



How does obtaining a permanent employment contract affect the job satisfaction of doctoral graduates inside and outside academia?

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Accepted: 26 July 2022 / Published online: 9 August 2022
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Abstract

Previous research has shown that temporary employment is negatively associated with many psychological and job-related outcomes, such as well-being, health, wages, organisational commitment, and job satisfaction. Among recent doctoral graduates, the proportion of temporary contracts is particularly high. However, research on the association between contract type and job satisfaction specifically among doctoral graduates is scarce. Therefore, whether and how obtaining permanent employment affects doctoral graduates' job satisfaction remains a notable research gap that we intend to narrow by using panel data from a recent doctoral graduation cohort and by adopting a panel research design. We examine what effect obtaining permanent employment has on doctoral graduates' job satisfaction and whether this effect differs by labour market sector. We use panel data that are representative of the 2014 doctoral graduation cohort in Germany and their career trajectories up to five years after graduation. We apply fixed-effects regression to approximate the within-effect of obtaining a permanent employment contract on job satisfaction. The analyses indicate that obtaining permanent employment increases doctoral graduates' job satisfaction and that this increase is not driven by time-varying confounders. We also find that doctoral graduates' labour market sector moderates the effect: the increase in job satisfaction is highest in the academic sector and statistically significantly different from that in the private sector. Overall, this paper offers new insights into the effect of obtaining a permanent contract on the job satisfaction of recent doctoral graduates throughout their first years after graduation, when they are often employed on temporary contracts.

Keywords Permanent employment · Temporary employment · Job satisfaction · Doctoral graduates · Germany

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Introduction

In recent decades, temporary employment has increased worldwide (OECD, 2021). Temporary employment is defined as a paid job with a fixed determination date. Types of temporary arrangement vary widely (e.g. seasonal workers, on-call workers, temporary agency workers), and the specific statutory provisions of temporary employees depend on national legislation; e.g. in Europe, these provisions are more protective than in Australia, Canada, or the USA (Cuyper et al., 2008, p. 27; Wilkin, 2013).

For employers, temporary contracts offer several advantages over permanent contracts. First, temporary employees may be particularly productive to increase their chances of obtaining a permanent employment contract. Second, employers can screen new employees before granting them a permanent contract. Finally, they enable employers to minimise adjustment costs in their workforce because they can flexibly react to changing labour market conditions and to increasing or decreasing demands for their products or services.

For employees, temporary employment often leads to job insecurity, which is negatively associated with many psychological and job-related outcomes, such as well-being, health, wages, organisational commitment, and job satisfaction (e.g. Dawson et al., 2017; Hünefeld et al., 2019; Macmillan & Shanahan, 2021; Virtanen et al., 2011; Witte & Näswall, 2003). Temporary contracts usually only have advantages for employees when the alternative is unemployment. In such cases, temporary employment may be an attractive possibility to gain professional experience and give employees the opportunity to demonstrate their productivity and commitment.

In many countries, temporary employment is increasingly common among doctoral graduates (Auriol, 2010; Auriol et al., 2013; BuWiN, 2013, p. 259; Mertens & Röbbken, 2013; Passaretta et al., 2019), especially in the first years after graduation (Auriol, 2010; Auriol et al., 2013; Schwabe, 2011, p. 155). In Germany, temporary employment and insecure employment prospects are especially widespread in the academic sector. However, research on the impact of temporary employment on doctoral graduates' outcomes is scarce. One of the few studies is by Waaijer et al. (2017), who have examined the association between doctoral graduates' contract type and job satisfaction. They found that temporary employment is negatively associated with graduates' job satisfaction and private lives and that doctoral graduates inside academia are less satisfied with their terms of employment than those outside academia. Their study provided initial insights into this association, but it was only cross-sectional and therefore simply allowed for descriptive interpretations.

However, whether and how obtaining permanent employment affects doctoral graduates' job satisfaction remains a notable research gap that we intend to narrow in this paper: *what effect does obtaining a permanent employment contract have on recent doctoral graduates' job satisfaction?* In addition, we intend to provide insights into whether the effect differs by labour market sector by addressing the following question: *is the effect different for doctoral graduates inside and outside academia?* To answer these research questions, we connect two different lines of research, namely, research on the association between contract type and job satisfaction and research on doctoral graduates' job satisfaction.

In addition to the research gap, there are further reasons for our research interest. First, job satisfaction is related to behavioural, emotional, and health outcomes; specifically, people who are satisfied with their job show higher job performance, less absenteeism, less intention to quit, less work-related stress, a lower risk of burnout, better mental health, and higher general life satisfaction (Fritzsche & Parrish, 2005; Ringelhan et al., 2013). Thus, working conditions that ensure high job satisfaction are in the interests of employees,

employers, and the economy, especially among doctoral graduates because they contribute substantially to economic growth, social innovation, and technological progress (Bogle et al., 2010; Diamond et al., 2014). The higher their job satisfaction is, the higher their motivation and work performance. Therefore, knowledge about the determinants of doctoral graduates' job satisfaction and conducive measures is necessary.

Second, the importance of temporary employment among doctoral graduates is unclear. On the one hand, doctoral graduates may be particularly affected by sustained temporary employment after graduation because they have already been concerned with temporary contracts for a long time during their doctoral training and they are comparatively old when entering the labour market after graduation. If they cannot transition to permanent employment after graduation, job insecurity may affect their further career development and private lives (Waijjer et al., 2017). This holds especially for doctoral graduates in Europe who remain inside academia after graduation because temporary employment is inherent in the European academic system (Herschberg et al., 2018; Waijjer, 2015; Waijjer et al., 2017). On the other hand, recent doctoral graduates may be less constrained by temporary employment than other educational groups if they consider temporary employment a necessary part of their early-career development that offers the opportunity to gain pertinent professional experience and to flexibly develop their careers, both of which improve their future job prospects (Auriol et al., 2013, p. 16; Schwabe, 2011, p. 155; Waijjer et al., 2017). Due to their high educational attainment, doctoral graduates may have particular confidence in their future career prospects. Against this background, we need to better understand the importance of temporary employment for postdoctoral careers and how permanent contracts affect job satisfaction both inside and outside academia.

Finally, the focus on a single, homogeneous, and highly educated group offers methodological advantages. Doctoral graduates seldom experience the most precarious types of temporary employment (e.g. on-call work, seasonal jobs). Therefore, by choosing this homogeneous group, we eliminate differences in types of temporary employment.

