i enters self-employment between years t and $t + 1$, and 0 otherwise. The latent index function of the logit model is written as

$$entry_{(i,t+1)}^* = X_{it}\beta + \epsilon_{it}, \quad (1)$$

where $entry^*$ is the propensity to enter self-employment, X is a vector of explanatory variables that includes the personality characteristics, β is a coefficient vector including a constant, and ϵ is an error term. We decompose the gender gap in the mean entry

¹⁶In the full sample of those not self-employed, the capital income of the household is higher on average for women than for men. In contrast to all other variables that each household member is asked individually, based on the personal questionnaire of the SOEP, capital income is elicited for the household as a whole using the household questionnaire, and then assigned to each household member. The higher average household capital income of women is explained by the fact that the self-employed, who on average have more capital income, are not in the estimation sample at risk of entering into self-employment, i.e., mostly men, while their wives are included in the sample, such that their households' capital income only appears in the women's average. Note that capital income is distributed very unequally; the medians are closer together, 0.22 for men and 0.24 for women.

¹⁷The results from the decomposition are qualitatively similar when we estimate a logit model of the probability of being self-employed instead of the probability of entry into self-employment, although this does not allow assessing the role of the current employment state. We prefer the entry model because here, all the explanatory variables are observed before a potential transition occurs, whereas in the model of self-employment state, the explanatory variables may be influenced by the current state, which is the dependent variable.

probability into a part explained by gender differences in endowments, including the scores in the personality traits, and an unexplained part reflected in differences in the coefficients and the intercept. The detailed decomposition allows assessing separately the contribution of each variable of interest.

Among the explanatory variables in X , we have a special interest in those traits which have not been used in such an analysis before, the Big Five traits, but also in specific personality characteristics such as risk tolerance, locus of control, and trust. To capture human capital, we include years of work experience and unemployment experience as well as dummy variables for educational degrees obtained: High school, i.e., university entrance qualification, vocational training, technical college, and university. These degree dummies are not mutually exclusive; for example, many individuals have earned a high-school degree and also finished vocational training.¹⁸ We also control for a self-employed father when the respondent was 15 years old.¹⁹ Self-employment of parents is likely to have an effect on the probability of offspring's self-employment, e.g. through inheritance of a business. At the same time, parental self-employment is likely to be correlated with own personality characteristics due to intergenerational transmission of personality (Anger, 2012), so it is an important control variable to avoid omitted variable bias in the coefficients of the personality variables. As an indicator of wealth, we include capital income defined as the sum of income from interests, dividends, and house rents of the respondent's household (these variables are not available on the individual, but only on the household level on an annual basis). We further control for age (linear and squared), current employment status (unemployed, not participating, or employed), marital status, number of children, disability status, German nationality, as well as regional and year dummy variables (see Table A.5 in Appendix A for variable descriptions). While we consider this set of explanatory variables very comprehensive, we might still miss relevant variables, which would tend to

¹⁸See Table 1 for the shares of respondents with the respective educational degrees in the sample. They add up to more than 100 percent because of the possibility of multiple degrees. There are also persons who have none of these degrees.

¹⁹Self-employed mothers were very rare in the generation of most respondents' parents, and the information on mother's occupation is often missing in the data, so we do not include mother's self-employment status.

increase the unexplained part in the decomposition analysis.²⁰

We follow an adaption of the decomposition approach originally suggested by Oaxaca (1973) and Blinder (1973); Fortin et al. (2011) provide an overview. As we have a binary outcome variable and estimate logit models, we apply the weighting method for nonlinear models as described by Yun (2004), which allows for a detailed decomposition by single variables as well as coefficients.²¹ A well-known issue pertains to whether the coefficients for men or women should be used to assess the contribution of the variables to the gender gap (index problem). Therefore, we follow Neumark (1988) and Oaxaca and Ransom (1994) and use the coefficients from an estimation of the logit model of entry on the pooled sample of men and women. We include a gender dummy in the pooled model, as recommended by Jann (2008), to avoid a potential spillover from the unexplained part of the differential into the explained component which may result from omitting the group variable. Furthermore, we normalise categorical variables such as the dummy variables describing the employment state. As a result, effects are expressed as deviations from the overall mean, and the detailed decomposition results do not depend on the choice of an otherwise arbitrarily omitted base category (Yun, 2005). We report standard errors robust to heteroskedasticity and clustering on the individual level, which we obtain by means of the delta method (cf. Jann, 2008). We describe this variant of a nonlinear decomposition formally in Appendix B.

4 Empirical Results

4.1 Probability Model of Entry into Self-Employment

The first step in the decomposition analysis is the estimation of the logit model of the probability of entry into self-employment separately for men and women and for the pooled sample. We conduct the decomposition with two sets of personality variables: First, we

²⁰A fixed effects specification could be considered to remove unobserved time invariant individual heterogeneity, but this would not allow analysing the role of personality characteristics, which are mostly stable over time for adults.

²¹Fairlie (1999), Fairlie (2005) and Fairlie and Robb (2007) suggest an alternative decomposition method for nonlinear models that has been applied for detailed decomposition by variables, but not by coefficients. The results from our decomposition concerning the variables are similar when Fairlie's method is used.

only include the Big Five traits, and second, we additionally include the specific personality characteristics; while the socio-demographic controls always enter the estimations. Table 2 provides the estimated marginal effects of the two sets of personality traits and selected other variables on the probability of entry for men and women (the logit coefficients of all explanatory variables for both genders and the pooled sample appear in Table A.4 in Appendix A). The results indicate that while we control for all kinds of socio-demographic and educational variables, personality traits influence the entry decision into entrepreneurship.

Most notably, risk attitudes and locus of control have significant partial effects even after controlling for the Big Five traits and for the typically used socio-demographic variables. Thus, the Big Five model does not capture all aspects of personality relevant for entrepreneurial entry, in line with the conclusion of Caliendo et al. (2014), which is why we prefer the more comprehensive specification. Risk tolerance increases the probability of entry for both, men and women.²² A more internal and a less external locus of control consistently increase the probability of becoming self-employed, but this holds only for men; for women, we do not find any significant effect of locus of control.

