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Stressed by your job: What is the role of personnel policy?*

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Abstract

Work-related stress can lead to substantial health problems and thereby result in immense costs for establishments. Therefore, the question as to what extent establishments contribute to their employees' stress levels is of great importance for firm performance. We investigate the relationship between personnel policies and work-related stress by considering a series of personnel policies that refer to a worker's job reward, job demand, or job control situation. Using data from the German Socio-Economic Panel (SOEP) we find statistically significant associations of several policies and work-related stress. Most importantly, bad promotion opportunities and low working time control turn out to be associated with higher stress levels, while the opposite is true for an adequate salary.

JEL-Classification: I10, J81, M54
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1 Introduction

Work relations have dramatically changed in most industrialized countries since the early 1990s. Increasing competition and technological change pose high flexibility demands on both establishments and employees. Therefore, the latter are increasingly confronted with rising job demands as well as flexible working arrangements. Although this development may bring about advantages from an employee's perspective, work-related health problems are on the rise as various official numbers indicate. This particularly concerns health problems associated with mental strain and stress. In the European Working Conditions Survey 2010 over 26% of the respondents from the EU27 countries report to experience stress at work "always or most of the time", and an additional 40% state to do so at least "sometimes" (Eurofond, 2010). Moreover, according to a European Commission report about 9% of the European working age population with health problems suffer most from mental health problems (Oortwijn et al., 2011). Over 14% of those working but having health problems, report to suffer most from stress, depression or anxiety (Eurostat, 2010). Finally, more than 50% of the respondents, who state stress, depression or anxiety to be their major work-related health problem, had to go on sick leave in the last twelve months and over 20% missed out on more than a month of work (Eurostat, 2010).

Work-related stress can lead to substantial health problems such as cardiovascular disease, musculoskeletal disease, back pain, depression, and burnout (e.g., Béjean and Sultan-Taïeb, 2005). The resulting costs pose an increasing challenge on establishments as ill employees are less productive and have higher absenteeism rates. For instance, Goetzel et al. (2003) name back disorders and depressions, illnesses that are associated with stress, among the ten most costly for U.S. enterprises. Moreover, disregarding subsequent health problems, stress at work itself has been shown to be a predictor for absenteeism and quitting intentions (Leontaridi and Ward, 2002). Thus, establishments are confronted with the question, to what extent they contribute to their employees' stress.

While stress is a very widely used term, its definition remains vague.[1] According to Kinman and Jones (2005, p. 101) a general definition of stress is that it "is the product of an imbalance between appraisals of environmental demands and individual resources". The two mostly used conceptional frameworks in epidemiology for work-related stress are the Job Demand-Control (JDC) model (Karasek, 1979) and the Effort-Reward Imbalance (ERI) model (Siegrist, 1996). Both frameworks are broadly in line with this

[1] See, for instance, Kinman and Jones (2005) for a discussion of the term workplace stress and the comparison of academic and layman understanding of the concept. For instance, in psychology there is a linguistic differentiation between stress and strain. While the first is the trigger or *stressor*, the latter is the outcome (Kinman and Jones, 2005). However, given the orientation of this paper, we remain in the *layman* terminology referring to the outcome also as *stress* as it has been previously done in economics (e.g., Hamermesh and Lee, 2007; Johnston and Lee, 2013). Furthermore, we disregard positive connotations of the term, namely that stress can also be understood as a positive stimulus that enhances the productivity of an individual.

general definition of stress and predict that an unfavourable combination of workload and responsibility or reward is detrimental to an individual's health.