Building on Waijjer et al. (2017), this paper examines the effect of obtaining a permanent employment contract on job satisfaction among doctoral graduates throughout their first years after graduation. We use the PhD Panel 2014 (waves 1–5) of the German Centre for Higher Education Research and Science Studies (DZHW), which are unique panel data on the careers of a recent doctoral graduation cohort from Germany over five years after their graduation. These data include doctoral graduates from all subject groups, from all formal types of doctoral training, and with postdoctoral employment inside or outside academia. These data enable us to estimate the effect of permanent contracts on doctoral graduates' job satisfaction by labour market sector net of time-constant unobserved heterogeneity and time-varying confounders.

Temporary employment and career structures in German academia

In Germany, temporary employment in the general working population has increased, especially from the 1980s to 2010 (OECD, 2021). In 2019, 12% of the German employees had a temporary employment contract, which is below the average for the EU-27 countries, but slightly above the OECD average.

It is regulated by law that employers are generally not allowed to employ their employees on a temporary basis for longer than two years ('Teilzeit- und Befristungsgesetz'). However, a special legal regulation was created for the academic sector to enable continuing

scientific qualification of early career researchers ('Wissenschaftszeitvertragsgesetz'). It generally allows temporary employment for six years prior to doctoral graduation and another six years after the doctorate. This twelve-year period can be extended for parents by two years for each child born within this period. In the case of third-party funding, the duration of temporary employment is unlimited.

For researchers inside academia, permanent employment typically presupposes the appointment to a regular professorship. According to official statistics (Federal Statistical Office, 2021a), approximately 48,500 researchers held a professorship at a university in 2019, 87% of whom were permanently employed. In the same year, more than 212,000 researchers were employed below the professorship level. In this group, in contrast, only approximately 20% were employed on permanent contracts. Given that the average age of appointment to a professorship is 40 years (Federal Statistical Office, 2021a), doctoral graduates striving for an academic career typically have to cope with long periods of career insecurity and with the risk of unintended dropout at a high age with very specific (i.e. academic) skills. Only recently, attempts have been made to improve this situation by establishing tenure track systems.

The relatively low proportion of permanent positions inside academia and the high number of doctoral graduates lead to a fierce competition for tenured positions. As the number of doctorates awarded per year and, thus, the number of potential candidates for postdoc positions have increased in recent decades (1999: 24,545; 2019: 28,690; Federal Statistical Office, 2021b), the rigor of performance evaluation has also increased.

Against this background, most doctoral graduates in Germany leave academia for jobs in other sectors. Five years after graduation, only 29% of them are employed in the academic sector, while 51% and 20% work in the private and the non-academic public sectors, respectively, with 70% to 95% being permanently employed (Goldan et al., 2022). Because permanent employment is the rule outside academia and the exception inside academia, it appears likely that the effect of obtaining permanent employment on individual job satisfaction is sector-specific.

Literature review

Contract types and job satisfaction

There is a large body of research on individual, psychological, and job-related outcomes of temporary employment or of subjective job insecurity among countries' general working populations (e.g. Hünefeld et al., 2019; Macmillan & Shanahan, 2021; Virtanen et al., 2011; Wilkin, 2013; Witte & Näswall, 2003). This research shows that temporary employees report lower well-being, have lower wages, achieve worse job matches, and participate less in training than permanent employees (e.g. Bertrand-Cloodt et al., 2012; Dawson et al., 2017). However, findings are largely inconclusive regarding job satisfaction (Cuyper et al., 2008). Some studies find that overall job satisfaction is lower among temporary employees than among permanent employees (e.g. Aleksynska, 2018; Forde & Slater, 2006), while other studies find the opposite pattern (e.g., McDonald & Makin, 2000; Wooden & Warren, 2004) or differences by contract type only for some facets of satisfaction (Booth et al., 2002; Dawson et al., 2017), and still others find no or only small differences in job satisfaction by contract type (e.g. Chadi & Hetschko, 2016; Wilkin, 2013; Witte & Näswall, 2003). According to Chadi and Hetschko (2016), there is a honeymoon effect of starting

a new job, which results in a short-term increase in job satisfaction. However, most studies examine the association between temporary employment and job satisfaction based on cross-sectional data.

Doctoral graduates' contract types

Temporary employment is increasingly common among doctoral graduates in many countries (Auriol, 2010; Auriol et al., 2013; BuWiN, 2013; Mertens & Rübken, 2013; Passaretta et al., 2019) and more frequent than among other higher education graduates and employees (BuWiN, 2013, pp. 258–259; Mertens & Rübken, 2013). According to the German National Report on Junior Scholars (BuWiN, 2013), one in five employed doctoral graduates between the ages of 35 and 45 has a temporary contract, while among higher education graduates of the same age, it is less than one in ten and only one in twenty among all employees in that age group. Studies have shown that while doctoral graduates frequently experience temporary employment during the first years after graduation, this is much less the case in later career stages (Auriol, 2010; Auriol et al., 2013; Schwabe, 2011, p. 155).

Inside academia, the proportion of doctoral graduates with temporary employment is particularly high because postdoctoral positions at universities or non-university research institutions below professorship are usually temporary positions (Auriol et al., 2013), especially in Germany (BuWiN, 2013; Kreckel, 2016; Waaijer, 2015). These positions are considered a 'qualification phase'; therefore, temporary contracts seem legitimate, and temporary contracts induce competitive pressure, which is supposed to motivate early-career researchers to be particularly productive. In addition, there are relatively few professorial positions (BuWiN, 2013, 2021, pp. 147–150; Kreckel, 2016). Thus, doctoral graduates seeking an academic career are particularly constrained by temporary employment and are likely to stagger from one temporary contract to the next. Therefore, there is an ongoing discussion about precarious working conditions inside academia and their side effects (e.g. Borgwardt, 2010; BuWiN, 2021; Herschberg et al., 2018; Loher et al., 2019).

Doctoral graduates' job satisfaction

Previous research found that doctoral graduates' job satisfaction is moderate to high (BuWiN, 2013, pp. 279–281, 2021, pp. 231–232; Enders, 2002; Enders & Bornmann, 2001, pp. 160–170; Schwabe, 2011) and associated with personal, doctoral, and job characteristics (Bender & Heywood, 2006; Canal Domínguez, 2013; Di Paolo, 2016; Enders & Bornmann, 2001, pp. 193–196; Escardíbul & Afcha, 2017; Moguérou, 2002; Parenti et al., 2020; Waaijer et al., 2017). The latter studies largely agree that earnings, relative pay, management positions, company size, and job adequacy are positively associated with doctoral graduates' job satisfaction and that partnerships have no effect. The studies disagree on whether parenthood, age, marriage, working hours, and labour market sector are associated with job satisfaction and, if so, in which direction. For example, Bender and Heywood (2006) and Escardíbul and Afcha (2017) find that labour market sector and job satisfaction are not associated when controlling for contract type and many other covariates. In contrast, Waaijer et al. (2017) find an association only with satisfaction with terms of employment, and other studies with similar model specifications find associations, albeit not uniform ones (Canal Domínguez, 2013; Di Paolo, 2016; Moguérou, 2002; Parenti et al., 2020). However, the studies employed cross-sectional research designs, which

simply permitted the identification of empirical associations between the determinants investigated and job satisfaction.