< Insert Table 2 about here >

Turning to the Big Five, openness to experiences has a positive and highly significant effect on the entry probability in both specifications and for both genders. If openness increases by one standard deviation, the probability of entry increases by 0.12 percentage points for men and even by 0.21 percentage points for women, based on the full models. Relative to the mean entry rate of 1.01 percent (1.35 percent) for women (men), this is an increase by 20.8 percent (8.9 percent). Extraversion and agreeableness increase the entrance probability significantly for men only. While Caliendo et al. (2014) found similar positive effects of openness and extraversion for the pooled sample, they did not distinguish by gender and were not able to reveal gender differences in the effects of extraversion and

²²The willingness to take risk enters the model as a quadratic function; the marginal effect of an increase by one point on the 11-point scale is estimated at the mean risk tolerance level.

agreeableness on the entry decision into entrepreneurship. Thus, overall we observe that personality traits have differing impacts on the entry probabilities of both genders.

The socio-demographic variables reveal interesting gender differences as well. Those currently unemployed or not participating have significantly higher entry probabilities than paid employees. This is true for both genders, but the point estimates of the partial effects are larger for men. These effects can be explained by the opportunity costs of employees which on average are higher for men because of higher wages.

Education increases the probability of entry into self-employment, as indicated by the positive coefficients of a university entrance qualification (high-school) and a university degree; the latter is statistically significant for men only. Vocational training decreases the entry probability for women. Interestingly, higher capital income of the household significantly increases the entrance probability for men only. We interpret this observation in the sense, that men have better access to their household's financial resources for investments in their businesses than women. Intergenerational links seem to be gender specific as well: A self-employed father (when the respondent was 15 years old) significantly increases the likelihood of entrepreneurial entry for women only.²³

< Insert Table 3 about here >

How much do the socio-demographic variables and the personality characteristics explain the gender gap in the probability of entry into self-employment? A first simple approach consists in starting with a logit model based on the pooled sample, but with a female dummy variable as the only explanatory variable, and successively adding explanatory variables. The discrete effects of the female indicator appear in Table 3. Without further controls, being female decreases the probability of entry by 0.34 percentage points (this corresponds to the raw gap between the entry rates). First adding the socio-demographic controls and then the Big Five traits does not reduce this unexplained gender gap, as perhaps expected, but increases it further. Thus, the raw gender gap is not due to

²³Interestingly, for English data, Schoon and Duckworth (2012) also find differing influences of parents on the two genders, even if their findings are not in line with ours.

omitting these variables in the first column. Only when the specific personality characteristics (risk, locus of control, and trust) are included, the partial effect of the female dummy decreases (in absolute terms) to -0.26 percentage points. This means that, among these groups of variables, only the gender differences in the specific personality characteristics contribute to partially explaining the gap.

4.2 Nonlinear Decomposition by Variables and Coefficients

To systematically explore the gender gap in the entry probability, we conduct our variant of a nonlinear Oaxaca-Blinder decomposition based on the estimated logit models discussed in the previous subsection.²⁴ The first three columns of Table 4 present the results from the model employing the Big Five as the only personality traits, and the other three columns the results from the preferred model additionally including the specific personality characteristics; all models adopt the full set of socio-demographic variables. The first three rows redisplay the annual entry rates for men and women and the raw differential between them of 0.34 percentage points, which is significantly different from zero at the one percent level. This raw differential is decomposed into a part explained by gender differences in endowments, i.e., in the variables, and an unexplained part. The latter is due to gender differences in the coefficients, which reflect the influence of the variables on the entry probability, and in the constant. In the preferred comprehensive model on the right hand side of the table, the explained gap is -0.16 percentage points, i.e. -46 percent of the raw differential (see next column), and the unexplained gap (further below in the table) is 0.50 percentage points, i.e. 146 percent (the two components sum up to the raw gap). Both parts are significant. The finding that the explained part is negative can be interpreted as follows: If women were more similar to men in all the explanatory variables (including personality), their entry rate into self-employment would be even lower and the gender gap would be larger. Therefore, the unexplained gender gap is larger than the raw gap.

< Insert Table 4 about here >

²⁴The only difference between the logit models in Tables 2 and A.4 and those used in the decomposition is that for the decomposition, categorical variables are orthogonalised, see Section 3.4. This does not change the coefficients of the other variables.

We further decompose both, the explained and the unexplained gaps. We start with the detailed decomposition of the explained part into the contributions of single variables and groups of variables. As a group, the Big Five traits contribute negatively to the explained part, which means that they additionally increase the unexplained gender gap. Further decomposition shows that among the Big Five, only openness to experience contributes significantly to the explained gap in the comprehensive model. The negative contribution is explained by the fact that openness to experience increases the probability of entry (see Table 2), and women score higher in this trait on average (see Table 1). Thus, if women were more similar to men, they would be less open and have a lower probability of entry - this result widens the unexplained gender gap. In contrast, the specific personality characteristics explain a very important part of the gap, i.e. 0.27 percentage points or 79 percent of the raw gap. Almost all of this can be attributed to risk attitudes, the only individually significant characteristic when this group is further decomposed. Here, the explanation is that risk tolerance increases the entrance probability, and women are on average less willing to take risks than men. Hence, accounting for differences in risk attitudes reduces the unexplained gender gap. This can be observed in the first three columns of the table, where risk attitude is omitted: Here, the explained gap is more negative and the unexplained part is much larger. We conclude that risk attitude is an important variable to explain the gender gap, and a substitution by the Big Five traits is not possible.

The decomposition of the socio-demographic variables yields further interesting insights; we will discuss the statistically significant contributions in the preferred model. Different levels of education explain 28 percent of the raw gender gap; more specifically, the lower shares of women with a high school degree and a university degree explain 18 percent and 14 percent of the gap, respectively, since both attainments increase the probability of entrepreneurial entry (see Table 2). The single variable most contributing to the negative explained part of the gap is the dummy indicating wage employment. Paid employment decreases the probability of becoming self-employed both for men and women

(Table 2) because of higher opportunity costs, *ceteris paribus*.²⁵ At the same time, a smaller share of women is employed in Germany in comparison to men. Thus, from the effect of the employment state and the distribution, one would expect a higher entry rate among women. This implies that accounting for the labour market status in the model decreases the explained part and further increases the unexplained part of the gender gap. The family situation does not explain the gender gap: The number of children is insignificant in the logit estimations of entry for men and women, and being married is insignificant for women and negatively associated with entry for men (Table A.4). Finally, capital income of the household also increases the unexplained gap, but only by 2.6 percent of the raw gap per 1000 euro.