In this paper, we investigate which human resource management practices tend to increase or mitigate the workers' stress levels. We regard the identification of such practices as relevant for firm performance. We contribute to the existing literature in a threefold way. First, most studies dealing with work-related stress use small data samples stemming from very specific populations. On the contrary, we aim to answer the proposed question utilizing a large representative household data set, the German Socio-Economic Panel (SOEP). Second, most related studies focus on a single personnel policy measure as main explanatory variable (e.g., Johnston and Lee, 2013), while we consider a series of personnel policy measures that may mutually influence work-related stress. Specifically, we consider the employees' working time arrangements, the benefit of a computer (or laptop) for private use, paid overtime hours, regular performance appraisals, salary adequacy, and promotion opportunities in our analysis. Finally, our data allow us to include a rich set of covariates reflecting individual and job characteristics as well as important life events that might also influence a worker's stress perception. This contributes to obtain more precise parameter estimates and limits the consequences of an omitted variables bias. In addition, we explicitly address other endogeneity issues that may be associated with our personnel policy measures by applying appropriate regression techniques. Provided that our approach to examine the stress consequences of various personnel policy measures prevents us from exercising an instrumental variables estimation to obtain causal effects, our applied estimation strategy is supposed to produce meaningful results that might serve as an early warning system for employers who are interested in identifying potential stress factors at work.

Our results indicate that bad promotion opportunities and low working time control are associated with higher stress levels, while salary adequacy is associated with lower stress levels. This holds in both (pooled) OLS and individual fixed effects specifications. Most of the results remain robust, when we exploit an exogenous source of variation of personnel policies by only considering individuals who did not change jobs in the period of observation. Although accounting for time-invariant individual fixed effects and exploiting exogenous variation do not allow us to interpret our estimates as causal effects, these procedures are supposed to reduce potential endogeneity biases by addressing important sources of endogeneity such as time-constant unobserved heterogeneity and self-selection.

The remainder of this paper is structured as follows. In Section 2 we review the background literature. In Section 3 we present the data, our key variables, and descriptive statistics. Section 4 continues with our empirical strategy. In Section 5, we present and discuss our estimation results. In Section 6 we conduct a sensitivity analysis, before Section 7 concludes.

2 Background literature

Two very influential conceptional frameworks explaining work-related stress are the Job Demand-Control (JDC) model (Karasek, 1979) and the Effort-Reward Imbalance (ERI) model (Siegrist, 1996). The JDC model's basic implication is that individuals feel overloaded when there is a disproportion between workplace requirements (job demand) and worker autonomy (job control). The demands are the job stressors or the workload, and the job control is the decision latitude an individual has over his activities. The model's postulation is that a relatively low level of control compared to high demands will result in mental stress, while a high level of demand combined with high decision latitude is described as an active job that leads to an adaptation to the situation, because the individual acquires new behavioural patterns.

Similarly, the ERI model (Siegrist, 1996) states that an imbalance between the costs and benefits of a job leads to stress, i.e., the combination of low reward (e.g., bad promotion opportunities) and high effort (e.g., high workload) is particularly unfavourable to an individual's health. Initially developed to explain cardiovascular diseases, the model's application has been extended to behavioural and psychological outcomes (for a review see van Vegchel et al., 2005). The ERI model distinguishes between extrinsic (situation-specific) and intrinsic (person-specific) dimensions, called *effort* and *overcommitment*.[2] An individual's effort is determined by extrinsic factors like job demand and obligations, while overcommitment depicts how an individual perceives his effort–reward situation, thereby influencing health outcomes indirectly.

In both conceptual frameworks one major component of the perceived overload or effort is time pressure. Time pressure is also one way in which economists have conceptualised stress. Hamermesh and Lee (2007) model stress as a time constraint that binds an individual. In their model, stress is the outcome "generated by feelings that the available time is insufficient to accomplish the desired activities" (Hamermesh and Lee, 2007, p. 374).[3]

Several studies from occupational medicine have analysed the association between working hours and health related outcomes. In this context, working hours arrangements can represent two aspects, job demands (e.g., via high workload that manifests itself in

[2]The term effort may be a misleading notation in personnel economics, where effort is associated with an employee's willingness to work, which is a desired behaviour for employers. However, for Siegrist (1996) effort means, that an individual has to deliver in order to fulfil the requirements of the job, which may result in perceived burden.

[3]In respect to different worker population surveys this seems a very reasonable approach. For instance "working under time and performance pressure" is the most frequently named (about 40%) work-related burden in a German working conditions survey conducted by the Robert Koch Institute (Kroll et al., 2011). Also, 62% of the overall (EU27) and 72.6% of the German individuals questioned in the European Working Conditions Survey 2010 state to work to tight deadlines "at least a quarter of the time" (Eurofond, 2010).

overtime) and job control when employees exert autonomy over their working schedule.