Doctoral graduates' contract types and job satisfaction

To the best of our knowledge, there is little and only cross-sectional research on contract types and doctoral graduates' job satisfaction. Some of the studies on the determinants of doctoral graduates' job satisfaction have accounted for contract type as one such determinant. Although referring to the same countries, namely, Spain and the USA, these studies provide mixed evidence: according to Canal Domínguez (2013), Escardíbul and Afcha (2017), and Mogueou (2002), doctoral graduates with permanent employment have, on average, higher job satisfaction than those with temporary employment. In contrast, Di Paolo's (2016) regression analyses indicate that contract type and job satisfaction are not associated when controlling for various other predictors. According to Bender and Heywood (2006), temporary jobs are positively associated with job satisfaction; however, this finding is likely to be biased by overcontrol bias, *inter alia*, because they included not only temporary employment in their regression analyses but also a measure for tenure, and these variables should be highly correlated with each other.

The most comprehensive study is by Waaijer et al. (2017), who examined the association between contract type and job satisfaction using cross-sectional survey data on recent doctoral graduates from five Dutch universities. They find that doctoral graduates on temporary contracts are less satisfied with several job aspects, especially job security, than those on permanent contracts, while they are more satisfied with the intellectual challenge of their jobs. In regression analyses, they find that doctoral graduates on temporary contracts tend to be less satisfied with job content and terms of employment while controlling for personal, doctoral, and job characteristics. They also find that temporary contracts negatively influence the ability to obtain a mortgage, the stability of family life, and the possibility to start a family. Because doctoral graduates inside academia more often experience temporary employment, the negative effects of temporary employment on personal lives are larger in this group. Overall, Waaijer et al. show that temporary employment not only lowers doctoral graduates' job satisfaction but also restrains their personal lives. Taken together, panel studies of the effect of doctoral graduates obtaining a permanent contract on their job satisfaction are a gap in research, especially in combination with sector-specific analyses.

Theoretical approach

To investigate the effect of obtaining a permanent employment contract on job satisfaction, we address our research interest through the lens of different theoretical perspectives: the sociological effort-reward imbalance model and the economic rational choice theory. We will see that regardless of which approach we adopt, or which social mechanism is postulated, we obtain the same intuitive conclusion: permanent contracts increase doctoral graduates' job satisfaction.

First, the *effort-reward imbalance model* (Siegrist, 1996, 2017) concerns social reciprocity in costly transactions, such as employment contracts. Following the principle of social reciprocity, employment contracts define what 'efforts are expected to be delivered by employees in exchange for rewards provided by the employer' (Siegrist, 2017, p. 25).

Typically, such rewards in the workplace are financial (salary, wages), status-related (promotion, job security), and socio-emotional (esteem, recognition). Note that employment contracts do not specify efforts and rewards in detail but provide a flexible framework for their exchange. If employees perceive their efforts and rewards as balanced, their job motivation is high, which should also apply to their job satisfaction. However, if employees perceive that their employer violates the principle of reciprocity and their efforts disproportionately exceed their rewards, this effort-reward imbalance induces negative emotions such as anger, frustration, and stress in the short term and decreases health and well-being in the long term. As a result, employees' job satisfaction is also likely to decrease. Applying the effort-reward imbalance model to doctoral graduates, we suggest that obtaining a permanent employment contract, *ceteris paribus*, increases their rewards in terms of job security. Therefore, any previously existing effort-reward imbalance should be redressed to some degree, and their job satisfaction should increase.

Second, we approach the effect of obtaining a permanent contract from a *rational choice perspective* with bounded rationality (e.g. Lindenberg, 1985; Opp, 1999; Simon, 1955). From this perspective, individuals are utility maximisers, i.e., rational, as they attempt to realise their preferences in decision-making situations under constraints. If individuals must decide between different alternative actions, they choose the alternative that promises the greatest utility. However, individuals are often not fully informed about all aspects that are important for that decision; therefore, decisions are typically made under a certain degree of uncertainty. The more information is available in the decision-making situation, the more accurate and reliable the decision, and the higher the satisfaction. Such rational decisions also occur in career and life planning. Individuals take rational decisions about their jobs and private lives against the background of their given working and living conditions—for example, in career advancement and household decisions such as the choice of residence and starting a family. However, temporary employees take such decisions under greater uncertainty than permanent employees. We assume that obtaining a permanent employment contract reduces that uncertainty because it increases the predictability of career trajectories and private lives. Employees can make decisions with more certainty, and thus, their job satisfaction should increase. This effect should be even more pronounced among doctoral graduates, because they have already been concerned with temporary contracts for a long time during doctoral training and are comparatively old when entering the labour market after graduation. Therefore, they are in a phase of life where decisions under certainty are particularly essential.

Although they stem from different disciplines, both theoretical perspectives suggest that obtaining a permanent employment contract increases doctoral graduates' job satisfaction. Accordingly, our main assumption is that *a change in contract type from temporary to permanent employment increases doctoral graduates' job satisfaction*. Furthermore, in accordance with previous research on doctoral graduates' job satisfaction, we assume that there may be confounders, i.e. variables that may affect both self-selection into permanent employment and job satisfaction. These confounders need to be considered to prevent omitted variable bias. While sociodemographic, personal, and doctoral characteristics may be time-constant confounders (e.g. gender, personality, final grade, or doctoral subject), there may also be time-varying confounders, namely, sociodemographic (e.g. household characteristics, age) and job characteristics. Empirical evidence suggests that job characteristics may be particularly important for job satisfaction. However, job characteristics may change along with permanent contracts; therefore, we need to account for the possibility of changing job characteristics. If we do not condition on job characteristics, we risk overestimating the permanent employment effect. We, therefore, condition on both time-constant

and time-varying confounders to estimate the effect of permanent contracts on doctoral graduates' job satisfaction.