In the decomposition of the unexplained gap, only two of the contributions of single (groups of) coefficients are statistically significant. The most important one is the dummy indicating that someone finished vocational training. It contributes 0.47 percentage points to the unexplained part (which is 0.50 percentage points in total). Table 1 shows that the share of women with vocational training in the estimation sample is only 3.4 percentage points below the share of men, but in the subsample of those who are about to enter self-employment, the gender difference is 11.5 percentage points. This is reflected in the estimated logit model, which reveals that vocational training decreases the probability of entry for women, but not for men (see Table 2). This gender difference in the influence of vocational training (while the distribution is similar) constitutes the significant contribution of vocational training to the unexplained gap. A likely explanation is that men choose apprenticeships in industries that exhibit higher self-employment rates, such as construction (cf. Table A.3). The second significant, albeit smaller, contribution to the unexplained gap is that of the coefficient of capital income. The effect of capital income is positive for men, but insignificant for women. As mentioned in the previous subsection,

²⁵To check the opportunity costs argument, one might consider including the current income as a paid employee in the model. We do not do so because labour income is likely to be endogenous, for example, because prospective entrepreneurs reduce their work hours to make preparations for their future start-up. We also considered temporary employment contracts and included a dummy variable controlling for a fixed-term employment status before entering self-employment in the estimation. We find an insignificant effect of temporary employment on the entry probability and for the decomposition results. Therefore, we decided not to include the temporary employment dummy in our final estimation specification.

it is possible that men have more control over the household's capital and can easier use it to start up a business than women. This result points to an unequal intra-household distribution of power over financial resources.²⁶

One might expect that the gender difference in the propensity to become an entrepreneur could differ by religion or cultural background. Our explanatory variables include regional dummies, which proxy religion in the sense that the East and North of Germany are predominantly Lutheran, while the South is more Catholic. Region neither contributes significantly to the explained, nor to the unexplained part, however. Likewise, the dummy variable indicating German nationality does not have any significant contribution in the decomposition. The largest immigrant group to Germany are from Turkey, who are predominately Muslim. In sum, our results do not point to differences in the entrepreneurship gender gap by religion.

5 Discussion and Conclusion

Based on the German Socio-Economic Panel, we decompose the gender gap in entry rates into self-employment by the most influential factors, including human capital, employments status and personality traits. We find that the overall gender gap can be split into a negative explained gap due to different distributions of characteristics and a positive unexplained gap due to different influences of these characteristics on the entry probability. This means that given their current characteristics, women should have a higher entry rate into self-employment than men (negative explained gap), but due to a less favourable rewarding of their characteristics with respect to entrepreneurial entry (positive unexplained gap) the female entry rate remains lower than that of males. Looking at the explained part of the gap, we find a strong influence and explanatory power of three groups of variables: Education, employment status, and personality characteristics.

²⁶Alesina et al. (2013) report that women pay more for credit than men in Italy. From this result alone, if it is applicable to Germany, we would expect that capital income (as an indicator for capital assets) should have a more positive effect on the probability of entry into entrepreneurship for women than for men, because women would depend more on own wealth, whereas men would find it easier to borrow and start up a business even when lacking own assets. The fact that we do not find this (cf. Table 2) is consistent with the interpretation that men control the household's capital assets, so household wealth does not help women to start up a business.

With respect to the role of endowments in the gender gap in entrepreneurial entry, the largest explanatory power among the personality characteristics is found when looking at the specific personality characteristics beyond the Big Five construct. The lower willingness to take risk among women explains almost three quarters of the overall gender differential. Women are, on average, more risk averse and therefore less likely to choose the transition into entrepreneurship. In contrast, the distribution of the traits of the Big Five Factor Model would rather imply a higher entry rate into self-employment for female individuals. Women score higher on average in openness to experience and extraversion than men and should therefore choose self-employment more often than observed. With respect to other traits, we find no or only small effects on the gender gap. Overall, it seems that beyond risk attitudes the explanatory power of personality characteristics for the gender gap is lower and different from what is mostly expected.

Looking at variables beyond traits, the lower average educational level of women explains about a quarter of the gender differential in the transition rate. Since today (unlike in the last century) as many women graduate from university as men in Germany, we can expect that the gender gap in entrepreneurship will become smaller in the future.²⁷ The current labour market status has another strong effect. Women have a lower rate of wage employment and are more often not participating, which, *per se*, would imply a higher transition rate into self-employment, holding everything else constant, such as education, work experience, and the family situation. This effect significantly reduces the explained gap of our model.

Decomposing the unexplained gender gap in the entry probability, we find significant gender differences only for two variables: vocational training, suggesting that men take apprenticeships in industries with higher self-employment rates, and capital income, suggesting that women have less control over the household's capital than men when it comes to investments in their business start-up. These findings are in line with most of previous research. Similar to our results, Georgellis and Wall (2005) report a higher influence of

²⁷The share of female university graduates rose steadily in post-war Germany and has reached, and even surpassed in some years, the male share, since about 2005 (Federal Statistical Office, 2013).

capital for men. Rosti and Chelli (2005) find a large effect of the current employment status on the transition rates into self-employment for Italy. The explanatory power of risk preferences is demonstrated by Fossen (2012), Bönnte and Piegeler (2013), and Furdas and Kohn (2010). In contrast to our results, Bönnte and Piegeler (2013) report a significant influence of competitiveness, which can be regarded as a component of the personality trait conscientiousness. Controlling for a wider range of personality characteristics, we do not find a significant effect of conscientiousness anymore. In this sense, we are able to control, in contrast to prior research, for a wide variety of socio-demographic and personality variables simultaneously. Our analysis demonstrates the importance of controlling for a full set of personality characteristics, employment status and human capital instead of picking single variables.

Our results clearly indicate that policy measures aiming to close the gender gap need to tackle the problem of differing risk attitudes, e.g. by offering public risk-sharing to (female) entrepreneurs. One solution to this problem was found by Caliendo and Kritikos (2010). They point to an earlier German start-up subsidy programme, which was available between 2003 and 2006, and which offered a fixed, but over the years diminishing amount, of financial support to founders out of unemployment for up to three years. This programme facilitated the step into self-employment for women, and the form of security offered by this specific design substantially increased the number of female applications to this support programme. While the male over female ratio is about 2:1 in most other programmes supporting business venturing in Germany, the share in this programme was equally distributed between men and women. It helped to reduce the entrepreneurial gender gap in Germany during this time.