Nijp et al. (2012) review 63 publications on the relationship of different types of working time control (e.g., control over daily working times, vacation days or overtime) and various work-related outcomes. They do not find a consistent overall effect of working time control on employee health and well-being, but can support the idea that flexible working time arrangements are positively associated with employee health and well-being.

The famous Whitehall II studies deal with the health impacts of job control. These studies followed the health development of British civil servants over several years and show negative associations between low job control (represented by job rank) and various health outcomes such as higher risk for coronary heart disease (Bosma et al., 1998; Marmot et al., 1997) or depression and anxiety (e.g., Stansfeld et al., 1999). Bosma et al. (1998) also tested the ERI model and found that an imbalance of efforts and rewards is associated with a significantly higher risk for coronary heart disease. Also, van Vegchel et al.'s (2005) review of more than 40 studies testing the ERI model finds support for the hypothesis that an unfavourable effort–reward combination is detrimental to individual health.

Van Doef and Maes (1999) review over 60 studies concerning the JDC model and psychological well-being. The analysed studies touch upon both aspects, job demands and job controls. Van Doef and Maes (1999) find that a large share of the reviewed studies supports the hypothesis that high job demands deteriorate well-being. However, evidence is rather mixed for the hypothesis that higher job control is associated with higher levels of well-being.

So far, only a few contributions from the field of economics have dealt with the outcomes of workplace characteristics on stress. So without the intention of drawing a complete picture we conclude this section by summarizing recent findings of workplace characteristics on stress, but also on related outcomes like health, well-being and job satisfaction.

In regard to the impact of single personnel policy measures on well-being, there are studies analysing the effects of promotions on stress (Johnston and Lee, 2013), health (Boyce and Oswald, 2012), and job satisfaction (Kosteas, 2011). Johnston and Lee (2013) regress different measures of well-being including stress on promotions and account for adaptation and anticipation effects. They find that promotions lead to more stress with the effect peaking about three years after the promotion. Although they also find that the perceived job control increases following a promotion, the increased job stress seems to be the dominating outcome. Boyce and Oswald (2012) evaluate the effect of promotions on health in a longitudinal setting and contrast previous findings of a positive association between job control and health by stating that actually there is a selection of healthy people into promotion, while after being promoted there are often substantial health deteriorations.

In a European comparison of the effect of working conditions on various mental health

indicators, Cottini and Lucifora (2013) find a statistically significant association of high job demands and stress. Furthermore, they support the idea of a negative causal effect of job demands on mental health by means of an instrumental variables (IV) regression, where they instrument job demands by exploiting the variation of the work-related institutional framework over countries and time. In contrast to our study, Cottini and Lucifora (2013) do not regard particular personnel policies, but group their explanatory variables by job demands and hazards that cover, for instance, psychological stressors like self-reported task complexities or support from colleagues.[4]

Furthermore, some research has been conducted on the effects of job satisfaction on stress and health (e.g., Fischer and Sousa-Poza, 2009; Gupta and Kristensen, 2008). In this context, Kleibrink (2014) has paid attention to the underlying drivers of job satisfaction such as working hours. Several studies deal with the effects of (undesired long) working hours on health and well-being (e.g., Bell et al., 2012; Robone et al., 2011; Wooden et al., 2009).[5] For instance, Bell et al. (2012) find evidence of a negative effect of so called overwork, defined as the positive difference between actual and desired working hours, on individuals' subjective health. Finally, in a recent study Goh et al. (2015) estimate that work-related mortality is the fourth largest death cause in the U.S. However, it should be noted that Goh et al. (2015) regard ten different workplace practices that could affect employee health including lay-offs and health insurance provision, which limits the comparability of their results to our study.

None of the above mentioned studies has explicitly addressed the issue of the effect of a series of personnel policies on stress. Therefore, we complement the existing literature by analysing several personnel policies at once, which allows us to mimic the decision scope of an employer who shapes an individual's working place, thereby affecting his or her stress level.