Since the employment situation inside and outside academia differs greatly, we assume that the labour market sector moderates the effect of permanent employment on job satisfaction. After graduation, doctoral graduates can either continue their academic qualification and attempt to obtain one of the few permanent academic positions or they can search for jobs in the private or the non-academic public sectors. Inside academia, temporary employment is very common, especially in the first years after doctoral graduation; in the private and the public sectors, it is far less common. Especially inside academia, obtaining a permanent contract should be perceived as a reward for individual performance and as a sign of professional success. Following *social comparison theory* (Festinger, 1954), doctoral graduates inside academia who are permanently employed may appreciate this privilege and be particularly satisfied with their job, because they compare themselves with other doctoral graduates inside academia who are temporarily employed. In contrast, because permanent employment is more common in the private and the non-academic public sectors, it may increase job satisfaction to a smaller extent. Therefore, we assume that *obtaining a permanent employment contract particularly increases the job satisfaction of doctoral graduates inside academia.*

Data and methods

Data and sample

We use the DZHW PhD Panel 2014 (waves 1–5) (Brandt et al., 2020a; Brandt et al., 2020b). These data are representative of the 2014 doctoral graduation cohort in Germany, i.e. persons who earned a doctorate at a German university in the winter semester 2013/14 or summer semester 2014. These graduates' employment and life courses were observed repeatedly over up to five panel waves. The first wave was realised as a standardised postal survey approximately one year after graduation. The subsequent waves were realised as annual standardised online surveys. Note that, in principle, the data allow for both gaps in the data and panel attrition.

The original dataset includes 5,408 doctoral graduates providing 17,533 person-years; however, for the purpose of our panel analyses, we confine the analysis to graduates who participated in at least two survey waves (–1,337 persons) and, consistent with previous research (Cuyper et al., 2008, p. 27), were never self-employed (–327 persons), leaving 3,744 persons providing 14,835 person-years in the analysis. Little's (1988) MCAR-test indicated that missing values were not missing completely at random in each wave ($p: 0.00$). Therefore, we multiply imputed missing values in the full baseline sample, which only requires missing values to be missing at random, compensates for item nonresponse, and is recommended for panel data (Lee et al., 2019; Romaniuk et al., 2014; Westermeier & Grabka, 2016; Young & Johnson, 2015). We applied multiple imputation by chained equations with $m=25$ imputations and 70 iterations to replace the missing values in all relevant variables in wide format (see Table 4 in the Appendix for details on imputation).

After imputation, we excluded imputed person-years in the contract type variable (–2,133 person-years, –97 persons), which is necessary to exclude graduates who were already permanently employed when first observed (–5,289 person-years, –1,542 persons). Thus, the final estimation sample consists of 2,105 persons providing 7,413 person-years.

Of the 2,105 persons, 812 (38.6%) have changed to a permanent position. Note that persons who have never obtained a permanent position have no within-variation and, therefore, do not contribute to estimating the effect of obtaining a permanent contract; however, they do contribute to estimating the time-varying controls. On average, the respondents participated in 3.5 waves.

Variables and controls

Our outcome variable is overall *job satisfaction*, which in previous research has been measured either by a single item or by a scale of facet satisfactions. In the literature, there are arguments for and against both types of measurement (Judge et al., 2001, pp. 32–33; Nagy, 2002; Scarpello & Campbell, 1983; Wanous et al., 1997). In our data, there was no single-item measure of job satisfaction available across waves, and therefore, we had to use an additive scale of facets of job satisfaction. The scale consists of 13 facet satisfactions with various job aspects that were measured on a 5-point scale from 1 ‘not at all’ to 5 ‘to a high extent’ in each wave.¹ We checked all scales for their reliability and found them to be internally consistent in each wave (Cronbach’s alpha: 0.84–0.86). The additive scale was min–max normalised between 0 and 1. *Contract type* is the treatment variable and is coded 1 for permanent contracts and 0 for temporary contracts.

Because obtaining a permanent employment contract is likely to be accompanied by changes in other job- and person-related characteristics, we control for potential time-varying confounders measured in each wave: *gross monthly earnings* in 1,000 €, *working time arrangement* (full-time, part-time/not fixed), *company size* (large, small/medium), *management position* (yes, no), *labour market sector* (academic, non-academic public, private), *vertical* and *horizontal job adequacy* (1 low–5 high),² *parenthood* (yes, no), *partnership* (yes, no), and *age* in years. Previous research has either shown that these variables are associated with doctoral graduates’ job satisfaction or provided mixed evidence for their association with job satisfaction. These variables are also in line with Cuyper et al. and’s (2008, p. 40) recommendations on the selection of control variables when studying temporary and permanent employment.

Methods

To estimate the effect of obtaining a permanent contract on doctoral graduates’ job satisfaction, we adopt a panel research design based on within-estimation (Allison, 2009; Brüderl & Ludwig, 2015). Panel research designs identify the effect of a treatment by investigating

¹ Job content, position, salary, working conditions, career opportunities, opportunities for further training, room for private life, job security, appropriateness of qualifications, equipment, opportunities to contribute own ideas, working atmosphere, and family-friendliness.

² *Vertical* adequacy describes whether the formal qualification level matches the job requirement level, while *horizontal* adequacy describes whether the specific content of the qualification is used in the job (Engelage & Schubert, 2009). To assess the degree of subjective job adequacy, respondents were asked in each wave to rate on a 5-point scale (from 1 ‘does not apply at all’ to 5 ‘applies completely’) whether they are employed according to their qualification (i.e., the doctoral degree). Vertical adequacy refers to (1) the professional position and (2) the level of work tasks. Horizontal adequacy refers to (1) the doctoral subject and (2) the dissertation topic. For both dimensions of job adequacy, we have added the single-item values and divided the sum by two (Cronbach’s alpha for vertical adequacy: 0.85–0.87; Cronbach’s alpha for horizontal adequacy: 0.83–0.85).

how the outcome changes if the same persons change from the control to the treatment condition over time (within-estimation), i.e. they implement a before and after comparison. Within-estimation provides an average treatment effect on the treated that can be generalised to those who are potentially able to experience the treatment. It requires temporal homogeneity and is unaffected by time-constant unobserved heterogeneity. Within-estimation builds on the error components model:

$$y_{it} = x_{it}\beta + \alpha_i + \epsilon_{it}$$

where y_{it} denotes the observed outcome of person i at time t , x_{it} is a vector of covariates of this person measured at the same time, and β is the corresponding vector of parameters to be estimated. The error term consists of two components: the person-specific, time-constant error term α_i , which captures time-constant individual heterogeneity, and the time-varying error term ϵ_{it} (idiosyncratic error). The intercept is collinear with the person-specific error α_i and therefore dropped.

In our analysis, we use fixed-effects regression, which is a specific type of within-estimation that applies pooled OLS regression to data that are transformed by demeaning prior to estimation. Demeaning means subtracting the person-specific mean values for each parameter from the equation above (within-transformation), which yields:

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\beta + \epsilon_{it} - \bar{\epsilon}_i$$

This transformation removes all between-variation, i.e. person-specific, time-constant parameters. Consequently, the time-constant error-term α_i is dropped from the equation, and fixed-effects estimation uses within-variation only. Fixed-effects estimation is consistent if the covariates are uncorrelated with the idiosyncratic error term at any time (strict exogeneity assumption). Further assumptions of fixed-effects estimation are that the idiosyncratic errors have constant variance across time (homoskedasticity) and are serially uncorrelated (no autocorrelation). To correct for heteroskedasticity and arbitrary serial correlation, we calculate panel-robust standard errors.