Based on our other findings, we propose three further policy measures. These relate to coaching, campaigning and capital access as an integrated concept to promote female self-employment. Externally provided professional coaching combines the enhancement of education-related skills, which might be less pronounced among higher aged female nascent entrepreneurs, with elements that support entrepreneurial decision making. Offered at an

early stage, it might be an instrument that helps increase the number of potential female entrepreneurs who are planning to enter entrepreneurial activities, but so far refrained from doing so.²⁸ Secondly, given the large unexplained gender gap in entrepreneurship, female entries into the start-up scene could also be promoted by public campaigns aiming at a de-stigmatization of female entrepreneurship. Last but not least, access to capital seems to be more difficult for women than for men. At the same time, we observe that female entrepreneurs are still less risk tolerant than their male counterparts, which might make them less open to loans as typical instrument of financing their businesses. Moreover, Alesina et al. (2013) reveal differing accesses to credit lines for women compared to men with women again being disadvantaged. This may point to specific needs of female entrepreneurs for different kinds of capital access, for instance equity or mezzanine capital.

Putting our findings together, we reveal that after controlling for the most important factors influencing the decision to become self-employed, the overall explained gender gap in entry into entrepreneurship is negative. Hence, given the distribution of their characteristics, women should be more likely to enter self-employment than men or, in other words, if women had on average the same characteristics as men, their entrepreneurial activity would be even lower. This effect widens the unexplained gender gap in entrepreneurship and suggests that the lower entry rate of women is also due to unobservable influences directly connected to gender. Reasons for these unobservable differences might be discrimination by customers (Borjas and Bronars, 1989) and capital providers (Georgellis and Wall, 2005; Alesina et al., 2013), cultural aspects (Campa et al., 2011) or different social and family roles or preferences (Verheul et al., 2012). The challenge for future research is to investigate the relative importance of these possible mechanisms. Another interesting avenue for the future is to assess gender differences in the success of entrepreneurial activities, which could be defined in terms of income, business growth, or survival of the ventures, and how such possible differences are related to personality.

²⁸Regarding the lower willingness to take risk for women, Booth and Nolen (2012) find a significantly higher risk preference for girls taught at single-sex schools or in all-girls groups, compared to their co-ed counterparts. This effect might also be of interest for entrepreneurial coaching strategies directed at women.

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Tables

Table 1: Mean characteristics by gender

Variable	Full estimation sample			Entry sample		
	Men	Women	p-Value	Men	Women	p-Value
Entry rate	0.0135	0.0101	0.0001	1.0000	1.0000	
Big 5						
Openness	4.3869	4.5671	0.0000	4.7754	5.0938	0.0001
Conscientiousness	5.9522	6.0520	0.0000	5.9443	5.9959	0.4573
Extraversion	4.6840	4.9733	0.0000	5.0018	5.1621	0.0446
Agreeableness	5.2477	5.5697	0.0000	5.3802	5.5576	0.0112
Neuroticism	3.6563	4.1290	0.0000	3.5022	4.0082	0.0000
Other Personality Traits						
Risk	5.0249	4.1681	0.0000	6.0159	5.0550	0.0000
Internal LOC	5.4600	5.4433	0.0146	5.6004	5.4699	0.0417
External LOC	3.3204	3.4220	0.0000	3.1516	3.3236	0.0244
Trust	2.3312	2.3300	0.7876	2.4182	2.4261	0.8531
School leaving degree						
High-School	0.3038	0.2453	0.0000	0.4934	0.4281	0.0836
Vocational training	0.5380	0.5045	0.0000	0.4668	0.3517	0.0019
Technical college	0.2295	0.2795	0.0000	0.2202	0.2966	0.0203
University	0.2479	0.1976	0.0000	0.4085	0.3609	0.1960
Age	41.41	41.43	0.79	40.15	40.11	0.95
Yrs work experience/10	1.9583	1.6072	0.0000	1.7119	1.3505	0.0000
Yrs unempl. experience/10	0.0586	0.0696	0.0000	0.0735	0.0870	0.2398
Disabled	0.0649	0.0468	0.0000	0.0557	0.0275	0.0650
German	0.9498	0.9540	0.0158	0.9443	0.9450	0.9697
SE father	0.0686	0.0707	0.3153	0.1141	0.1223	0.7349
# of children	0.7389	0.7507	0.1361	0.7772	1.0245	0.0017
Married	0.6946	0.7297	0.0000	0.6180	0.7554	0.0001
Divorced	0.0616	0.0817	0.0000	0.0637	0.0612	0.8916
East Germany	0.2812	0.2676	0.0002	0.3448	0.2569	0.0114
South Germany	0.2749	0.2663	0.0174	0.2440	0.2905	0.1641
North Germany	0.1057	0.1116	0.0217	0.0796	0.1040	0.2620
City States	0.0183	0.0181	0.8525	0.0080	0.0245	0.0784
Capital income/1000 in EUR	2.1292	2.9371	0.0000	9.0557	4.6747	0.0467
Unemployed	0.0626	0.0579	0.0155	0.2653	0.1651	0.0013
Not participating	0.0101	0.1906	0.0000	0.0318	0.3242	0.0000
# of person-years	27,902	32,411		377	327	

Notes: The full estimation sample includes all observations of persons not currently self-employed; the entry sample those who we observe just before entering self-employment. The p-values refer to t-tests of equal means by gender. Detailed information on all variables are provided in Table A.5 in Appendix A.

Source: Authors' calculations based on the SOEP (2000-2010).