3 Data, variables, and hypotheses

For our analysis we use data from the German Socio-Economic Panel (SOEP).[6] The SOEP is an annual longitudinal household survey conducted since 1984 and is considered to be the most important representative household survey in Germany. The SOEP questionnaires contain a wide range of individual and job-related characteristics, including variables on health and individual well-being.[7] However, while standard variables such as socio-economic factors or wages are surveyed every year, a lot of additional information

[4] In their job demand measures they include "long working hours", which is somewhat similar to our explanatory variable of paid overtime (see Section 3.2).

[5] See Bassanini and Caroli (2014) for a survey on the relationship between working hours and health.

[6] More specifically, we use the SOEPlong v30 dataset.

[7] For more detailed information about the SOEP, see Wagner et al. (2007).

is only included on a bi-annual or even less regular basis.

In order to examine the relationship between work-related stress and human resource management practices we rely on the SOEP waves of 2006 and 2011 since several job stress related questions are included in these waves.[8] These questions are in line with a shortened version of the ERI questionnaire (Siegrist et al., 2009). However, we depart from the original theoretical framework to some extent. In the ERI model, health risks are measured by a weighted quotient of the effort and reward items. On the contrary to this approach, we limit our stress view solely to the perceived burdens given by an individual's effort. However, we include selected reward items as representations of personnel policies in our set of explanatory variables (see Subsection 3.2), because we assume that efforts and rewards are not independent.[9]

Our analysis is restricted to workers aged between 20 and 65. Self-employed individuals, individuals enrolled in army or civil service, and apprentices are excluded from the sample.[10] Furthermore, individuals who earn less than 400€ per month (so called mini-jobbers) are not taken into account.

It should be mentioned that the SOEP is not designed as a balanced panel as over the course of the years individuals drop out of or enter the sample. Sometimes individuals also miss out on survey years and are reintegrated in the sample later on. As we use the years 2006 and 2011 and also aim at specifications that account for individual time-invariant effects (see Section 4), we conduct our main analysis on the basis of a balanced sample containing 4,800 observations. To the best of our knowledge, the SOEP is the only German dataset that contains information on both individual stress perceptions and job-related characteristics. Therefore, we consider these data as the most suitable for our research question.

3.1 Dependent variable: the extrinsic stress index

Our dependent variable, the extrinsic stress index, is constructed from three items covering stress caused by extrinsic factors. The three items consist of the following statements: (*i*) "I have constant time pressure due to a heavy workload" (TPWL), (*ii*) "I have many interruptions and disturbances while performing my job" (INTERRUPT), and (*iii*) "Over the past few years, my job has become more and more demanding" (JOBDEM).[11] All these items are measured in two stages. First, the respondents are asked to confirm or deny

[8] The original questionnaires and their translations into English can be retrieved online http://www.diw.de/de/diw_02.c.238114.de/frageboegen_methodenberichte.html.

[9] It is, for instance, reasonable to consider both working conditions and the rewards like salary to be fixed in the employment contract and form an individual's expectations regarding his job.

[10] Self-employed individuals are excluded because they are by definition not subject to any employer's personnel policy measures.

[11] These items represent a shortened operationalization of the effort component in the ERI model (Siegrist et al., 2009).

whether a certain statement applies to them or not. Thereafter, they have to indicate on a 1 ("not at all") to 4 ("very heavily") scale, to what extent they feel burdened by the issue the particular item covers. Following Richter et al. (2013), the answers are then recoded to a five-point Likert scale, so the higher the score, the more burdened an individual feels by the particular item.

In order to construct a convenient overall stress index we follow Bresnahan et al. (2002) and Bloom et al. (2011) by applying a double standardization approach. We first standardize (STD) each recoded item into a variable with mean 0 and variance 1 by subtracting each item's mean and dividing the result by the item's standard deviation. This eliminates problems associated with different distributions on the items' responses, i.e., a larger share of individuals may respond to feel heavily burdened by time pressure than by frequent interruptions. We then standardize the sum of the three standardized items as presented in equation (1):

$$\begin{aligned} stress_{it}^{ext} =& STD[STD(TPWL_{it}) + STD(INTERRUPT_{it}) \\ &+ STD(JOBDEM_{it})]. \end{aligned} \tag{1}$$

$Stress_{it}^{ext}$ is the resulting extrinsic stress index for individual i at time t, again a standardized variable with mean 0 and variance 1. The second standardization allows for a more convenient interpretation. A one unit change of an independent variable translates into an $stress_{it}^{ext}$ change of standard deviations of our extrinsic stress index. Thus, the higher the index value, the more burdened an individual feels.

