Contents lists available at ScienceDirect





Labour Economics

journal homepage: www.elsevier.com/locate/labeco

Do recruiters select workers with different personality traits for different tasks? A discrete choice experiment



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ARTICLE INFO

JEL: J23 D91 M51

Keywords: Recruitment Personality traits Tasks Discrete choice experiment

1. Introduction

While the economic principle that different tasks require different vocational skills (Geel et al., 2011) is well known, the question arises as to whether it also applies to personality traits. The literature on personality traits and their labor market outcomes clearly shows that personality traits correlate with occupation and career choices (e.g., Jackson, 2006; Caliendo et al., 2014; Wells et al., 2016). However, the within-occupation variance of tasks explains a significant portion of wage differentials between workers (Autor and Handel, 2013). Given that both personality traits and job tasks are predictive of individual labor market success, whether employers prefer applicants with different personality traits for different tasks remains under-researched.

Indeed, although two strands of the economic literature—one on job tasks and the other on personality traits—have been growing over the past decade, little is known about the relationship between job tasks and personality. Except for a few studies that focus primarily on interactive tasks (e.g., Mount et al., 1998; Borghans et al., 2008a; Weinberger, 2014), labor economic research remains silent about which tasks require which kinds of personality traits. This research gap is problematic, because analytical and interactive tasks have gained importance due to technological change, while routine tasks have lost their relevance (Autor et al., 2003; Weinberger, 2014). This labor market de-

ABSTRACT

This paper explores whether firms recruit workers with different personality traits for different tasks. We conduct a discrete choice experiment among recruiters of 634 firms in Germany, asking recruiters to choose between job applicants who differ in seven characteristics: professional competence, the Big Five personality traits, and the prospective wage level. We find that all personality traits affect the hiring probability of the job applicant, with conscientiousness and agreeableness having the strongest positive effects. However, for analytical tasks, recruiters have a stronger preference for more open and conscientious applicants, while favoring more open, extraverted, and agreeable workers for interactive tasks.

velopment sets the agenda for research into the relationship between job tasks and personality traits in terms of hiring decisions.

In this paper, we investigate whether firms recruit workers with different personality traits for different tasks. We develop a representative firm survey in Germany (BIBB Cost-Benefit Survey (BIBB-CBS) 2017/2018), in which 1336 recruiters are randomly chosen to participate in a discrete choice experiment on their hiring decisions. In this experiment, recruiters are asked to choose between two hypothetical job applicants-all of whom are graduates of German upper secondary vocational training programs, with five years of professional work experience-in seven rounds of choosing. We frame the experiment as two applicants having already passed the initial stage of selection, based on their cover letters and CVs, and having been invited to participate in a job interview and a trial work day, after which the respondent has to choose to hire one or the other. This recruitment procedure gives the recruiter the opportunity to select according to the specific applicant characteristics that we include in our discrete choice experiment: (1) professional competence; (2) the Big Five personality traits, i.e., openness, conscientiousness, extraversion, agreeableness, and emotional stability; and (3) the wage that the applicant asks for.

To model personality traits within our experiment, we use attributes values that are validated in large-scale surveys such as the German

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https://doi.org/10.1016/j.labeco.2022.102186

Received 19 October 2020; Received in revised form 18 May 2022; Accepted 20 May 2022 Available online 21 May 2022 0927-5371/© 2022 Published by Elsevier B.V. Socio-Economic Panel (GSOEP).¹ To obtain measures of job tasks that are relevant to each firm, we (a) relate both the survey question on job tasks and the discrete choice experiment to a reference occupation for which the firm actually recruits and (b) ask about the tasks performed by the firm's latest new hire in this occupation. We distinguish among five different tasks: analytical, interactive, routine, non-routine, and interactive job tasks (Gerhards et al., 2014; Rohrbach-Schmidt and Hall, 2013). To analyze recruiters' preference heterogeneity relative to the applicants' personality traits, we interact these traits with the job tasks that have to be performed in the reference occupation—which, while given for each recruiter, varies between recruiters. In total, our data covers 130 different occupations.

The strength of our empirical approach is twofold: First, by implementing a discrete choice experiment, we do not depend on observed matching outcomes, in which employers' and employees' choices are determined simultaneously (Eriksson and Kristensen, 2014). The discrete choice experiment provides an experimental setting that is preferable to using observed outcomes because (1) all available choice options are observed, including the options that recruiters do not chose, and (2) job attributes vary exogenously. Each recruiter faces seven sets of applicants to choose between. Therefore, in our economic approach, we model a recruiter's choices as dependent observations and allow the preference parameters to differ among recruiters.

Second, because the firms participating in our discrete choice experiment are a random subset of representative firms drawn from a national register for survey purposes, our results have a high degree of external validity (Hainmueller et al., 2015). This register from the Federal Employment Agency contains all German firms with at least one employee. We further strengthen external validity by collecting detailed information about the respondent's role in the recruitment process. To ensure a strong overlap between the firms' actual recruitment process and our experiment, we only included respondents with recruitment power, i.e., actual recruiters.

We find that all Big Five personality traits affect a job applicant's probability of being hired. While conscientiousness and agreeableness have the strongest positive effects, openness to experience and emotional stability are also important. Although extraversion and aboveaverage professional competencies are also relevant, they are less important for being selected than the other four personality traits. Furthermore, we find that the relevance of the various personality traits differs strongly between the job tasks for which the firm recruits: for analytical tasks, recruiters prefer open and conscientious applicants, whereas for interactive tasks they favor open, extraverted, and agreeable applicants.

Our paper contributes to two different strands of the economics literature. First, we complement the literature on personality traits, in which various studies show that personality traits are important for individual labor market outcomes such as employability, job performance, and wages (e.g., Borghans et al., 2008b; Heineck and Anger, 2010; Almlund et al., 2011). Moreover, research shows that personality traits are important for recruiters' hiring choices (Dunn et al., 1995; Moy and Lam, 2004; Hoeschler and Backes-Gellner, 2018). However, no evidence yet exists on the heterogeneity of recruiters' hiring preferences relative to an applicant's Big Five personality traits and job tasks. We contribute to this literature by analyzing the relationship between the applicant's Big Five personality traits and the job tasks for which recruiters' hire new workers.

Second, we add to the literature on job tasks, in which Autor et al. (2003) and subsequent empirical studies (e.g., Spitz-Oener, 2006; Black and Spitz-Oener, 2010; Autor and Handel, 2013) highlight the importance of tasks in determining the employability and wages of workers. In this literature, studies on the selection of workers into job tasks find that possessing social skills is associated with a higher probability of performing interactive tasks (e.g., Borghans et al., 2008a; Weinberger, 2014). However, these studies cover only a limited number of personality traits and job tasks. Moreover, as they observe labor market outcomes based on decisions made by both the employee and the employer, they cannot disentangle the role of the employer. We contribute to the literature on job tasks and personality traits by analyzing the heterogeneity of recruiters' hiring preferences and including the full range of Big Five personality traits and job tasks.

The paper is structured as follows. Section 2 discusses the literature on recruiters' hiring preferences, the link between the Big Five personality traits and job performance, and the assessment of Big Five personality traits within the recruitment process. Section 3 describes the methodology of our experiment, the underlying data, the measurement of both job tasks and the attributes of the hypothetical job applicants, and the descriptive statistics of our working sample. Section 4 discusses our empirical model, and Section 5 presents the estimation results, including the robustness analyses. Section 6 concludes and discusses implications for policymakers.