Table 2: Logit estimation of the probability of entry into self-employment: Marginal effects

	Men		Women	
Big 5				
Std Openness	0.0019*** (0.0005)	0.0012*** (0.0004)	0.0028*** (0.0004)	0.0021*** (0.0004)
Std Conscientiousness	-.0003 (0.0006)	-.0006 (0.0004)	-.0003 (0.0005)	-.0004 (0.0004)
Std Extraversion	0.0021*** (0.0006)	0.0011** (0.0004)	0.0003 (0.0004)	-.00008 (0.0004)
Std Agreeableness	0.0007 (0.0005)	0.0007* (0.0004)	-.0004 (0.0004)	-.0002 (0.0004)
Std Neuroticism	-.0006 (0.0005)	0.0002 (0.0004)	-.0003 (0.0004)	3.00e-06 (0.0004)
Other Personality Traits				
Risk		0.0009*** (0.0002)		0.0007*** (0.0002)
Std Internal LOC		0.0012*** (0.0004)		0.0005 (0.0004)
Std External LOC		-.0008* (0.0005)		-.0001 (0.0004)
Std Trust		0.0006 (0.0004)		0.0006 (0.0004)
School leaving degree				
High-School	0.0051*** (0.0019)	0.0041*** (0.0015)	0.0032** (0.0014)	0.0028** (0.0012)
Vocational training	0.0003 (0.0014)	0.0003 (0.0011)	-.0033*** (0.0011)	-.0026** (0.0011)
Technical college	0.0016 (0.0017)	0.0009 (0.0013)	-.0010 (0.001)	-.0007 (0.0009)
University	0.0057** (0.0023)	0.004** (0.0017)	0.0026 (0.0016)	0.0021 (0.0014)
SE father	0.0026 (0.0021)	0.0015 (0.0015)	0.0035* (0.0018)	0.0033** (0.0016)
Capital income/1000 in EUR	0.0001*** (0.00002)	0.00009*** (0.00002)	1.00e-05 (9.00e-06)	1.00e-05 (8.00e-06)
Not participating	0.0356** (0.0154)	0.0256** (0.0115)	0.0095*** (0.0024)	0.0085*** (0.0023)
Unemployed	0.061*** (0.0095)	0.0481*** (0.0081)	0.0257*** (0.0055)	0.0218*** (0.0049)
Further control variables	Yes	Yes	Yes	Yes
# of person-years	27,902	27,902	32,411	32,411
Pseudo-R ²	0.1076	0.1291	0.0801	0.0909
log-Likelihood	-1,782.323	-1,739.36	-1,681.928	-1,662.095
Wald χ^2	421.7296	480.9014	281.6382	339.4749

Notes: Marginal effects after logit estimation, estimated at the means of the explanatory variables. Cluster and heteroskedasticity robust standard errors in parentheses. The logit coefficients are provided in Table A.4. Detailed information on all variables are provided in Table A.5 in Appendix A.

***/**/* indicate significance at the 1/5/10 % levels, respectively.

Source: Authors' calculations based on the SOEP (2000-2010).

Table 3: Effect of being female on the probability of entry into self-employment

Logit model				
Effect size of being female	-.0034***	-.0039***	-.0042***	-.0026***
Robust std err.	(0.001)	(0.0008)	(0.0007)	(0.0006)
Socio-demographic control variables	No	Yes	Yes	Yes
Big Five personality traits	No	No	Yes	Yes
Specific personality characteristics	No	No	No	Yes
# of person-years	60,313	60,313	60,313	60,313
Pseudo-R ²	0.002	0.073	0.0864	0.1024
log-Likelihood	-3,825.461	-3,553.139	-3,501.691	-3,440.464
Wald χ^2	12.3299	520.937	598.0605	724.682

Note: The table shows the estimated discrete effects of being female on the probability of entry into self-employment in models with different sets of control variables. The standard errors are robust to heteroskedasticity and clustering at the individual level. Stars (***) indicate significance at the 1% level.

Source: Authors' calculations based on the SOEP (2000-2010).

Table 4: Detailed non-linear decomposition of the gender gap in entrepreneurial entry

Variable	Differential	%	p-Value	Differential	%	p-Value
Probability for Men	0.0135 ***	.	0.0000	0.0135 ***	.	0.0000
Probability for Women	0.0101 ***	.	0.0000	0.0101 ***	.	0.0000
Raw Differential	0.0034 ***	1.0000	0.0005	0.0034 ***	1.0000	0.0005
Explained Gap	-0.0037 ***	-1.0730	0.0000	-0.0016 *	-0.4588	0.0618
Big 5	-0.0012 **	-0.3499	0.0401	-0.0014 **	-0.4180	0.0133
Openness	-0.0010 ***	-0.2990	0.0000	-0.0009 ***	-0.2637	0.0041
Conscientiousness	0.0001	0.0327	0.3464	0.0002	0.0655	0.1362
Extraversion	-0.0008 ***	-0.2244	0.0028	-0.0004	-0.1265	0.1032
Agreeableness	-0.0001	-0.0329	0.7122	-0.0003	-0.0843	0.3730
Neuroticism	0.0006	0.1738	0.1108	-0.0000	-0.0090	0.9384
Other pers. Traits	.	.	.	0.0027 ***	0.7888	0.0077
Risk	.	.	.	0.0025 ***	0.7236	0.0086
Internal LOC	.	.	.	0.0001	0.0160	0.4200
External LOC	.	.	.	0.0002	0.0479	0.1676
Trust	.	.	.	0.0000	0.0013	0.9162
Education	0.0009 ***	0.2580	0.0012	0.0010 **	0.2781	0.0241
High-School	0.0006 ***	0.1651	0.0023	0.0006 **	0.1819	0.0248
Vocational training	-0.0001	-0.0389	0.1445	-0.0001	-0.0376	0.2091
Technical College	-0.0000	-0.0035	0.9223	-0.0000	-0.0026	0.9491
University	0.0005 **	0.1353	0.0103	0.0005 *	0.1364	0.0532
Year	-0.0000	-0.0022	0.7045	-0.0000	-0.0019	0.7537
Region	0.0000	0.0074	0.6157	0.0000	0.0116	0.5127
German	0.0000	0.0012	0.8145	0.0000	0.0022	0.7238
Other control variables	0.0009	0.2487	0.2547	0.0009	0.2734	0.3281
SE father	-0.0000	-0.0046	0.7131	-0.0000	-0.0048	0.7134
Capital Income/1000 in EUR	-0.0001 ***	-0.0247	0.0062	-0.0001 **	-0.0260	0.0294
Employed	-0.0038 ***	-1.1132	0.0000	-0.0042 ***	-1.2313	0.0016
Not participating	-0.0004	-0.1191	0.3273	-0.0005	-0.1576	0.2837
Unemployed	0.0001	0.0267	0.1909	0.0001	0.0288	0.2240
Unexplained Gap	0.0071 ***	2.0730	0.0000	0.0050 ***	1.4588	0.0001
Big 5	-0.0001	-0.0296	0.2890	-0.0002	-0.0487	0.2058
Openness	0.0000	0.0049	0.6614	0.0000	0.0011	0.9285
Conscientiousness	-0.0000	-0.0031	0.3971	-0.0000	-0.0022	0.6431
Extraversion	-0.0000	-0.0132	0.3553	-0.0001	-0.0158	0.3690
Agreeableness	0.0000	0.0007	0.9561	0.0000	0.0002	0.9920
Neuroticism	-0.0001	-0.0190	0.2013	-0.0001	-0.0319	0.1298
Other pers. Traits	.	.	.	-0.0096	-2.8096	0.1418
Risk	.	.	.	-0.0096	-2.8128	0.1415
Internal LOC	.	.	.	0.0000	0.0015	0.8135
External LOC	.	.	.	0.0000	0.0015	0.8381
Trust	.	.	.	0.0000	0.0000	0.9269
Education	0.0071 **	2.0688	0.0420	0.0075 *	2.1934	0.0983
High-School	0.0005	0.1457	0.6575	0.0007	0.2038	0.6024
Vocational training	0.0045 **	1.3003	0.0266	0.0047 *	1.3816	0.0673
Technical College	0.0013	0.3911	0.1938	0.0012	0.3521	0.3282
University	0.0008	0.2316	0.4348	0.0009	0.2559	0.4619
Year	0.0000	0.0125	0.6686	0.0000	0.0115	0.7340
Region	0.0037	1.0709	0.1111	0.0045	1.3166	0.1324
German	-0.0033	-0.9706	0.5952	-0.0025	-0.7576	0.7300
Other control variables	-0.0312	-9.1161	0.3394	-0.0226	-6.6032	0.5445
SE father	-0.0002	-0.0548	0.5336	-0.0003	-0.0932	0.3605
Capital Income/1000 in EUR	0.0005 ***	0.1370	0.0007	0.0005 **	0.1495	0.0148
Employed	-0.0058 *	-1.7083	0.0616	-0.0066	-1.9241	0.1182
Not participating	0.0000	0.0118	0.8564	0.0000	0.0129	0.8636
Unemployed	0.0002	0.0467	0.4408	0.0003	0.0740	0.3290
Constant	0.0330	9.6342	0.3102	0.0314	9.1799	0.3998
# of person-years	60,313			60,313		