3.2 Explanatory variables

The SOEP contains numerous work-related questions. Thus, the data offer several measures that are suitable for capturing the human resource management practices in an individual's workplace. We group the selected explanatory variables by the expected channel of their effect on stress, i.e., job demand, job control, and job reward.

Job demand

In order to include a measure in our analysis that captures long working hours without being related to an individual's particularly strong motivation or work ethic, we rely on paid overtime, as this variable rather indicates a company induced motive. The variable measures how many paid overtime hours an individual worked in the month before the survey.[12] We assume that paid overtime is positively associated with higher stress levels, because it reflects higher job demands.

[12]We recode the measure into weekly hours in order to make it comparable to other working hours relevant information that is measured in hours per week.

In cross-sectional specifications we consider whether individuals face performance appraisals. This is a dummy variable with value 1 for individuals who are subject to regular performance appraisals by their supervisors and 0 if this is not the case. Often the work of individuals who are subject to performance appraisals is evaluated by pre-determined goals and the achievement of these goals is important for subsequent promotion and remuneration decisions. Therefore, we assume that facing regular performance appraisals might increase the perceived job pressure, and thus, job demand. Unfortunately, information on performance appraisals is neither collected in 2006 nor in 2005, so we cannot impute values of 2005 into 2006. Therefore, it is impossible to include this variable in our longitudinal analysis.

Job control

We include an individual's working time arrangement in our set of explanatory variables.[13] The working time regimes to be considered are: fixed working time (FWT), employer-determined working time (EDWT), self-managed working time (SMWT), and flextime within a working hours account (FT).[14] We create four dummy variables, indicating whether or not an individual faces FWT, EDWT, SMWT, or FT. In the course of the analysis, FWT serves as reference category. Table 1 displays the average contractual and effective working hours of employees by working time arrangement.

[Insert Table 1 about here]

We can see that the difference between effective and contractual working hours is larger for employees with flexible working hours, i.e., EDTW, SMWT, and FT employees, than for FWT employees. This suggests that employees with flexible working hours face higher job demands than employees with fixed working time.

In the first instance, however, the assignment of an employee to a certain working time arrangement provides information on his level of job control. By definition, FWT and EDWT employees have low working time autonomy and thus low job control with regard to scheduling individual working time, while FT employees and especially SMWT employees face higher levels of working time autonomy and thus job control. Therefore, we expect that EDWT (i.e., high job demand combined with low job control) is associated with higher stress levels, while FT and particularly SMWT (i.e., high job demand combined with high job control) are expected to mitigate the stress-enhancing effect of longer working hours.

[13] All uneven SOEP waves from 2003 through 2011 contain information on an individual's working time arrangement. For 2006 we utilize the information from 2005, if the individual holds the same position at the same company as in the previous year.

[14] See Beckmann et al., 2015 and Table A.1 in Appendix A.1 for more information and a precise definition.

Job reward

We continue to enrich our set of human resource practices by measures of positive and negative job rewards. At first, we consider the fringe benefit, provision of a computer (or laptop), in our analysis.[15] This is a dummy variable taking on value 1 if an individual receives a computer (or laptop) for personal use from his employer and 0 otherwise. In our opinion, the impact of the provision of a computer for personal use on an employee's stress level is ambiguous. On the one hand, the provision of a computer for personal use allows the employee to work more autonomously, thereby increasing perceived job control. On the other hand, the provision of a computer for personal use can reinforce tendencies to work on weekends or after closing time, which goes along with higher job demands. In line with our argumentation on the higher job control associated with flexible time arrangements, we expect the beneficial component of the computer to outweigh the demand component.

Furthermore, we consider an individual's response in regard to the promotion opportunities in his company. Our measure is a dummy variable indicating whether an individual states that the promotion opportunities in his company are bad. We assume that bad promotion opportunities support higher stress levels as they reflect low job rewards.