2. Literature

2.1. What do we know about recruiters' hiring preferences?

While the economic literature on the relationship between personality traits and labor market outcomes shows that personality traits are important determinants for individuals' occupation and career choices (Jackson, 2006; Caliendo et al., 2014; Wells et al., 2016), these traits may also be relevant for the hiring decisions of firms. Several studies have investigated the relevance of personality traits for recruiters' hiring choices. Dunn et al. (1995), who analyze the preferences of US managers for workers' Big Five personality traits and general mental ability, show that conscientiousness and general mental ability are the most important qualities for being hired.

Hoeschler and Backes-Gellner (2018) investigate the influence of the Big Five personality traits of vocational education and training apprentices—as well as their grit, economic preferences (i.e., risk aversion and time preferences), grades, and intelligence—on firms' job offers for them at the end of the training. They find that the apprentices' Big Five personality traits are the most important predictors for receiving a job offer from their apprenticeship training firm. Moy and Lam (2004) explore employers' hiring preferences in Hong Kong by studying both the Big Five personality traits and practical skills. They show that conscientiousness is the most dominant attribute in hiring decisions, followed by communication skills, openness to new experiences, academic performance, and agreeableness.

Among the studies that analyze recruiters' hiring preferences, some build on discrete choice experiments. Humburg and van der Velden (2015), who study the recruitment of Dutch university graduates, distinguish between interview selection and hiring. They find that, for the initial interview selection, although employers focus on elements appearing in CVs (e.g., degree, field of study, grades, work experience, and study abroad), the hiring decision then depends on observable professional and social skills (e.g., general academic, creative, interpersonal, commercial, and entrepreneurial skills). Other discrete choice experimental studies have analyzed the importance of applicants' educational background (Teijeiro et al., 2013; Di Stasio, 2014; Di Stasio and van de Werfhorst, 2016), study abroad (Petzold, 2017), or being a Spanish immigrant as opposed to a descendant of Spanish immigrants (Protsch and Solga, 2017) in firms' hiring processes. Other such studies focus on specific sectors, such as health institutions or high-tech firms (Biesma et al., 2007; Frosch et al., 2015).

Autor et al. (2003) and later empirical studies (e.g., Spitz-Oener, 2006; Black and Spitz-Oener, 2010; Autor and Handel, 2013) highlight the importance of tasks in determining the productivity of a

¹ For example, to measure agreeableness, we use the description "seems to be somewhat cold and rude to others" for one applicant and "seems to be considerate and kind to others" for the other. This contrast clearly allows the recruiter to determine which of the two is the more agreeable applicant.

worker. Some studies have shown the importance of social skills for a worker's performance in interactive tasks (e.g., Mount et al., 1998; Borghans et al., 2008a; Weinberger, 2014; Deming, 2017; Deming and Kahn, 2018; Piopiunik et al., 2020). However, no study has yet focused on which tasks require specific Big Five personality traits.

2.2. How are the Big Five personality traits linked to performance in specific job tasks?

Various studies show that both cognitive skills and personality traits affect a worker's job performance (e.g., Borghans et al., 2008b; Weinberger, 2014; Deming and Kahn, 2018). Borghans et al. (2008b) argue that while cognitive ability predicts performance across all job tasks, personality traits explain performance in specific tasks. They define personality traits as "patterns of thought, feelings, and behavior" (p. 974) and summarize favorable behaviors applied in specific job tasks as personality skills that increase individual job task performance. This explains why recruiters assess applicants on both cognitive skills and personality traits, where the relative importance of specific traits differs between tasks.

Openness to experience is "the degree to which a person needs intellectual stimulation, change, and variety" (Hogan and Hogan, 2007, p. 9). Open employees are considered broad-minded, imaginative, curious, cultured, and intelligent (Costa and McCrae, 1992), and openness is found to be positively related to performance in jobs dealing with innovation and creativity (Judge and Zapata, 2015). Moreover, open employees have high training proficiency relative to high learning motivation, have positive expectations of educational programs, take responsibility for their own learning progress, and enjoy discussing training content with classmates (Barrick and Mount, 1991; Salgado, 1997).

Conscientiousness is the "degree to which a person is willing to comply with conventional rules, norms, and standards" (Hogan and Hogan, 2007, p. 9), and conscientious employees are characterized as hardworking, thorough, responsible, organized, persevering, and achievement oriented (Costa and McCrae, 1992). Conscientiousness is related to job performance independent of the employee's occupation (Barrick and Mount, 1991; Salgado, 1997).

Extraversion is the "degree to which a person needs attention and social interaction" (Hogan and Hogan, 2007, p. 9), with extroverted employees defined as social, assertive, active, bold, energetic, and adventurous (Costa and McCrae, 1992). Extraversion predicts job performance in sociable and interactive occupations, such as management and sales (Barrick and Mount, 1991). This finding is linked not only to the sociable, gregarious, talkative, and assertive competencies of extroverted employees (Barrick and Mount, 1991) but also to the wish to excel and surpass others, to strive for status, and to obtain rewards (Barrick et al., 2002).

Agreeableness is the "degree to which a person needs pleasant and harmonious relations with others" (Hogan and Hogan, 2007, p. 9), and agreeable employees are cooperative, kind, trusting, and sympathetic (Costa and McCrae, 1992). Studies reveal that more agreeable employees show higher job performance, especially in collaborative and interactive working environments (Mount et al., 1998). Agreeable employees aim at establishing positive and satisfying social relationships with others (Barrick et al., 2002). Although they tend to avoid conflict, when conflicts at work occur, agreeable employees respond with less negativity and tend to use more constructive conflict resolution strategies (Graziano et al., 1996; Judge and Zapata, 2015).

Neuroticism—in contrast to its opposite, emotional stability—is the "degree to which a person experiences the world as threatening and beyond his/her control" (Hogan and Hogan, 2007, p. 9). People who are high in neuroticism or low in emotional stability are anxious, depressed, hostile, impulsive, and vulnerable (Costa and McCrae, 1992). Studies find that emotional stability is important for job performance across occupations (Salgado, 1997; Hogan and Holland, 2003), particularly in job tasks involving social interaction (Mount et al., 1998; Judge and Zapata, 2015). Emotionally stable employees are less likely to perceive stressful work environments as threats, less sensitive to others' (possibly negative) emotions, and better able to control their emotions. This more balanced mentality of emotionally stable individuals decreases the like-lihood of their overreacting in challenging work situations (Judge and Zapata, 2015).

2.3. How can Big Five personality traits be assessed in the recruitment process?

As the Big Five personality traits enable specific skills and are important for job performance, recruiters base their hiring decisions on evaluations of the applicants' personality when such information is available (e.g., Dunn et al., 1995; Moy and Lam, 2004; Hoeschler and Backes-Gellner, 2018). This recruiter behavior raises the question of whether one can assess the Big Five personality traits within the recruitment process?

Caldwell and Burger (1998) argue that, even without formal assessment, recruiters can derive this information from the cover letter and CV (Bretz et al., 1993; Brown and Campion, 1994) or a job interview (Funder and West, 1993). Personality assessments are conducted intuitively (Newman and Uleman, 1989), even without the recruiter's awareness (Uleman, 1987). Yet, given the importance of the applicant's personality for future job performance, it is likely that recruiters are both eager and able to draw initial conclusions about the applicant's personality from the cover letter, the CV, the job interview, or a combination of them.