Our treatment is obtaining a permanent contract, and our outcome variable is job satisfaction. To disentangle the effect of obtaining a permanent contract on job satisfaction net of potential confounders, we condition on time-constant and time-varying confounders in two different ways. Because of within-estimation, we eliminate all time-constant unobserved heterogeneity by default. By controlling for potential time-varying confounders, we account for time-varying observed heterogeneity to a certain degree, which is a potential source of endogeneity and omitted variable bias. Note that a general limitation of fixed-effects estimation is that it does not allow to identify causal effects but only correlative effects. Thus, we cannot rule out the possibility of reverse or more complex causal relationships between out treatment and outcome (what is explained in detail under the term ‘causal dynamics’ in Imai & Kim, 2019), such as higher job satisfaction increasing the chance of obtaining a permanent employment or of persons anticipating the attainment of a permanent employment and therefore being already more satisfied. However, based on our theoretical arguments, presented in the “[Theoretical approach](#)” section, we assume that the main direction of the effect is from obtaining a permanent contract on job satisfaction. Another potential source of bias is measurement error. In general, we cannot fully exclude measurement error and argue that reduced bias due to time-constant unobserved heterogeneity in fixed-effects regression outweighs the possible bias due to measurement error. Another potential source of bias is endogenous selection bias if both the treatment and the outcome affect the response rate in the survey and cause panel attrition. To control for such

bias, we repeated our analyses only with graduates who were observed in all five waves. The results were robust and therefore unlikely to be biased by panel attrition.

The analyses are conducted in four steps. First, we describe the variables with a special focus on the treatment and the outcome (Tables 1, 2; Fig. 1). Second, we run fixed-effects regression on job satisfaction using contract type and the above-mentioned time-varying controls (M2 in Table 3). Third, to gain further insights and to test our assumption regarding the moderating effect, we add an interaction term to M2 to account for the interaction of contract type with the labour market sector (M3 in Table 3; Fig. 2). Finally, for a more complete overview, we include a conditional effect plot that shows the change in job satisfaction by waves since obtaining a permanent employment contract to investigate whether there is a honeymoon effect (Fig. 3).

Results

Descriptive results

Table 1 presents all variables, their distributions, and their between- and within-variation. We find that both the treatment and the outcome vary over time (within-variation). Over all person-years, the global mean of job satisfaction is 0.65. Between respondents, job satisfaction varies with a standard deviation of 0.13. Within respondents, job satisfaction varies with a standard deviation of 0.10, which is each respondent's average deviation from their mean over time. The global mean of the contract variable is 0.23, which indicates that 23% of all person-years' contracts are permanent and 77% are temporary. The variation in contract type between respondents (SD: 0.29) is nearly equal to the variation observed within respondents over time (SD: 0.30).

Figure 1 indicates the distribution of permanent contracts across waves, both overall and by labour market sector. In each wave, we find that the highest proportion of graduates with permanent contracts is in the private sector, followed by the public and the academic sectors. Five years after graduation, the proportion of graduates with permanent contracts is 67% in the private sector, 46% in the public sector, and only 24% in the academic sector.

Table 2 presents the average job satisfaction in each sector for those in temporary and permanent employment as well as the mean difference within sectors and overall difference, without any controls. We find that average job satisfaction in each sector is lower in temporary employment than in permanent employment. The mean difference in job satisfaction between temporarily and permanently employed graduates is 10 percentage points in the academic and the public sectors and 6 percentage points in the private sector. However, these are only gross differences that do not account for confounders, within-variation, and time trends. Therefore, the following fixed-effects regressions will provide a better understanding of the associations between contract type, labour market sector, and job satisfaction.

Within-effect of obtaining permanent employment on job satisfaction

Table 3 displays the results of the fixed-effects regression. M1 includes only the contract type variable. As expected, we find that obtaining a permanent employment contract statistically significantly increases doctoral graduates' job satisfaction. If doctoral graduates change from temporary to permanent employment, their job satisfaction increases on

Table 1 Description of variables

	Variable		Mean	SD	Min	Max
Outcome	Job satisfaction	Overall	0.65	0.16	0.00	1.00
		Between		0.13		
		Within		0.10		
Treatment	Permanent contract (<i>ref. temporary</i>)	Overall	0.23	0.42	0.00	1.00
		Between		0.29		
		Within		0.30		
Controls	Gross monthly earnings (<i>in 1,000 €</i>)	Overall	5.19	8.66	0.01	470.22
		Between		4.64		
		Within		7.23		
	Working-time arrangement: full-time (<i>ref. part-time/not fixed</i>)	Overall	0.75	0.43	0.00	1.00
		Between		0.35		
		Within		0.27		
	Company size: large (<i>ref. small/medium</i>)	Overall	0.71	0.45	0.00	1.00
		Between		0.38		
		Within		0.25		
	Management position: yes (<i>ref. no</i>)	Overall	0.20	0.40	0.00	1.00
		Between		0.31		
		Within		0.26		
	Labour market sector: academic	Overall	0.46	0.50	0.00	1.00
		Between		0.45		
		Within		0.22		
Labour market sector: public	Overall	0.32	0.47	0.00	1.00	
	Between		0.42			
	Within		0.21			
Labour market sector: private	Overall	0.22	0.42	0.00	1.00	
	Between		0.36			
	Within		0.21			
Vertical job adequacy (<i>1 low–5 high</i>)	Overall	3.95	1.08	1.00	5.00	
	Between		0.88			
	Within		0.68			
Horizontal job adequacy (<i>1 low–5 high</i>)	Overall	3.28	1.34	1.00	5.00	
	Between		1.15			
	Within		0.75			
Parenthood: yes (<i>ref. no</i>)	Overall	0.37	0.48	0.00	1.00	
	Between		0.44			
	Within		0.22			
Partnership: yes (<i>ref. no</i>)	Overall	0.83	0.37	0.00	1.00	
	Between		0.34			
	Within		0.18			
Age (in years)	Overall	34.56	4.09	26.00	63.40	
	Between		3.93			
	Within		1.36			

DZHW PhD Panel 2014 (waves 1–5); multiply imputed data, results reported for $m = 1$; 7,413 person-years clustered in 2,105 persons

Table 2 Description of job satisfaction by labour market sector and contract type

Labour market sector	Contract type	Person-years	Mean	SD	Δ_{mean}
Academic	Temporary	3,048	0.65	0.16	+0.10
	Permanent	345	0.75	0.15	
Public	Temporary	1,806	0.60	0.15	+0.10
	Permanent	573	0.70	0.14	
Private	Temporary	820	0.63	0.16	+0.06
	Permanent	821	0.69	0.15	
Overall	Temporary	5,674	0.63	0.16	+0.07
	Permanent	1,739	0.70	0.15	

DZHW PhD Panel 2014 (waves 1–5); multiply imputed data, results reported for $m=1$; 7,413 person-years clustered in 2,105 persons

average by 7.6 percentage points. The within- R^2 indicates that changes in contract type explain 5.8% of the within-variation in job satisfaction.