An adequate salary reflects a company's remuneration policy. We include a dummy variable indicating whether an individual considers his salary as adequate. We expect that an adequate salary mitigates an individual's perceived stress level as it reflects a high job reward situation.

3.3 Descriptive analysis

In Figure 1 we present descriptive statistics of our dependent variable, the extrinsic stress index, depicted by the categories of the selected human resource practices for our full sample. Recall that the higher the stress index, the higher the perceived stress level for the respective group.

[Insert Figure 1 about here]

Individuals receiving a computer (or laptop) exhibit median extrinsic stress indices above zero, while those who do not receive such a fringe benefit have a median below zero (Figure 1a). The median extrinsic stress index is higher for individuals believing that the promotion prospects in their company are bad (Figure 1d), and for individuals subject to regular performance appraisals (Figure 1f). On the contrary, those who believe their

[15] All even SOEP years from 2006 through 2012 cover a list of benefits provided by an employer. For 2011 we utilize the information from 2010, if the individual holds the same position at the same company as in the previous year.

salary to be adequate have lower (median below zero) extrinsic stress indices (Figure 1e) than those who do not consider their salary as adequate (median above zero). Individuals who executed paid overtime in the month before the survey exhibit a higher median extrinsic stress index than those who did not (Figure 1c).[16] Finally, Figure 1b shows the depiction of the extrinsic stress index by working time arrangements. FWT workers exhibit the lowest median extrinsic stress index, while the median for those with EDWT, SMWT and FT is visibly above zero. However, these figures display bivariate statistics that provide only first insights regarding the assumed associations.

4 Empirical strategy

The aim of this analysis is to identify human resource practices that are associated with a worker's perceived stress level. As a starting point, we run a cross-sectional OLS regression of our extrinsic stress index introduced in Section (3.1) on all personnel policy measures that are available in our data. The observation period is the panel wave of 2011, as one of our considered policies, performance appraisals, is only included in this wave. The regression model is therefore specified as

$$stress_i^{ext} = HRP_i\gamma + X_i\beta + u_i. \tag{2}$$

Here, HRP_i is a vector of human resource practices for individual i, X is a vector of control variables, and u_i denotes an idiosyncratic error term with zero mean and finite variance. The inclusion of X conveys the fact that an individual's perceived stress level may also depend on various factors that are not related to specific human resource practices. At first, an individual's stress level might be influenced by certain private life events that happened in the year of the observation. For this reason, we include significant life events, namely the birth of a child, a separation or divorce from partner or spouse, and the death of a close relative to X.

Moreover, X includes individual characteristics such as age, years of schooling, gender, nationality, marital status, the existence of children in the household, an individual's self-reported health status, as well as the number of hours devoted to leisure-time activities. Our set of control variables is further enriched with job characteristics and variables from an individual's employment history that may affect his stress perception. These variables include an individual's monthly gross wage (in natural logarithms), the weekly contracted working hours, the type of employment contract (fixed-term vs. permanent), the tenure

[16] Note that due to a large sample share of individuals with 0 of paid overtime in the month before the survey (88%) we grouped this variable for convenience in simply two groups: individuals with 0 hours, and those who had more than 0 hours.

with the respective company, and the amount of years an individual has experienced in unemployment and part time occupations, respectively. The job-specific variables also include a dummy variable indicating whether an individual holds a management position or is employed in the public sector. Also, we add dummies for the size of the company at which the individual is employed and for the company's sector affiliation. Finally, we include a regional dummy for the worker's place of residence (East or West Germany) into the set of our control variables. Table A.1 in Appendix A.1 provides the definitions and descriptive statistics of the complete set of variables used in this study.