Therefore, to increase the chances of being hired, the applicant has a strong incentive to give a good impression and hide a possibly disadvantageous personality. Caldwell and Burger (1998) argue that hiding such traits is very difficult. For example, because the extraverted applicant is likely to be more talkative than an introverted one, assessing the Big Five personality trait of extraversion in a job interview is relatively easy (Funder and Dobroth, 1987; Funder and Colvin, 1988; John and Robins, 1993). Nevertheless, given the applicants' incentive to hide negative personality traits, a precise assessment of all Big Five personality traits likely calls for a longer period for the recruiter to observe the applicant (Funder and Colvin, 1988; Paulhus and Bruce, 1992). Therefore, personality traits and related job performance are often tested in an assessment center or during a trial work day (Spector et al., 2000; Scroggins et al., 2009).

3. Methodology and data

3.1. Discrete choice experiment

Assessing causal relationships in firms' recruitment decisions with standard surveys is challenging for the following two reasons. First, the attributes of both the chosen applicant and the rejected competitors are typically not observed simultaneously. Second, because applicants' attributes are not exogenous, creating data that allows for identification strategies suited for causal inference is difficult (Eriksson and Kristensen, 2014). In our study, we use a discrete choice experiment, which is preferable to using survey questions, because we can observe both the chosen as well as rejected applicants and the applicants' attributes vary exogenously.

Hainmueller et al. (2015) show that experimentally elicited stated preferences are close to revealed preferences if respondents are highly committed to the decisions that they have to make. To meet this condition, we limit our working sample to firm owners, CEOs, and heads of HR departments, all of whom are involved in the recruitment process and are therefore familiar with making hiring decisions.

We develop the randomized discrete choice experiment among a sample of firms' recruiters who hire skilled workers. Doing so allows us to randomly vary the attributes of all the job applicants. In our experiment, the recruiters have to choose between two hypothetical job Following is a question on the recruitment of skilled workers. Please imagine this situation, regardless of whether your firm is currently looking for professionals or not:

Your firm has an urgent need to fill a full-time position in the profession (Prog.: Show selected profession). After you review the application documents, only two people remain for you to choose from, and you will definitely hire one of them.

- Both are 28 years old, with German as their mother tongue.
- Both have a good vocational training diploma and five years of relevant professional experience in the firm where they
 did their apprenticeship training.
- All other unspecified decision criteria for recruitment—e.g., gender or additional qualifications—are the same for both applicants.

Based on the personal interview and a trial work day, you have received an impression of their professional competencies, as well as their personalities. This information is presented below. Please indicate if you would hire skilled worker 1 or 2.

Please enter the appropriate number 1 or 2 and then click Return.

1: Profile Job Applicant 1	2: Profile Job Applicant 2
has average professional competence	has above-average professional competence
shows active imagination and solves tasks in an original way	shows little imagination and solves tasks in a conventional way
completes tasks thoroughly and efficiently	completes tasks carelessly and in a disorganized way
seems to be reserved and quiet when dealing with others	seems to be communicative and sociable when dealing with others
seems to be considerate and kind to others	seems to be sometimes somewhat rude to others
seems to be tense and nervous	seems to be relaxed and handles stress well
receives a wage that equals the firm's average skilled labor wage	receives a wage that is 5% above the firm's average skilled labor wage

Fig. 1. Example of the discrete choice experiment on recruiting decisions.

applicants—who graduated from German upper secondary vocational training programs and have five years of work experience—in seven choice sets, and make a critical decision. All job applicants are described by seven attributes, including professional competence, the Big Five personality traits, and the wage level they request. While the order of the choice sets randomly varies for each respondent, the order of the attributes (i.e., characteristics of the hypothetical applicant) remains fixed, thereby decreasing the cognitive burden on the respondent.

Following Humburg and van der Velden (2015), we design the discrete choice experiment within a two-staged selection process. The attribute values of the applicants are based on the findings in both the first stage (i.e., cover letter and CV) and the second stage (i.e., interview and trial work day) of the recruitment process. Our experiment takes place at the end of the second stage of the hiring process, when the recruiter has to make a final decision about the two remaining applicants.² The recruiters' choices allow us to assess their preferences for applicants' attributes, including professional competence, personality traits, and the applicants' preferred wage level. Fig. 1 provides an example of the choice set-up that the respondent sees on the screen during the interview.

As in other discrete choice experiments, we do not assign all possible choice sets to the respondents. Instead, we present a subset of choice

sets by maximizing the D -efficiency of the design. The corresponding Stata command is programmed by Hole (2015). In our design, we allow for all combinations of applicants' attribute values, because all combinations might occur in real life. For example, a less conscientious applicant might be able to compensate for this deficit through high cognitive ability or openness, thereby showing above-average competence.

3.2. Data source

We included the discrete choice experiment in the BIBB-CBS 2017/2018 survey (Schönfeld et al., 2020; Pfeifer et al., 2021). In the BIBB-CBS, a total of 4045 firms were surveyed. Of these firms in the full sample, we have randomly assigned 1,336 to our discrete choice experiment.

At the beginning of the questionnaire, the respondents report the occupations for which their firm recruits new hires. The respondents can here report up to six occupations that they most extensively recruit for. If the firm recruits for only one occupation, this occupation is the reference occupation for this firm throughout the survey (this refers to 501 firms). If the firm recruits for multiple occupations, a simple algorithm in the CAPI (computer assisted personal interview) questionnaire randomly chooses the reference occupation.³ This occupation is then the reference occupation for (a) all survey questions on recruitment and (b) the discrete choice experiment for this firm. Thus, while the reference occupation is given for each recruiter, it varies between recruiters.⁴

² As our experiment focuses on the final decision about the two remaining applicants in the recruitment process, we are only interested in understanding the relative difference in recruiters' hiring preferences across applicant attributes and attribute values. We therefore do not include a "neither candidate" option in the design of our discrete choice experiment, which increases the statistical power of our analysis.

³ The distribution of randomly chosen occupations out of the lists of reported occupations shows that the randomly chosen occupations are almost equally distributed among the listed occupations (see Supplementary Material Table S.1).



Fig. 2. From full BIBB-CBS to working sample.

Shortly before the choice experiment, the respondent is asked whether the firm has recently hired workers in the reference occupation (i.e., after 2014) and, if yes, which job tasks this most recently hired skilled worker performs. If the firm did not recently hire any skilled workers for this occupation, we collect no information on job tasks for that firm and therefore do not include it in our analyses. This step reduces our sample to 922 firms. In our experiment, the reference occupations vary among firms. However, for each recruiter we use (the job tasks of) the most recently hired skilled worker in the reference occupation. By choosing a reference occupation for which the firm actually recruits, we ensure that the setting is highly relevant for the respondent.

Next, we identify the firm respondents with decision-making power for recruitment by asking (in the survey) for the respondents' recruitment role: "Please indicate the extent to which you participate in the decision-making and whether and, if so, which skilled workers are recruited." The answer categories were "I decide on my own," "I decide together with others," "I support or advise the decision-makers," "I am not involved in the decision," "declined to answer," and "don't know." For our analysis, we use information only from those respondents with direct participation in the recruitment decision, i.e., recruiters who decided either independently or together with others.⁵ This choice leaves us with 674 actual recruiters, 634 of whom participated in the choice experiment. Fig. 2 provides an overview of the data collection process by depicting the steps leading from the full BIBB-CBS 2017/2018 sample to our working sample.