Note that the within-effect of obtaining a permanent employment contract would be overestimated if other variables changed along with the contract type and affected job satisfaction. Therefore, we take potential time-varying confounders into account in M2: job characteristics, household characteristics, and age. When controlling for these variables in M2, the contract type effect on job satisfaction is robust, as it barely changes (β : 0.071). This implies that obtaining a permanent employment contract increases job satisfaction and that the effect is not driven by the time-varying confounders taken into account.

Nevertheless, some of the covariates in M2 are also statistically significantly associated with doctoral graduates' job satisfaction. If doctoral graduates change from the academic to the private sector, their job satisfaction increases by 4 percentage points, *ceteris paribus*. If their vertical and horizontal job adequacy increases by one unit, their job satisfaction increases by 4.7 and 0.7 percentage points, respectively. None of the other covariates has a statistically significant effect on doctoral graduates' job satisfaction. The within- R^2 indicates that the model fit has substantially improved because changes in the covariates explain 18.8% of the within-variation in job satisfaction.

In M3, we add the interaction term that associates contract type with labour market sector. We find no interaction effect in the academic vs. public sector, i.e. obtaining a permanent employment contract has a similar effect in both sectors. However, in the academic vs. private sector, we do find a statistically significant interaction effect that indicates that the increase in job satisfaction due to obtaining permanent employment is statistically significantly higher in the academic sector than in the private sector.

Figure 2 plots the interaction between contract type and labour market sector based on M3. Starting-level job satisfaction in temporary employment differs across the three sectors, with satisfaction being lowest in the academic sector. Permanent employment increases job satisfaction in all three sectors and is eventually similar across sectors for permanent employment. As noted previously, permanent contracts similarly increase job satisfaction in the academic and the public sectors. However, we find statistically significant interaction effects in the private sector and both the academic and public sectors. As expected, the increase in job satisfaction is highest in the academic sector.

Figure 3 shows how doctoral graduates' job satisfaction increases over time after obtaining a permanent employment contract. The largest increase is directly after

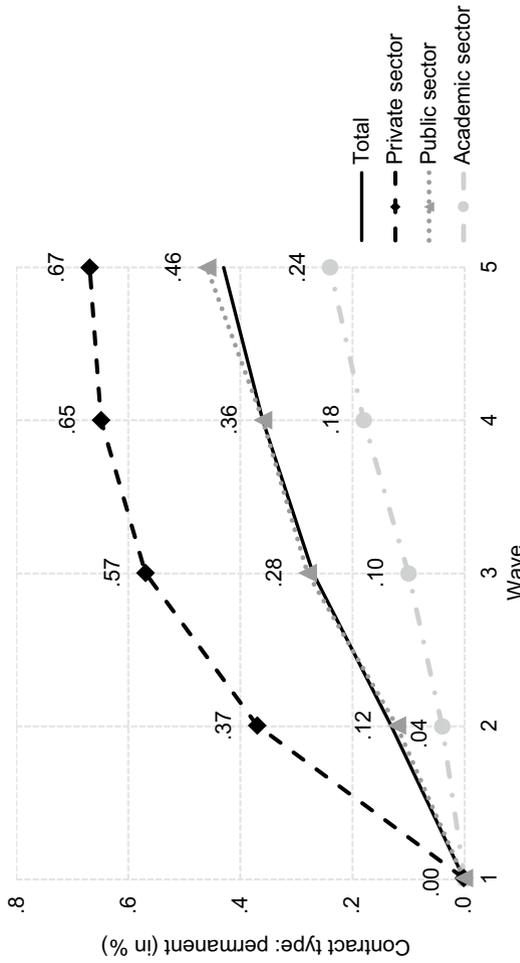


Fig. 1 Proportion of permanent contracts by wave and labour market sector

Table 3 Fixed-effects regressions on job satisfaction

	M1	M2	M3
Treatment			
Permanent contract (<i>ref. temporary</i>)	0.076*** (0.006)	0.071*** (0.006)	0.087*** (0.011)
Controls			
Gross monthly earnings (<i>in 1,000 €</i>)		0.000 (0.000)	0.000 (0.000)
Working-time arrangement: full-time (<i>ref. part-time</i>)		0.007 (0.006)	0.007 (0.006)
Company size: large (<i>ref. small/medium</i>)		0.005 (0.007)	0.005 (0.007)
Management position: yes (<i>ref. no</i>)		0.009 (0.005)	0.008 (0.005)
Labour market sector (<i>ref. academic</i>)			
• Non-academic public		0.014 (0.009)	0.015 (0.009)
• Private		0.040*** (0.010)	0.054*** (0.011)
Vertical job adequacy (<i>1 low–5 high</i>)		0.047*** (0.003)	0.047*** (0.003)
Horizontal job adequacy (<i>1 low–5 high</i>)		0.007** (0.002)	0.007** (0.002)
Parenthood: yes (<i>ref. no</i>)		–0.003 (0.006)	–0.003 (0.006)
Partnership: yes (<i>ref. no</i>)		–0.004 (0.007)	–0.004 (0.007)
Age (<i>in years</i>)		–0.001 (0.001)	–0.001 (0.001)
Interaction			
Permanent contract # labour market sector (<i>ref. academic</i>)			
• Non-academic public			–0.006 (0.014)
• Private			–0.037** (0.014)
Constant	0.629*** (0.001)	0.417*** (0.046)	0.420*** (0.046)
within-R ²	0.058	0.188	0.191
Person-years	7,413	7,413	7,413
Persons	2,105	2,105	2,105

Significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; panel-robust standard errors in parentheses; data: DZHW PhD Panel 2014 (waves 1–5), multiply imputed data

the change in contract type. In the first wave after obtaining a permanent employment contract, i.e. approximately one year later, their job satisfaction increased by approximately 7 percentage points on average. Interestingly, doctoral graduates' job