Note: The p-Value refers to a test of significance of the differential. Other control variables are age, age squared, years of work experience, years of unemployment difference, disabled, number of children, marital status; Year and Region include year and region dummies. ***/**/* indicate significance at the 1/5/10 % levels.

Source: Authors' calculations based on the SOEP (2000-2010).

Appendix A

Table A.1: Person-year observations entering and not entering into self-employment

	No entry	Entry	Total	Entry rate
Men	27,525	377	27,902	0.0135
Wage employed	25,607	265	25,872	0.0102
Unemployed	1,647	100	1,747	0.0572
Not participating	271	12	283	0.0424
Women	32,084	327	32,411	0.0101
Wage employed	24,188	167	24,355	0.0069
Unemployed	1,823	54	1,877	0.0288
Not participating	6,073	106	6,179	0.0172
Total (men and women)	59,609	704	60,313	0.0117

Source: Authors' calculations based on the SOEP (2000-2010).

Table A.2: Inventories used to measure the personality traits

Personality trait	Questionnaire wording
Big Five Model	<i>Scale: 1 ("does not apply to me at all") to 7 ("applies to me perfectly")</i>
	I see myself as someone who ...
Openness to experience	is original, comes up with new ideas
Openness to experience	values artistic experiences
Openness to experience	has an active imagination
Conscientiousness	does a thorough job
Conscientiousness	does things effectively and efficiently
Conscientiousness (<i>inverted</i>)	tends to be lazy
Extraversion	is communicative, talkative
Extraversion	is outgoing, sociable
Extraversion (<i>inverted</i>)	is reserved
Agreeableness	has a forgiving nature
Agreeableness	is considerate and kind to others
Agreeableness (<i>inverted</i>)	is sometimes somewhat rude to others
Neuroticism	worries a lot
Neuroticism	gets nervous easily
Neuroticism (<i>inverted</i>)	is relaxed, handles stress well
Locus of control	<i>Scale: 1 ("disagree completely") to 7 ("agree completely")</i>
Internal locus	How my life goes depends on me
Internal locus	One has to work hard in order to succeed
Internal locus (<i>inverted</i>)	If I run up against difficulties in life, I often doubt my own abilities
Internal locus (<i>not used</i>)	If a person is socially or politically active, he/she can have an effect on social conditions
External locus	Compared to other people, I have not achieved what I deserve
External locus	What a person achieves in life is above all a question of fate or luck
External locus	I frequently have the experience that other people have a controlling influence over my life
External locus	The opportunities that I have in life are determined by the social conditions
External locus	Inborn abilities are more important than any efforts one can make
External locus	I have little control over the things that happen in my life
Trust	<i>Scale: 1 ("totally agree") to 4 ("totally disagree")</i>
Trust (<i>inverted</i>)	On the whole one can trust people
Trust	Nowadays one can't rely on anyone
Trust	If one is dealing with strangers, it is better to be careful before one can trust them
Risk tolerance	<i>Scale: 0 ("fully unwilling to take risks") to 10 ("fully willing to take risk")</i>
	Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

Notes: The items on the Big Five factors were included in the survey waves 2005 and 2009 of the SOEP; those on locus of control in 2005; those on trust in 2003 and 2008; on the willingness to take risks in 2004, 2006, 2008, and 2009.

Source: Adapted from Caliendo et al. (2014).

Table A.3: Industry of self-employment by gender

Industry	Entry sample		
	Men	Women	p-Value
Manufacturing	0.0690	0.0275	0.0116
Agriculture, forestry	0.0080	0.0000	0.1063
Mining/ quarrying, energy/ water supply	0.0053	0.0031	0.6486
Chemicals, pulp and paper industry	0.0186	0.0183	0.9829
Construction and nonmetallic mineral processing	0.1300	0.0214	0.0000
Iron and steel industry	0.0239	0.0061	0.0583
Textile and apparel industry	0.0027	0.0183	0.0364
Wholesale and retail trade	0.1379	0.1437	0.8256
Transport and communication	0.0345	0.0245	0.4365
Public and social service activities	0.1326	0.2446	0.0001
Financial intermediation and private services	0.2865	0.1957	0.0051
Not categorized	0.1512	0.2966	0.0000
# of person-years	377	327	

Notes: The p-values refer to t-tests of equal means by gender.

Source: Authors' calculations based on the SOEP (2000-2010).