3.3. Measurement of job tasks and job applicants' attributes

This subsection describes the measurement of the job tasks and the applicants' attributes that we included in the discrete choice experiment.

3.3.1. Job tasks

The BIBB-CBS survey includes the measurement of four different job tasks, all previously validated and used by the BIBB/BAuA Employment Survey (Rohrbach-Schmidt and Hall, 2013) and the BIBB Qualification Panel (Gerhards et al., 2014): analytical, interactive, routine, and nonroutine tasks. We embed the question on the tasks in a BIBB-CBS survey module that specifically asks about the last recruited skilled worker in the reference occupation. We focus on the last recruited skilled worker because doing so improves the quality of the response for the following two reasons: (1) minimization of time distance between the actual recruitment and the survey response, and (2) reference to a concrete person for respondent answering the questions. Respondents answer the following question: "How often does it occur in a work situation that the most recently hired skilled worker in the occupation [name selected occupation]

- has to face new challenges that require intense up-front thinking? (analytical tasks)
- has to convince others or negotiate compromises with customers and colleagues? (interactive tasks)
- has to repeat work steps that are characterized by the same exact procedure? (routine tasks)
- has to react to and solve problems?" (non-routine tasks)

The answer categories for the four tasks vary from 1 (never) to 5 (often). Answer categories 6 and 7 are "no answer" and "don't know," respectively. In this way, we obtain a valid indicator for the task structure in a specific occupation, an indicator highly valuable for the firm the respondent represents. We then interact this task structure with the personality traits included in the discrete choice experiment, as described in Table 1.

3.3.2. Job applicants' attributes

As Table 1 shows, the job applicants described in our experiment differ in the following attributes: professional competence, Big Five personality traits, and gross wage that the applicants request relative to the average wage of skilled workers in the firms.

Because of the initial selection in the first stage (cover letter and CV), applicants who enter the second stage of the hiring process (job interview and trial work day) usually have either average or above-average

⁴ In total, we cover 130 different occupations of skilled workers. The most important occupations are office or secretarial staff (56 recruiters), vehicle technicians (36 recruiters), and sales staff (30 recruiters).

 $^{^{5}}$ When we also include the respondents who only supported or advised the decision-makers (N = 768) in our analysis, the estimation results are similar to our main results (see Supplementary Material Table S.2).

Table 1

Overview of applicants	' attributes	and values in	1 the	discrete	choice experiment.
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Attribute	Attri	bute Values
	The a	applicant
Competence	1)	has average professional competence
	2)	has above-average professional competence
Openness	1)	shows little imagination and solves tasks in a conventional way
	2)	shows active imagination and solves tasks in an original way
Conscientiousness	1)	completes tasks carelessly and in a disorganized way
	2)	completes tasks thoroughly and efficiently
Extraversion	1)	seems to be reserved and quiet when dealing with others
	2)	seems to be communicative and sociable when dealing with others
Agreeableness	1)	seems to be cold and sometimes somewhat rude to others
	2)	seems to be considerate and kind to others
Emotional Stability	1)	seems to be tense and nervous
	2)	seems to be relaxed and handles stress well
Gross Wage	1)	receives a wage that is 15% above the firm's average skilled labor wage
	2)	receives a wage that is 10% above the firm's average skilled labor wage
	3)	receives a wage that is 5% above the firm's average skilled labor wage
	4)	receives a wage that equals the firm's average skilled labor wage
	5)	receives a wage that is 5% below the firm's average skilled labor wage
	6)	receives a wage that is 10% below the firm's average skilled labor wage
	7)	receives a wage that is 15% below the firm's average skilled labor wage

professional competencies. In our discrete choice experiment, the attribute values of applicants' competencies are therefore either average or above average.

The well-known Big Five personality traits are openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability. Instead of directly mentioning those personality traits, our experiment uses item values—validated and used in various surveys—to describe each specific trait. In those surveys, the item "agreeableness," for example, is measured by the item values "I see myself as someone who is sometimes somewhat rude to others" and "I see myself as someone who is considerate and kind to others" (Richter et al., 2013, p. 45). We draw on the adjectives used in these item values to describe the hypothetical applicants in our discrete choice experiment. For example, to measure agreeableness, we use the description "(the applicant) seems to be cold and sometimes somewhat rude to others" or "(the applicant) seems to be considerate and kind to others."

We mainly draw on the items used in the German Socio-Economic Panel (GSOEP) (Richter et al., 2013, p. 44–46), complemented by the Big Five Inventory (BFI) (John et al., 1991) and the Ten-Item Personality Inventory (TIPI) (Gosling et al., 2003). For each personality trait, we include two opposing attribute values, each described by two adjectives. To adhere as closely as possible to the items in these surveys, we do not include a third middle or average category for the Big Five attribute values, and we frame the attributes as follows (with the survey source of the item values in brackets):

Openness to experience:

- 1) ... shows little imagination (BFI, GSOEP [reverse]) and solves tasks in a conventional way (TIPI).
- 2) ... shows active imagination (BFI, GSOEP) and solves tasks in an original way (BFI, GSOEP).

Conscientiousness:

- 1) ... completes tasks carelessly (BFI) and in a disorganized way (BFI).
- 2) ... completes tasks thoroughly (BFI, GSOEP) and efficiently (BFI, GSOEP).

Extraversion:

- 1) ... seems to be reserved (BFI, GSOEP) and quiet (BFI) when dealing with others.
- 2) ... seems to be communicative (GSOEP) and sociable (BFI, GSOEP) when dealing with others.
 - Agreeableness:

- 1) ... seems to be cold (BFI) and sometimes somewhat rude to others (GSOEP, BFI).
- 2) ... seems to be considerate (SOEP, BFI) and kind to others (GSOEP, BFI).

Emotional Stability:

- 1) ... seems to be tense (BFI) and nervous (GSOEP, BFI).
- 2) ... seems to be relaxed (GSOEP, BFI) and handles stress well (GSOEP, BFI).

For the wage level the applicant asks for, we distinguish between a gross wage equal to the firm's average gross wage for skilled workers in the occupation and a wage that deviates from the average gross wage by -15%, -10%, -5%, +5%, +10%, or +15%. As wages in various occupations vary widely, we use deviations from the average wage instead of monetary values.

3.4. Descriptive statistics

Among the 634 recruiters in our working sample, 541 respondents made all seven choices (85%), 24 made six, 21 made five, 14 made four, 18 made three, nine made two, and seven made only one, leaving us with data on 8,342 worker profiles from 4,171 recruitment decisions made by 634 respondents. Table A1 provides an overview of the proportional frequencies of the attribute values in the 8,342 worker profiles and the 4,171 attribute choices made by the recruiters.