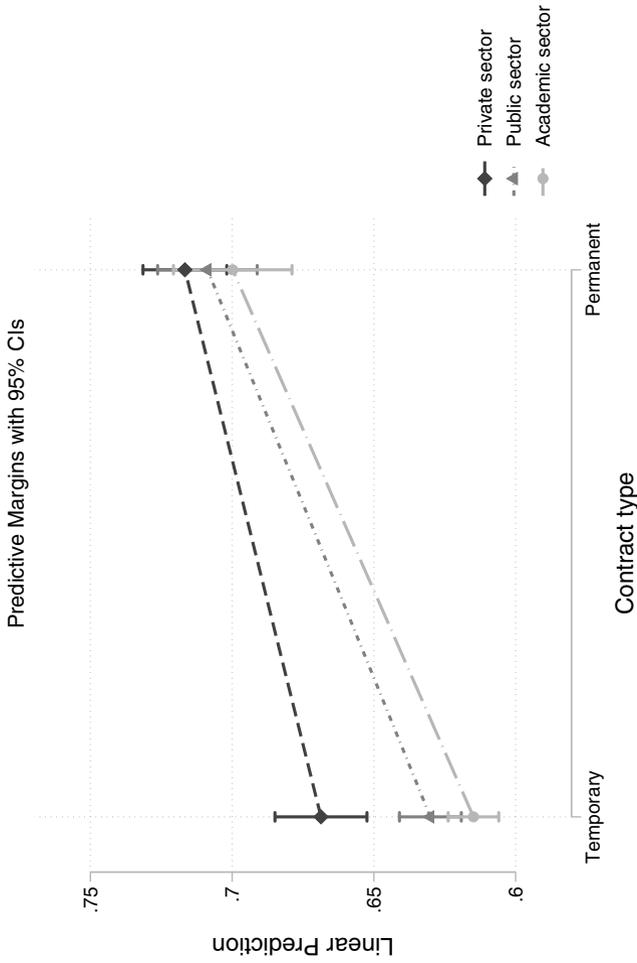


Fig. 2 Conditional effect plot (predictive margins) of the interaction effect of contract type and labour market sector based on M3

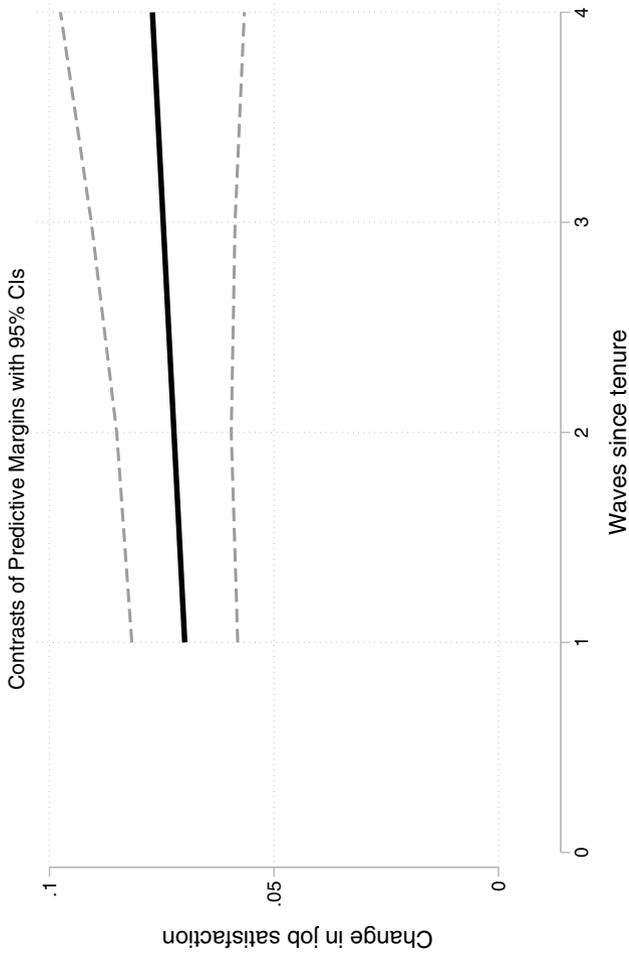


Fig. 3 Conditional effect plot (contrasts of predictive margins) based on M2 with additional control for waves since obtaining permanent employment

satisfaction does not decrease thereafter but rather tends to increase slightly further over time—at least in the short period of five years after graduation that is considered here. Thus, their increase in job satisfaction does not seem to be the result of a honeymoon effect, which would be the case if their job satisfaction after the change in contract type were initially high but rapidly decreased later.

Discussion and conclusions

This paper sought to answer the following questions: what effect does obtaining a permanent employment contract have on recent doctoral graduates' job satisfaction? Is the effect different for doctoral graduates inside and outside academia? Based on panel survey data with German doctoral graduates, we estimated the within-effect of contract type changes using fixed-effects regressions. The results show that obtaining permanent employment increases doctoral graduates' job satisfaction. Controlling for potential time-varying confounders confirmed the robustness of this finding. Moderator analyses revealed that the effect of permanent contracts is especially large in the academic sector.

We identified different theoretical mechanisms explaining why obtaining a permanent employment contract increases job satisfaction and why this effect is sector-specific. From the perspective of the effort-reward imbalance model, a permanent employment contract can be viewed as a form of reward provided by the employer. Thus, a permanent contract positively influences the ratio of job-related efforts and rewards and, consequently, leads to higher job satisfaction. From a rational choice perspective, doctoral graduates on permanent contracts can make decisions about their jobs and private lives (e.g. family formation or choice of residence) with more certainty, which increases job satisfaction. According to social comparison theory, doctoral graduates are likely to compare their achievements with other doctoral graduates in the same employment sector. As a result, a permanent position inside academia, where temporary contracts are the rule, is perceived more as a reward for individual performance and as a sign of professional success compared with its perception in other sectors and, thus, particularly increases job satisfaction.

Our main results relate to previous cross-sectional studies among doctoral graduates in Spain (Canal Domínguez, 2013; Escardíbul & Afcha, 2017), the USA (Moguéro, 2002), and the Netherlands (Waaiker et al., 2017). In contrast to these studies, we were able to apply panel analyses and to estimate the within-effect of changes in contract type. In addition, our study expands the state of research by focusing on doctoral graduates in Germany and by performing sector-specific analyses.