Although we employ a rich set of control variables, estimation of equation (2) is likely to suffer from an omitted variables bias caused by time-invariant and time-varying unobserved individual characteristics. An example for unobserved heterogeneity is an individual's general resistance to stress. The problem of time-invariant unobserved heterogeneity can be eliminated by specifying an individual fixed effects model, i.e.,

$$stress_{it}^{ext} = HRP_{it}\gamma + X_{it}\beta + \alpha_i + \eta_t + \epsilon_{it}. \tag{3}$$

Equation (3) contains observations from two panel waves $t = 2006$ and $t = 2011$.[17] Recall that the performance appraisals variable is no longer included in the HRP-vector. α_i is the individual-specific, time-invariant effect, η_t is a time fixed effect captured by a time dummy variable, and ϵ_{it} denotes an idiosyncratic error term with zero mean and finite variance. Vector X now additionally includes a dummy indicating whether individuals have changed jobs between the two observations in time. This dummy allows to decrease issues associated with possible self-selection into jobs according to individual stress preferences. Equation (3) is estimated using both the pooled OLS (thereby ignoring α_i) and the within estimator.

5 Results

The first three columns of Table 2 display the estimation results according to equation (2). Column (1) contains the results for the variables in HRP without control variables X. The estimates in column (2) refer to an OLS regression of $stress^{ext}$ on HRP and controls for live events. Compared to column (1), the coefficients for the HRP variables in column (2) remain virtually unchanged in terms of both size and significance level. Apart from "salary adequate", each of the other HRP-variables turns out to be a highly significant driver of extrinsic stress perception. In contrast, an adequate salary apparently reduces an individual's perceived extrinsic stress intensity. The corresponding parameter estimate is negative and highly significant at the 1%-level. Interestingly, life events are almost

[17] With panel data consisting of only two periods the fixed effects estimator is algebraically the same as a first difference estimator (Angrist and Pischke, 2009).

irrelevant concerning their association with the extrinsic stress index.[18] We attribute this somewhat surprising finding to the way we measure stress, namely as the perceived burden of very work-specific things such as time pressure or interruptions.

[Insert Table 2 about here]

Column (3) displays the results for the HRP-variables conditioned on the complete set of control variables X. Here, it can be noticed that the coefficient for the PC variable becomes insignificant. Furthermore, also the coefficients for SMWT and Paid overtime become smaller but remain statistically significant. The remaining HRP-variables for employer-determined working time, flextime, salary adequacy, regular performance appraisals, and bad promotion prospects remain statistically significant at the 1%-level indicating a strong positive association with extrinsic stress intensity.

The panel estimates displayed in columns (4) and (5) do not include the coefficients for the performance appraisal variable any more. In addition, note that the pooled OLS estimates in column (4) are based on the unbalanced full sample including individuals whose responses are only observed in one of the two periods, while the fixed effects estimates refer to a balanced panel that only consists of individuals with responses in both periods. While the pooled OLS estimates are mostly in line with the cross-sectional estimates displayed in column (3), the parameter estimates from the fixed effects model specified in equation (3) reveal a remarkable difference with respect to the variables for an employee's working time arrangements. More precisely, when accounting for unobserved individual fixed effects, the coefficients for the flextime and the self-managed working time variable are no longer statistically significant, meaning that workers in these regimes are unlikely to suffer from more extrinsic stress. However, we still observe a highly significant positive association between employer-determined working time and extrinsic stress intensity. Similarly, accounting for individual fixed effects does not affect the significance of the remaining HRP-variables, i.e., paid overtime, salary adequacy, and bad promotion prospects.[19] As a consequence, we can conclude so far that employer-determined working time, paid overtime, and bad promotion prospects are found to be positively associated with extrinsic stress intensity, while salary adequacy apparently mitigates extrinsic stress

[18]The only life event exhibiting a weak statistic association with the extrinsic stress index is the death of a close family member. The coefficients of life events are not reported here, but available from the authors upon request.

[19]In order to test our assumption that stress levels may be prone to unobserved individual time-invariant effects, we run an auxiliary regression of the stress index on all personnel policy measures, control variables as well as the averages of all time-variant covariates. Since the Hausman test is only valid under homoscedasticity and we cluster our standard errors, we run an auxiliary regression instead of applying the usual Hausman test (see Wooldridge, 2010). The null hypothesis of the averages of all time-variant variables being zero is rejected. Thus, our preferred specification is the individual fixed effects model.

intensity.[20]

In attempting to find explanations for our empirical results, we start with the policy of employer-determined working time. We know from Table 1 that individuals with flexible working time regimes are more likely to work long hours than individuals with fixed working time. However, after accounting for unobserved time-constant worker characteristics only employer-determined working time is found to be a driver of a worker's perceived stress intensity. This indicates that longer and flexible working hours do not not necessarily need to be stress-enhancing. In fact, this finding suggests that the lack of working time autonomy is a potential source of increasing stress at work. It therefore supports Karasek's JDC hypothesis, according to which high job demands (here: longer effective working hours) combined with low levels of perceived job control (as documented by employer-determined working time) are likely to involve high stress levels.