As we fully randomize the order of the seven choice sets, the missing choices should not systematically affect our results. However, to test whether estimation results change when we reduce the sample to recruiters without any missing choices, we estimate our main regressions in Sections 5.1 and 5.2 for a sample of the 541 recruiters who answered all seven choice sets. Moreover, we estimated our main regressions when controlling for the order of the choice sets. In both tests, the estimation results remain largely robust.⁶

⁶ For the sample of 541 recruiters, Supplementary Material Table S.3 shows that the estimation results are very similar. Although the significance of the interaction effects slightly decreases, the interaction effect between openness and analytical tasks is weakly significant at 5.6%, and the interaction effect between extraversion and interactive tasks is weakly significant at 7.6%. The interaction effect between openness and interactive tasks becomes insignificant. These differences in significance are most likely related to the reduced number of observations. Moreover, Supplementary Material Table S.4 shows that our estimation results remain highly robust when we control for the order of the choice sets.

Table A2 gives an overview of the sample characteristics. The table shows that non-routine tasks are the most frequent, followed by analytic, routine, and interactive ones, respectively. However, the difference in the relevance of the different tasks is not very large. The table further shows that 62% of the recruiters are male and that 46% of them have a tertiary academic degree. The average firm tenure of the recruiters is 14 years, 41% of the respondents are firm owners, and 7% work in the public sector. Moreover, 74% of the firms provide vocational apprenticeship training. The average firm size in our working sample is 79 workers, and the average skilled worker's gross wage is 2,670 Euros per month.

To reveal any potential differences between our working sample and the full BIBB-CBS sample, Table A2 also provides a *t*-test comparing the means of the job tasks and recruiters' and firm characteristics in both samples. The table shows that the composition of the job tasks is similar in both samples. Moreover, no significant differences appear in terms of respondents with a tertiary academic degree, the wage level, or the proportion of vocational training providers.

However, in comparison to the BIBB-CBS, our working sample consists of slightly more males, firm owners, respondents with shorter job tenure (about nine months on average), firms in the private sector, and smaller firms. Some of these differences are likely related to the selection of respondents who have had decision-making power for recent recruitment. To handle differences in the recruiter and firm characteristics, we provide robustness analyses that control for recruiter and firm effects in Section 5.3.

4. Econometric model

Our econometric strategy for the analysis in this paper is based on Revelt and Train's (1998) approach, which has been used in several studies analyzing data from discrete choice experiments (e.g., Eriksson and Kristensen, 2014 and Humburg and van der Velden, 2015). We model the choices made by the recruiters in our experiment within a utility maximization framework and use a mixed logit model to obtain our estimates (see Greene, 2003 and Hensher and Greene, 2003 for details on this estimation method). In this framework, the respondents (n = 1, ..., N) choose among J options in each of T choice sets. The utility a recruiter n obtains from choosing job applicant j in choice set t is

 $\mathbf{U}_{\mathrm{njt}} = \beta_{\mathrm{n}} \mathbf{X}_{\mathrm{jt}} + \boldsymbol{\varepsilon}_{\mathrm{njt}},$

where β_n is a parameter vector and X_{jt} is a vector of the observed attributes of the job applicants, i.e., competence level, the Big Five personality traits, and wage. ϵ_{njt} is an unobserved error term that is independent and identically distributed (IID) (McFadden, 1973) over respondents *N*, job applicants *J*, and choice sets *T*.

Given the design of our experiment, with the choice between two applicants, the probability that choice j = 1 is: $\operatorname{Prob}(U_{n1t} > U_{n2t})$. Using the simulated maximum likelihood method to maximize probability, we estimate the parameter vector β_n .

Compared to an ordinary conditional logit model, which is an alternative method for analyzing discrete choice data (McFadden, 1973), the mixed logit model does not assume that β is the same for all respondents. Instead, it allows the respondents' preferences for attribute values to vary.⁷ The parameter vector β_n can be rewritten as $\beta_n = b + \eta_n$, where η_n denotes the respondent's deviation from the population mean (Revelt and Train, 1998). This means that the mixed logit model explicitly considers (a) the distribution of preference weights across the sample and (b) the differences in preferences among respondents by modeling the parameters of that distribution for each attribute value. Because the choice sets *T* are randomly assigned to respondents' *n*, we can rule out potential correlations between unobserved preferences of respondents and the applicant attributes in our choice experiment.

As we are interested not only in the mean preferences for applicant attributes (i.e., in the coefficients βn) but also in the differences of these preferences across job tasks (*k*), we extend the utility model by including k to interact with the applicant attributes X_{jt} , providing us with the additional parameter vector γ :

$$U_{njt} = \beta_n X_{jt} + \gamma_n X_{jt} * k_n + \varepsilon_{njt}$$

The respective coefficients of the interaction terms reflect the respondents' heterogeneity in personality preferences for the different job tasks, as reported for the last hired worker in the firm. We calculate 300 Halton draws to approximate the log-likelihood function (Lancsar et al., 2017).

5. Results

5.1. Preferences for applicants' competence and personality

Table A3 in the Appendix shows the coefficients of the discrete choice experiment based on conditional and mixed logit regression models. As the job applicants in the experiment vary only in their attributes of competence, personality, and requested wage, and are assumed identical in all other characteristics, we have to interpret the coefficients in relation to the coefficients of the other attributes. The estimation results show that above-average professional competence and all five personality traits positively influence the probability of the job applicants being hired. However, Column 3 shows that the standard deviations of the coefficients for professional competence and most personality traits are significant, indicating that recruiters' preferences for these personal attributes are heterogeneous. This makes the mixed logit model the preferred model for analyzing our data (see Cameron and Trivedi, 2010). We therefore here focus on discussing the mixed logit results.

Fig. 3 shows the marginal effects for having professional competence and personality traits. The six marginal effects of having higher competence or stronger traits are all significantly different from the reference category, i.e., an applicant who is more extraverted, for example, has a significantly higher probability of being hired compared to an applicant who is less extraverted. By performing t-tests to analyze the significance of differences between attribute coefficients, we find three pairs of attributes that significantly differ in their relative importance for recruiters. First, recruiters' hiring preferences are the lowest for more extraverted applicants, significantly increasing the probability of being hired by only two percentage points. Similarly, the preference for an above-average competence level, compared to an average one, is significant, but low (about four percentage points). The marginal effects for being more extraverted and having above-average competence do not significantly differ from each other.

Second, recruiters' hiring preferences are strongest for agreeable and conscientious applicants. These personality traits significantly increase the probability of being hired by about 19 percentage points. The marginal effects for agreeableness and conscientiousness significantly differ from the marginal effects for extraversion and having aboveaverage competence, but do not significantly differ from each other. Third, higher emotional stability and openness to experience increase recruiters' hiring preferences by nine and seven percentage points, respectively. These medium-sized marginal effects do not significantly differ from each other, but are significantly higher compared to the lowest group, i.e., extraversion and above-average professional competence, and significantly lower compared to the highest group, i.e., agreeableness and conscientiousness.

In terms of predicted probabilities within the experiment setting (i.e., all other characteristics being the same), an applicant who is less agreeable, for example, has a 37% probability of being hired, while one who is more agreeable has a 56% probability.⁸ These findings show that our

⁷ This also relaxes the Independence of Irrelevant Alternatives" (IIA) assumption (see e.g., Layton, 2000). We further discuss this and related issues in Section 5.3.



Fig. 3. Marginal effects: competence and personality. Note: The marginal effects are based on the mixed logit model specification presented in Table A3. Source: BIBB-CBS 2017/2018, authors' calculations.

results are economically meaningful, meaning that differences in applicants' personality traits play an important role in the individual hiring probability.