Nevertheless, our paper has some limitations. First, within-estimation demonstrates an average treatment effect on the treated that can only be generalised to those who are potentially able to experience the treatment, such as doctoral graduates who were temporarily employed when first observed in our case. Second, with a maximum of five waves, our panel is short; therefore, our analyses indicate short-term effects on job satisfaction rather than medium- or long-term effects. Repeating our analyses with first-differences regression supports this assumption because it indicates the immediate effect of a treatment on the outcome; here, the size and direction of the regression coefficients were similar to those of fixed-effects regression. Third, we cannot differentiate between different types of temporary employment. However, doctoral

graduates seldom experience the most precarious types of temporary employment. We compared the between-variance of job characteristics of doctoral graduates with temporary and permanent contracts and found that between-variance is similar in both groups or partly even higher between doctoral graduates with permanent contracts than between doctoral graduates with temporary contracts. Fourth, our panel data are unbalanced. If both the treatment and the outcome affected the response rate in the survey and caused panel attrition, our analyses would be biased. However, the results were robust when we repeated our analyses with a subsample of graduates who participated in all waves. Finally, because our results are based on survey data and not experimental data, causal interpretations should still be made with caution. Although we were able to control for many potential job- and person-related time-varying confounders, we cannot rule out the possibility that our results are biased due to time-varying unobserved heterogeneity (e.g. health status, geographic mobility, household characteristics such as the partner's income), or reversed or more complex patterns of causality (Imai & Kim, 2019). Despite these limitations, our study provides evidence that obtaining a permanent employment contract increases job satisfaction. This suggests that it may also yield a wide range of other positive behavioural, emotional, and health outcomes because people who are satisfied with their job show higher job performance, less absenteeism, less intention to quit, less work-related stress, a lower risk of burnout, better mental health, and higher general life satisfaction (Fritzsche & Parrish, 2005; Ringelhan et al., 2013).

Inside academia, temporary employment is particularly common, and our analyses demonstrate that the satisfaction-increasing effect of permanent contracts is particularly high. In Germany, the proportion of faculty with temporary contracts has increased in recent years. Possibly, this development has also resulted in less satisfying (and less healthy) working environments, especially among early-career researchers striving for an academic career. According to Reevy and Deason (2014), faculty in temporary positions perceive the precariousness of their positions as the most important work-related stressor. Studies have also reported a high prevalence of mental health problems among early-career researchers (Levecque et al., 2017). Against this background, increasing the proportion of tenured positions inside academia could be a means of increasing the attractiveness of academic careers. However, the academic system uses competition for permanent positions to enhance academic productivity. Moreover, universities have to ensure the scientific qualification of future graduates, which requires constant change of staff. However, these principles do not release policy-makers and employers from their obligation to strive for health-promoting working conditions inside academia. Since permanent positions are rare inside academia, the recruitment procedures should be as transparent and fair as possible. Increasing the number of tenure-track professorships with clearly formulated requirements and structured procedures can increase the predictability of future career trajectories. Furthermore, universities may also optimise measures to prepare early-career researchers for careers outside academia, for example, by expanding doctoral training to include skills that are needed in non-academic sectors (Waaiker et al., 2017) or by expanding their career guidance offers.

Future research must evaluate which measures or organisational reforms are appropriate to improve the situation of postdocs inside academia. Empirical studies could also contribute to the state of research by examining the effects of obtaining permanent employment on other outcomes, such as health, or by identifying specific vulnerable groups.

Appendix

Table 4 Imputation model

Variable	Wave	% _{missing}	N _{complete}	N _{imputed}	Estimator
Job satisfaction	1	7.75	3,454	290	Propensity mean matching ^a
	2	11.05	2,584	321	
	3	8.02	2,466	215	
	4	7.50	2,528	205	
	5	7.36	2,568	204	
Contract type	1	24.01	2,845	899	Logit ^b
	2	20.86	2,299	606	
	3	8.09	2,464	217	
	4	7.68	2,523	210	
	5	7.25	2,571	201	
Gross monthly earnings	1	11.94	3,297	447	Propensity mean matching ^a
	2	15.01	2,469	436	
	3	10.26	2,406	275	
	4	9.37	2,477	256	
	5	9.34	2,513	259	
Working-time arrangement	1	23.96	2,847	897	Logit ^b
	2	20.90	2,298	607	
	3	8.54	2,452	229	
	4	7.79	2,520	213	
	5	7.32	2,569	203	
Company size	1	8.57	3,423	321	Logit ^b
	2	11.67	2,566	339	
	3	11.67	2,368	313	
	4	15.66	2,305	428	
	5	14.61	2,367	405	
Management position	1	24.73	2,818	926	Logit ^b
	2	21.31	2,286	619	
	3	8.62	2,450	231	
	4	8.12	2,511	222	
	5	7.32	2,569	203	
Labour market sector	1	9.05	3,405	339	Multinomial logit ^b
	2	11.57	2,569	336	
	3	11.19	2,381	300	
	4	15.29	2,315	418	
	5	14.25	2,377	395	
Vertical job adequacy	1	8.71	3,418	326	Propensity mean matching ^a
	2	11.02	2,585	320	
	3	7.83	2,471	210	
	4	7.21	2,536	197	
	5	6.78	2,584	188	

Table 4 (continued)

Variable	Wave	% _{missing}	N _{complete}	N _{imputed}	Estimator
Horizontal job adequacy	1	8.95	3,409	335	Propensity mean matching ^a
	2	11.05	2,584	321	
	3	7.94	2,468	213	
	4	7.28	2,534	199	
	5	6.82	2,583	189	
Parenthood	1	9.27	3,397	347	Logit ^b
Partnership	1	0.27	3,734	10	Logit ^b
	2	6.16	2,726	179	
	3	5.71	2,528	153	
	4	5.93	2,571	162	
	5	5.66	2,615	157	
Year of birth	1	0.16	3,738	6	Propensity mean matching ^a

^aPropensity mean matching with five nearest neighbours; ^b augmented; data: DZHW PhD Panel 2014 (waves 1–5)

Acknowledgements We thank Micha Pastuschka for literature review.

Author contributions All authors contributed to the study conception and design. Data analysis was performed by Lea Goldan. The first draft of the manuscript was written by Lea Goldan, except for the discussions and conclusions, of which the first draft was written by Steffen Jaksztat. All authors revised previous versions of the manuscript and approved the final manuscript.

Funding Open Access funding enabled and organized by Projekt DEAL. This work was supported by the German Research Foundation (DFG, Deutsche Forschungsgemeinschaft) under grant 433155285 and a doctoral scholarship by the German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes). Proofreading was subsidised by the Faculty of Human Sciences at the University of Würzburg under grant 10 2020/3.25.

Data Availability The dataset analysed in the current study is available at the Research Data Centre for Higher Education Research and Science Studies (FDZ-DZHW) as scientific use file (<https://doi.org/10.21249/DZHW:phd2014:4.0.0>).

Code availability We used Stata/SE 16.1 to complete our work. Our code is available upon request at the Research Data Centre for Higher Education Research and Science Studies (FDZ-DZHW) under DOI: <https://doi.org/10.21249/DZHW:goldan2022c:1.0.0>.

Declarations

Competing interests The authors declare no competing interests.

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