Table A.4: Logit estimation of the probability of entry into self-employment: Coefficients

	Full sample		Men		Women	
Female	-.5529*** (0.0993)	-.4196*** (0.1023)				
Big 5						
Std Openness	0.3219*** (0.0462)	0.2593*** (0.0458)	0.2279*** (0.0636)	0.1778*** (0.0627)	0.4169*** (0.0677)	0.351*** (0.0679)
Std Conscientiousness	-.0467 (0.0483)	-.0856* (0.0482)	-.0342 (0.0664)	-.0926 (0.0674)	-.0494 (0.0701)	-.0699 (0.0688)
Std Extraversion	0.1466*** (0.0477)	0.0755 (0.0481)	0.2486*** (0.068)	0.1731** (0.0683)	0.0513 (0.0666)	-.0135 (0.067)
Std Agreeableness	0.0166 (0.0452)	0.0388 (0.0448)	0.0853 (0.0623)	0.1062* (0.06)	-.0641 (0.066)	-.0397 (0.0667)
Std Neuroticism	-.0745* (0.0438)	0.0035 (0.0457)	-.0752 (0.0633)	0.0339 (0.0648)	-.0517 (0.0614)	0.0004 (0.0648)
Other Personality Traits						
Risk		-.1494** (0.0678)		-.2675*** (0.1035)		-.0353 (0.0925)
Risk sq.		0.0307*** (0.0064)		0.0408*** (0.0093)		0.0193** (0.0094)
Std Internal LOC		0.1239*** (0.0466)		0.1856*** (0.0679)		0.0831 (0.0643)
Std External LOC		-.0733 (0.0471)		-.1243* (0.0697)		-.0202 (0.0632)
Std Trust		0.0927** (0.0453)		0.0979 (0.0649)		0.0944 (0.0628)
School leaving degree						
High-School	0.4788*** (0.1201)	0.4819*** (0.1202)	0.5362*** (0.18)	0.5567*** (0.1856)	0.4242** (0.1681)	0.4208** (0.1658)
Vocational training	-.1968* (0.118)	-.1741 (0.1188)	0.0406 (0.1648)	0.0438 (0.1634)	-.4889*** (0.1673)	-.4485*** (0.1722)
Technical college	0.012 (0.1227)	0.0079 (0.1238)	0.1764 (0.1844)	0.1329 (0.186)	-.1490 (0.163)	-.1226 (0.1664)
University	0.4568*** (0.1343)	0.4206*** (0.1351)	0.5719*** (0.1976)	0.5369*** (0.1963)	0.3532* (0.1938)	0.3269* (0.196)
Age	0.1336*** (0.0504)	0.1427*** (0.0501)	0.0972 (0.0676)	0.1238* (0.068)	0.1675** (0.0782)	0.1649** (0.077)
Age sq.	-.0019*** (0.0006)	-.0020*** (0.0006)	-.0016* (0.0008)	-.0019** (0.0008)	-.0023** (0.0009)	-.0022** (0.0009)
Yrs work experience/10	0.0807 (0.0955)	0.0827 (0.0956)	0.142 (0.1898)	0.1513 (0.1914)	0.0957 (0.1221)	0.0893 (0.123)
Yrs unempl. experience/10	-.5150* (0.2969)	-.4046 (0.2956)	-1.1420** (0.5278)	-.8915* (0.5157)	0.1615 (0.347)	0.2099 (0.3544)
Disabled	-.1651 (0.213)	-.1393 (0.2137)	-.0940 (0.2601)	-.0654 (0.2589)	-.3572 (0.3676)	-.3310 (0.367)
German	-.0485 (0.1999)	-.0777 (0.2006)	-.1599 (0.2642)	-.1444 (0.2652)	0.0527 (0.2979)	-.0046 (0.3001)
SE father	0.3752*** (0.1326)	0.3579*** (0.1326)	0.2683 (0.192)	0.2143 (0.1917)	0.4356** (0.1862)	0.4625** (0.1833)
# of children	0.0445 (0.049)	0.0355 (0.0488)	0.0665 (0.072)	0.0562 (0.0724)	0.0525 (0.0685)	0.0449 (0.0681)
Married	-.1287 (0.1116)	-.0998 (0.1135)	-.2954* (0.1585)	-.3206** (0.1623)	0.0867 (0.1694)	0.1562 (0.1702)
Divorced	-.2101 (0.1839)	-.2549 (0.1872)	-.2250 (0.2511)	-.3246 (0.259)	-.1977 (0.2728)	-.1915 (0.2736)

(Table continued on next page)

(Table continued)

	Full sample		Men		Women	
East Germany	0.0194 (0.1165)	0.0378 (0.117)	0.0626 (0.1593)	0.0932 (0.158)	-.0441 (0.1855)	-.0440 (0.1856)
South Germany	0.0216 (0.1101)	0.0571 (0.1111)	-.0709 (0.1546)	-.0211 (0.1559)	0.165 (0.1571)	0.1864 (0.1582)
North Germany	-.1506 (0.1595)	-.1489 (0.1613)	-.2366 (0.2317)	-.2162 (0.234)	-.0393 (0.2199)	-.0402 (0.2211)
City States	-.3448 (0.3565)	-.4119 (0.3646)	-.9557 (0.5857)	-1.0676* (0.5931)	0.2394 (0.4211)	0.2092 (0.4375)
Capital income/1000 in EUR	0.0052*** (0.0011)	0.005*** (0.0011)	0.0145*** (0.0025)	0.0138*** (0.0026)	0.0021 (0.0013)	0.002 (0.0014)
Not participating	1.1864*** (0.1649)	1.2207*** (0.1651)	1.6852*** (0.3732)	1.6317*** (0.3765)	1.0097*** (0.1938)	1.0225*** (0.1948)
Unemployed	2.0370*** (0.1286)	2.0353*** (0.1291)	2.2771*** (0.1751)	2.3013*** (0.1767)	1.6826*** (0.2013)	1.6471*** (0.2016)
Const.	-7.2125*** (0.9853)	-7.5586*** (0.988)	-6.5589*** (1.3549)	-7.0250*** (1.3631)	-8.3630*** (1.5184)	-8.5454*** (1.5087)
Year-Dummies	Yes	Yes	Yes	Yes	Yes	Yes
# of person-years	60,313	60,313	27,902	27,902	32,411	32,411
Pseudo-R ²	0.0864	0.1024	0.1076	0.1291	0.0801	0.0909
log-Likelihood	-3,501.691	-3,440.464	-1,782.323	-1,739.36	-1,681.928	-1,662.095
Wald χ^2	598.0605	724.682	421.7296	480.9014	281.6382	339.4749

Notes: Estimates are controlled for year effects. Cluster and heteroskedasticity robust standard errors in parentheses.