This result is in line with those of related studies finding that conscientiousness in particular is an important hiring signal for managers (Dunn et al., 1995; Moy and Lam, 2004; Hoeschler and Backes-Gellner, 2018), followed by agreeableness, openness to experience, and emotional stability, whereas extraversion is less important (Hoeschler and Backes-Gellner, 2018).

The very low preference for above-average professional competencies, compared to average ones, is in line with the findings of Humburg and van der Velden (2015), who showed that recruiters generally tend to avoid applicants with below-average professional competencies while not having a particular preference for those with aboveaverage ones.

For wage attributes included as wage request dummies, Appendix Table A3 suggests that recruiters prefer the average wage, and that wage requests either above or below it are significantly less preferred. While this result is partly in line with that of Humburg and van der Velden (2015), this preference for the average wage is even more pronounced in our analysis. One reason for the higher preference for average wages over lower ones is that collective agreements (common for skilled workers in Germany) keep the firm from paying lower than the bargained wages.

5.2. Heterogeneity in personality preferences by job tasks

Table A4 in the Appendix shows the interaction effect between applicants' professional competence and personality traits and the analytical, interactive, routine, and non-routine job tasks required in the jobs for which the respondent recruits. Column 1 shows that, for analytical tasks, recruiters prefer applicants with high conscientiousness and openness to experience. For tasks that focus on the interaction with colleagues and customers (Column 2), recruiters prefer applicants with high extraversion, agreeableness, and openness to experience. For routine and non-routine tasks (Columns 3 and 4), we find neither stronger nor weaker preference for professional competence or any of the Big Five personality traits.

Fig. 4 depicts the predicted hiring probabilities for job applicants with different personality types relative to different tasks for which the recruiters are hiring. Fig. 4(a) shows that, when the intensity of analytical job tasks is higher (within the setting of the experiment), the probability of being hired increases from 44% to 52% for more open applicants. For more conscientious applicants, the hiring probability even increases from 49% to 58% with higher analytical job task intensity. Fig. 4(b) shows that, when the intensity of interactive job tasks is higher (within the setting of the experiment), the probability of being hired increases from 46% to 51% for more open applicants, from 44% to 48% for more extraverted applicants, and from 51% to 62% for more agreeable applicants. This finding is in line with that of Mount et al. (1998), who found that agreeableness is particularly positively related to performance in jobs involving interpersonal interactions. For routine and non-routine job tasks, Figs. 4(c) and (d) show no significant change in the hiring probabilities with increasing task intensity.

5.3. Robustness of results

Despite the experimental design of the recruitment decisions made by the respondents, we need to deal with concerns about potentially bi-

⁸ The predicted hiring probabilities for the remaining personality trait attributes and professional competence are as follows: 36% for less conscientious applicants versus 54% for more conscientious applicants, 41% versus 49% for less/more emotionally stable applicants, 42% versus 49% for less/more open applicants, 44% versus 46% for less/more extraverted applicants, and 43% versus 46% for average/above-average competent applicants.



Fig. 4. Interaction effect between personality traits and tasks

Note: The predicted probabilities are based on the mixed logit model specification presented in Table A4. The significant interaction terms are marked in black; the insignificant ones, in gray.

Source: BIBB-CBS 2017/2018, authors' calculations.

ased results from the mixed logit regression models, which do not consider possible recruiter or firm-specific effects. We therefore provide estimates from the following set of alternative model specifications. First, we extend our mixed logit model by including additional interaction terms between the applicants' attributes and observable recruiter and firm characteristics to control for recruiter- and firm-specific effects. Regarding recruiters' characteristics, we include the respondents' gender (male/female), function in the firm (owner/non-owner), job tenure (above/below median), and qualification (tertiary academic degree/ no tertiary academic degree). With respect to firm characteristics, we include the average skilled worker wage (above/below median), training apprentices (yes/no), economic sector (public/private), and firm size (small/large). Second, we estimate linear probability and logit models that include recruiter/firm fixed effects. To reduce complexity and to compare the effect sizes across the different model specifications, we graphically display the (average) marginal effects of the main attributes and interaction terms from the previous subsections.

5.3.1. Robustness of preferences for applicants' competence and personality

Fig. 5 shows the marginal effects of the basic model discussed in Section 5.1 and the three additional model specifications. The figure shows that the marginal effects of the personality traits for being hired slightly increase when we control for recruiter and firm characteristics in the mixed logit model. However, professional competence—one of the attributes with the lowest relative importance for recruiters—further decreases in size and becomes insignificant (see Supplementary Material Table S.5, Column 1). In both the linear probability model and the logit

model with recruiter/firm fixed effects, the marginal effects for being hired of above-average competence as well as the five personality traits are larger than in the basic model (see also Supplementary Material Tables S.6 and S.7, Columns 1).

5.3.2. Robustness of heterogeneity in personality preferences by job tasks

In a similar way, we did robustness analyses of the estimate on the heterogeneity of recruiters' hiring preferences across job tasks, as discussed in Section 5.2. Fig. 6 compares the average marginal effects of the four models for the significant interactions between personal attributes and analytical as well as interactive tasks initially shown in the mixed logit model (Fig. 4).⁹

Fig. 6 shows that the sizes of the average marginal effects remain largely robust when we control for recruiter and firm characteristics in the mixed logit model (see also Supplementary Material Table S.5, Columns 2 and 3). Similar to Fig. 5, the average marginal effects for the interactions between openness to experience and analytical tasks and extraversion as well as agreeableness and interactive tasks are larger when we use fixed effects linear probability and logit models.¹⁰ How-

⁹ Tables S.5, S.6, and S.7, S.10, and S.11 in the Supplementary Material show the corresponding coefficients and average marginal effects for the remaining interactions between the personal attributes and job tasks. We do not discuss the results of these estimates in detail because these interactions yield insignificant coefficients in the mixed logit including controls for recruiters and firm characteristics as well as the linear probability and logit models including recruiter/firm fixed effects.

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Mixed Logit

Mixed Logit incl. Recruiter/Firm Controls

- Linear Prob. Model incl. Recruiter/Firm Fixed Effects
- Logit Model incl. Recruiter/Firm Fixed Effects



Mixed Logit incl. Recruiter/Firm Controls

Linear Prob. Model incl. Recruiter/Firm Fixed Effects

Logit Model incl. Recruiter/Firm Fixed Effects

ever, the average marginal effects stay robust in terms of the relative importance of the attributes. 11

It should be noted that the latter two models have the disadvantage that they impose unrealistic assumptions about recruiters' preferences. First, they assume that the error term of the recruiters' utility function is independent and identically distributed (IID), which does not allow for the possibility that the recruiters' unobserved characteristics may correlate across the alternatives in each choice situation and across choice situations (Hensher and Greene 2003). Second, these mod% Fig. 5. Comparison of marginal effects for recruiters' preferences for applicants' competence and personality.

Note: The marginal effects are based on the estimation results presented in Table S.9 in the Supplementary Material. The coefficient for above-average competence is insignificant in the mixed logit model with controls (see Supplementary Material Table S.5, Column 1).

Source: BIBB-CBS 2017/2018, authors' calculations.

Fig. 6. Comparison of average marginal effects for heterogeneity in recruiters' personality preferences by analytical and interactive tasks.

Note: The average marginal effects are based on the specifications presented in Table S.10 in the Supplementary Material. The coefficients for the interactions between analytical tasks and conscientiousness as well as between interactive tasks and openness to experience are insignificant when calculating a linear probability model including recruiter/firm fixed effects (see Supplementary Material Table S.6, Columns 2 and 3).

Source: BIBB-CBS 2017/2018, authors' calculations.

els assume an independence of irrelevant alternatives (IIA), which implies that the joint probability of choosing close substitutes will be overestimated (Layton 2000, pp. 23–24). Given these restrictive properties of linear probability and logit models, we remain with the mixed logit model as our preferred estimation method.¹² Overall Figs. 5 and 6 illustrate that while our main results are quantitatively sensitive, they are qualitatively and in terms of relative importance of the attributes robust across model specifications.

6. Conclusion

The task literature shows that analytical and interactive tasks have gained importance due to technological change, while routine tasks have lost their relevance (Autor et al., 2003). This labor market change raises the question whether it affects the demand for different personality traits in the labor market. In a discrete choice experiment among recruiters, we therefore investigate whether recruiters select applicants with different personality traits for different tasks. If they do, the shifting task structure is likely to (a) result in shifting labor market demands for personality traits and (b) create labor market disadvantages for individuals lacking the specific traits important for firms.

¹⁰ However, in the linear probability model, the interaction effects between conscientiousness and analytical tasks as well as between openness to experience and interactive tasks become insignificant (see also Supplementary Material Table S.6, Columns 2 and 3). This might be due to the linear probability model's assumption of a linear relationship between the dependent and the independent variables. The results of the fixed effects logit model are shown in Supplementary Material Table S.7.

¹¹ To control for over-rejection of the null hypotheses, we also conduct a Romano-Wolf multiple hypothesis correction (Clarke et al., 2020), based on the logit model with recruiter/firm fixed effects. Table S.8 in the Supplementary Material shows that the p-values remain largely robust. However, the p-value of interaction effect between openness and interactive tasks increases to a 12.9% level and therefore becomes insignificant, and the one between extraversion and interactive tasks increases to 9.2% and therefore becomes weakly significant. Given the restrictive properties of linear probability and logit models in comparison to the preferred mixed logit model, we do not think this result is critically challenging our main results.

¹² For a more in-depth discussion on the advantages of mixed logit models over simple logit and conditional logit models, see Layton (2000) and Hensher and Greene (2003).

Our study is the first to experimentally answer this question by covering the full range of Big Five personality traits and job tasks. Hainmueller et al. (2015) state that respondent engagement with the choices to be made is a key factor for the reliability of the results of a discrete choice experiment. By basing our experiment on a representative firm survey in Germany, covering 130 occupations of skilled workers, and using responses of real recruiters, we ensure a high degree of external validity. However, the interpretation of our results in terms of the effects on absolute hiring probabilities builds on the specific setting of the discrete choice experiment.

We find that all Big Five personality traits affect the probability of an applicant's being hired by a firm, with conscientiousness and agreeableness having the strongest positive effects. We also find that the importance of specific personality traits depends on the type of job tasks for which firms recruit new hires: For analytical tasks, recruiters particularly value high conscientiousness and openness to experience; for interactive tasks, they favor applicants with high extraversion, agreeableness, and openness to experience. We show that our results remain largely robust after we control for various recruiter and firm characteristics in different model specifications.

Most likely, recruiters prefer applicants with specific personality traits for specific job tasks because recruiters expect that skilled workers with specific personality traits are most effective in those tasks. While previous studies have found that openness to experience positively affects performance in jobs dealing with innovation and creativity (e.g., Judge and Zapata, 2015), this strand of literature says very little about the relationship of conscientiousness to the performance of analytical tasks. Likewise, while prior studies have linked the performance of interactive tasks with extraversion and agreeableness (e.g., Barrick and Mount, 1991; Mount et al., 1998), none have linked it with openness to experience. Future research needs to build on our novel findings and investigate these overlooked relationships.

In addition, we had initially expected recruiters to also favor certain personality traits, such as high openness to experience, for the performance of non-routine tasks. However, our empirical analysis does not support this expectation, possibly because "non-routine" is too heterogeneous a concept, covering a wide variety of different jobs. Future research should analyze the personality–task matches in this broad task domain more specifically than our data set allowed us to do.

Our analysis has critical implications for both employers and policymakers as our results suggest that individuals lacking the specific personality traits that recruiters value for jobs with analytical and interactive tasks are likely to face increasing labor market disadvantages. Policymakers and firms involved in apprenticeship training need to recognize that fostering particular personality skills both in high school and vocational training is crucial for preparing students for rapidly changing labor market demands.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

None.

Acknowledgments

Comments from Wilbert van der Klaauw, Bart de Koning, Mark Levels, Samuel Mühlemann and two anonymous referees were very much appreciated and helped improve the paper. We wish to thank the participants of the CEDEFOP, EUROFOUND and IZA Conference on Workplace and Management Practices, the Lunch Talk Series on VET and Personnel Economics at the University of Zurich, the IAB Conference on Labour Market Transitions, the Scientific Advisory Board Meeting at BIBB, and the 7th Congress on Research in Vocational Education and Training at the Swiss Federal Institute for Vocational Education and Training (SFIVET) for their valuable comments. We also appreciate the support of Natalie Reid for language consulting.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.labeco.2022.102186.

Appendix

Table A1, A2, A3, A4

Table A1

Proportional frequencies of attribute values in worker profiles and choices made.

Variable Names	Worker Profiles mean	Choices Made mean
Average Competencies	0.50	0.50
Above-average Competencies	0.50	0.50
Less Open to Experience	0.50	0.43
More Open to Experience	0.50	0.57
Less Conscientiousness	0.50	0.30
More Conscientiousness	0.50	0.70
Less Extraversion	0.50	0.47
More Extraversion	0.50	0.53
Less Agreeableness	0.50	0.28
More Agreeableness	0.50	0.72
Less Emotional Stability	0.50	0.43
More Emotional Stability	0.50	0.57
15% Above-average Wage	0.15	0.13
10% Above-average Wage	0.14	0.14
5% Above-average Wage	0.14	0.14
Average Wage	0.14	0.16
5% Below-average Wage	0.14	0.14
10% Below-average Wage	0.15	0.15
15% Below-average Wage	0.14	0.14
N	8,342	4,171

Source: BIBB-CBS 2017/2018, authors' calculations.

Table A2

Comparison of job tasks and recruiter and firm characteristics of the working sample with representative full BIBB-CBS.

	Work	ing Sample	e			Full BIE	B-CBS				<i>t</i> -test
Variable Names	Ν	mean	SD	min	max	Ν	mean	SD	min	max	p-value
Job Task Structure											
Analytical Tasks	634	3.41	1.08	1	5	2,783	3.45	1.09	1	5	0.52
Interactive Tasks	634	2.82	1.23	1	5	2,783	2.75	1.20	1	5	0.16
Routine Tasks	634	3.08	1.33	1	5	2,783	3.10	1.28	1	5	0.79
Non-Routine Tasks	634	3.71	1.07	1	5	2,783	3.71	1.04	1	5	0.94
Recruiter Characteristics											
Male	634	0.62	0.49	0	1	4,045	0.57	0.50	0	1	0.01
Tertiary Academic Degree	634	0.46	0.50	0	1	3,761	0.43	0.50	0	1	0.23
Tenure	634	14	10	1	50	3,756	15	11	0	55	0.04
Firm Owner	634	0.41	0.49	0	1	4,045	0.35	0.48	0	1	0.01
Firm Characteristics											
Public Sector	634	0.07	0.26	0	1	4,045	0.10	0.30	0	1	0.01
Training Provider	634	0.74	0.44	0	1	4,045	0.75	0.43	0	1	0.37
Firm Size	634	79	219	1	3,300	4,038	225	2,161	1	76,000	0.01
Worker Wage	634	2,670	731	1,200	10,000	2,874	2,718	707	750	10,000	0.10

Source: BIBB-CBS 2017/2018, authors' calculations.