***/**/* indicate significance at the 1/5/10 % levels, respectively.

Detailed information on all variables are provided in Table A.5.

Source: Authors' calculations based on the SOEP (2000-2010).

Table A.5: Description of control variables

Variable	Definition
Female	Dummy for females
High School	Dummy for individuals who finished higher secondary school with a university entrance qualification
Vocational Training	Dummy for individuals who finished an apprenticeship
Technical College	Dummy for individuals who finished a higher technical college, a health care school, or civil service training
University	Dummy for individuals who have a university degree
Age	Age of individual
Yrs work experience/ 10 ¹	Years of full time work experience prior to the year of observation, divided by 10
Yrs unempl. experience/ 10 ¹	Years of unemployment experience prior to the year of observation, divided by 10
Disabled	Dummy for physically challenged individuals
German	Dummy for German nationality
SE father	Dummy for indiv. whose father was self-empl. when the respondents were 15 years old
# of children	Number of children under 17 in the household
Married	Dummy for married and not separated individuals. Omitted category for marital status is "single"/"widowed"
Divorced	Dummy for divorced individuals. Omitted category for marital status is "single"/"widowed"
East	Dummy for individuals living in the area of former East Germany or Berlin
South	Dummy for individuals living in Baden Wuerttemberg or Bavaria
North	Dummy for individuals living in Schleswig Holstein or Lower Saxony
City States	Dummy for individuals living in Bremen or Hamburg
Capital income/ 1000 in EUR ²	Real income from interests, dividends, and house rents in 1000 Euro in prices of 2005
Not participating	Dummy for individuals not participating in the labor market
Unemployed	Dummy for individuals who are unemployed
x sq.	Square of variable x

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

¹ Uses information from the lifetime employment history in the SOEP.

² Some respondents report the exact amount of their financial income, while others just indicate a range. For the latter respondents, we impute the mean income of those who actually give the exact amount within this range.

Appendix B

Our logit model of the probability of entry into self-employment can be written as:

$$Y = F(X\beta) \quad (\text{B.1})$$

where Y is the vector of predicted entry probabilities, X the matrix of independent variables, β the coefficient vector, and F the cumulative logistic distribution function. A non-linear decomposition of the mean difference in entrepreneurial entry by gender can be written as:

$$\bar{Y}_M - \bar{Y}_F = \left[\overline{F(X_M\beta_M)} - \overline{F(X_F\beta_M)} \right] + \left[\overline{F(X_F\beta_M)} - \overline{F(X_F\beta_F)} \right] \quad (\text{B.2})$$

where index M stands for the male subsample and index F for the female subsample. In equation B.2 the first summand is the contribution of the distribution of the variables to the overall gender gap, i.e. the explained part, whereas the second summand is the contribution of differences in the coefficients (including the constant), i.e. the unexplained part.²⁹ Following the approach of Yun (2004), for a detailed decomposition which assesses the contributions of each single variable (or group of variables) separately in this non-linear setting, both for the explained and unexplained gaps, two approximations are necessary. First, we consider predictions at the mean values of the explanatory variables:

$$\bar{Y}_M - \bar{Y}_F = [F(\bar{X}_M\beta_M) - F(\bar{X}_F\beta_M)] + [F(\bar{X}_F\beta_M) - F(\bar{X}_F\beta_F)] + R_A \quad (\text{B.3})$$

where

$$R_A = \left[\overline{F(X_M\beta_M)} - \overline{F(X_F\beta_M)} \right] + \left[\overline{F(X_F\beta_M)} - \overline{F(X_F\beta_F)} \right] - [F(\bar{X}_M\beta_M) - F(\bar{X}_F\beta_M)] + [F(\bar{X}_F\beta_M) - F(\bar{X}_F\beta_F)] \quad (\text{B.4})$$

Second, a first order Taylor expansion around the mean characteristics is used. Hence, we can rewrite equation B.3 as follows:

$$\begin{aligned} \bar{Y}_M - \bar{Y}_F &= [(\bar{X}_M - \bar{X}_F)\beta_M] f(\bar{X}_M\beta_M) \\ &+ \bar{X}_F(\beta_M - \beta_F) f(\bar{X}_F\beta_F) + R_A + R_T \end{aligned} \quad (\text{B.5})$$

In this equation $f(\cdot)$ is the first order derivative of $F(\cdot)$, and

$$\begin{aligned} R_T &= [F(\bar{X}_M\beta_M) - F(\bar{X}_F\beta_M)] + [F(\bar{X}_F\beta_M) - F(\bar{X}_F\beta_F)] \\ &- [(\bar{X}_M - \bar{X}_F)\beta_M] f(\bar{X}_M\beta_M) - \bar{X}_F(\beta_M - \beta_F) f(\bar{X}_F\beta_F) \end{aligned} \quad (\text{B.6})$$

Using B.5, a detailed decomposition of equation B.2 can be written as

$$\bar{Y}_M - \bar{Y}_F = \sum_{i=1}^K W_{\Delta X}^i \left[\overline{F(X_M\beta_M)} - \overline{F(X_F\beta_M)} \right] + \sum_{i=1}^K W_{\Delta \beta}^i \left[\overline{F(X_F\beta_M)} - \overline{F(X_F\beta_F)} \right] \quad (\text{B.7})$$

i.e., the detailed decomposition includes weights for the contributions of the characteristics

²⁹More precisely, as mentioned in Section 3.4, we use the coefficient estimates from a pooled estimation for the decomposition of the contributions of the endowments to the gap; see Jann (2008) for the technical details.

$(W_{\Delta X}^i)$ and for the contributions of the coefficients $(W_{\Delta \beta}^i)$, with

$$W_{\Delta X}^i = \frac{(\overline{X}_M^i - \overline{X}_F^i)\beta_M^i}{(\overline{X}_M - \overline{X}_F)\beta_M} \quad \text{and} \quad W_{\Delta \beta}^i = \frac{\overline{X}_F^i(\beta_M^i - \beta_F^i)}{\overline{X}_F(\beta_M - \beta_F)}$$

for variable i in the set of K explanatory variables (Yun, 2004).