Note: Only firms that recruited skilled workers after 2014 were asked about the task structure in the reference occupation. In terms of sectors, our working sample does not significantly differ from that of the full BIBB-CBS. Only in the sector "wholesale and retail trade" do we have significantly more firms in our working sample than in the BIBB-CBS (20% vs. 16%).

Table A3

Regression models: basic specification for recruitment decisions.

	Conditional Logit	Mixed Logit MEAN	SD
Personal Attributes			
Above-average Competence	0.253***	0.341***	-0.387**
(Ref. Average Competence)	(0.043)	(0.059)	(0.141)
More Open to Experience	0.447***	0.625***	0.509***
(Ref. Less Open to Experience)	(0.046)	(0.067)	(0.132)
More Conscientiousness	1.114***	1.569***	0.844***
(Ref. Less Conscientiousness)	(0.054)	(0.100)	(0.100)
More Extraversion	0.133***	0.196***	-0.187
(Ref. Less Extraversion)	(0.040)	(0.055)	(0.193)
More Agreeableness	1.109***	1.581***	1.100***
(Ref. Less Agreeableness)	(0.055)	(0.100)	(0.098)
More Emotional Stability	0.538***	0.764***	0.644***
(Ref. Less Emotional Stability)	(0.047)	(0.072)	(0.107)
Wage Attributes: Ref. Average	Wage		
15% Above-average Wage	-0.600***	-0.777***	
	(0.104)	(0.145)	
10% Above-average Wage	-0.309**	-0.319*	
	(0.110)	(0.151)	
5% Above-average Wage	-0.200^{*}	-0.252	
	(0.096)	(0.134)	
5% Below-average Wage	-0.252**	-0.269*	
	(0.097)	(0.131)	
10% Below-average Wage	-0.186	-0.195	
	(0.110)	(0.149)	
15% Below-average Wage	-0.314**	-0.419**	
- 0	(0.110)	(0.149)	
Observations; N	8,342; 634	8,342; 634	
Log-likelihood	-1,960	-1,877	

Source: BIBB-CBS 2017/2018, authors' calculations.

Note: Clustered standard errors on the respondent level in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001. We calculate conditional logit and mixed logit regressions models.

Table A4

Recruitment decisions and skilled worker's tasks.

	Analytical	Interactive	Routine	Non-Routine
MEAN				
Personal Attributes				
Above-average Competence	0.347	0 484***	0 407**	0 446*
(Ref Average Competence)	(0.196)	(0.144)	(0.144)	(0.204)
More Open to Experience	0.082	0.348*	0.571***	0.510*
(Ref Less Open to Experience)	(0.196)	(0.152)	(0.148)	(0.218)
More Conscientiousness	0.994***	1.333***	1.507***	1.258***
(Ref. Less Conscientiousness)	(0.241)	(0.188)	(0.191)	(0.267)
More Extraversion	0.169	-0.060	0.258*	0.017
(Ref Less Extraversion)	(0.181)	(0.135)	(0.130)	(0.194)
More Agreeableness	1 239***	0.964***	1 400***	1.191***
(Ref Less Agreeableness)	(0.226)	(0.180)	(0.189)	(0.259)
More Emotional Stability	0.636**	0.777***	0.876***	0.729**
(Ref Less Emotional Stability)	(0.207)	(0.159)	(0.166)	(0.238)
Interaction between Personal A	ttributes and	Tasks (for Tas	sk see Column	(0.200) Title)
Above-average Competence	-0.001	-0.051	-0.022	-0.028
v Task	(0.057)	(0.049)	(0.043)	(0.053)
More Open to Experience	0.163**	0 103*	0.017	0.032
v Task	(0.056)	(0.051)	(0.045)	(0.058)
More Conscientiousness	0.173**	0.089	0.021	0.086
v Task	(0.065)	(0.069)	(0.051)	(0.069)
More Extraversion	0.009	0.097*	_0.020	0.049
v Task	(0.051)	(0.046)	(0.038)	(0.052)
More Agreeableness	0 104	0 224***	0.058	0 107
v Task	(0.062)	(0.061)	(0.054)	(0.068)
More Emotional Stability	0.038	-0.005	-0.038	0.010
v Task	(0.058)	(0.052)	(0.047)	(0.061)
Wage Attributes: Ref Average	Wage	(0.032)	(0.047)	(0.001)
15% Above-average Wage	-0.766***	-0.767***	-0.776***	-0.771***
ionibore arerage mage	(0.145)	(0.144)	(0.146)	(0.145)
10% Above-average Wage	-0.311*	-0.313*	-0.322*	-0.315 *
10% Hbove average mage	(0.150)	(0.150)	(0.151)	(0.151)
5% Above-average Wage	-0.240	-0.241	-0.248	-0.249
s in fibore average mage	(0.134)	(0.133)	(0.134)	(0.134)
5% Below-average Wage	-0.269*	-0.266*	-0.268*	-0.266*
570 Below average Mage	(0.131)	(0.131)	(0.130)	(0.131)
10% Below-average Wage	-0.178	-0 194	-0.197	-0.190
10% below average mage	(0.148)	(0.148)	(0.149)	(0.149)
15% Below-average Wage	-0.405**	-0.403**	-0.421**	-0.415**
15% below-average wage	(0.148)	(0.148)	(0.148)	(0.148)
SD	(0.140)	(0.140)	(0.140)	(0.140)
Above-average Competence	-0.406**	-0.400**	-0.377**	-0 389**
hove average competence	(0.137)	(0.130)	(0.144)	(0.136)
More Open to Experience	0.10/	0.405***	0.508***	0.510***
More Open to Experience	(0.122)	(0.128)	(0.121)	(0.120)
More Consciontiousness	0.133)	0.120)	0.131)	0.125)
More Conscientiousness	0.031	0.033	0.045	0.040
Mana Entropolog	(0.099)	(0.101)	(0.100)	(0.100)
More Extraversion	-0.182	-0.209	-0.178	-0.180
Mone Assesshieres	(0.196)	(0.105)	(0.211)	(0.186)
wore Agreeableness	1.103	1.003	1.094	1.100
Mana Emotional Otabilita	(0.099)	(0.100)	(0.098)	(0.098)
More Emotional Stability	0.636***	0.036***	0.640***	0.036***
Observation of N	(0.108)	(0.105)	(0.107)	(0.108)
Observations; N	1.000	8,342	34	1.074
Log-likelihood	-1,869	-1,864	-1,875	-1,874

Source: BIBB-CBS 2017/2018, authors' calculations.

Note: Clustered standard errors on the respondent level in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001. We calculate mixed logit regression models based on 300 Halton draws.

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