A similar reasoning can be applied for the paid overtime variable. Paid overtime does not only indicate longer working hours and thus high job demands, but also less job control, because overtime is paid suggesting that it is induced by the employer.[21] The positive stress effect can be interpreted to be in accordance with the JDC hypothesis. Moreover, it is in line with the literature suggesting that longer working hours are detrimental to an individual's health (see e.g. Bell et al., 2012; Robone et al., 2011).[22]

Finally, the positive stress effect for individuals who consider their promotion prospects as bad supports the theoretical assumption of the ERI model, according to which lower perceived rewards go along with higher stress perceptions. Consequently, the negative stress effect for individuals who perceive their salary as adequate supports the hypothesis that a positive reward situation is negatively associated with extrinsic stress intensity.

[20] We also conducted separate regression analyses for each of the items entering the extrinsic stress index, i.e., time pressure due to a heavy work load, frequent interruptions and disturbances, and increasing job demands over the last years. The resulting parameter estimates are qualitatively similar to the estimates for the extrinsic stress index. An exception, however, is the paid overtime variable whose coefficients turn out to be insignificant in each of the separate regressions. The results of these separate regressions are available from the authors upon request.

[21] The coefficient of the variable paid overtime is rather small (about 0.019), yet statistically significant at the 5% level. Given the average number of paid overtime hours in our sample of 0.53 (see Table A.1 in Appendix A.1) this seems to be a negligible effect. However, when interpreting the effect size one should keep in mind that this low average is due to a large share of respondents with zero paid overtime hours per week. This means that those who do have paid overtime hours actually conduct much more than this average (for our balanced panel this is over 4 hours per week) resulting in a not so small effect for those, who do actually work overtime.

[22] We also added interaction terms of the paid overtime variable with the working time arrangement dummies to equation (3) but obtained no significant effect. This indicates that there is no mutual reinforcing impact of the considered HRP practices on extrinsic stress perception.

6 Sensitivity analysis

In this section, we aim at checking the robustness of our results obtained in the previous section. We proceed in three steps. First, we replace our dependent variable, i.e., the extrinsic stress index, with an intrinsic stress index that will be derived in equation (4). Second, we estimate equation (3) separated for male and female workers. We proceed in that way because we believe that there may be a systematic difference of work-related outcomes by gender. For example, today women still provide the larger share of household production and may therefore suffer more from time-consuming personnel policies such as paid overtime. Moreover, female workers may be more likely to be involved in certain flexible working time arrangements than male workers. Finally, we exploit an exogenous source of variation in our HRP measures by focusing on individuals who have not changed their jobs between the two observation periods 2006 and 2011. We thereby address a potential limitation of our empirical approach in the previous section, where we explicitly account for time-constant unobserved worker characteristics but not for other endogeneity issues such as reversed causality or selectivity.

6.1 Effects on intrinsic stress index

We enrich our analysis with a further dependent variable, the intrinsic stress index. The intrinsic stress index consists of six items measuring an individual's intrinsic coping pattern with job stress. These items are: (i) "At work, I easily get into time pressure" (TIMEPRESS), (ii) "I often think about work-related problems when I wake up" (WPWU), (iii) "When I get home, it is easy to switch off from work" (EASYSO),[23] (iv) "Those closest to me say I sacrifice too much for my career" (SACCAR), (v) "Work seldom lets go of me; it stays in my head all evening" (EVENING), and (vi) "If I put off something that needs to be done that day, I can't sleep at night" (BADSLEEP). For all these items the respondents are asked to what extent they agree to the presented statements on a 1 ("not at all") to 4 ("very heavily") scale.[24] We then proceed as in the case of the extrinsic stress index, i.e., at first we standardize the score of each item, before we standardize the sum of these six standardized items:

$$\begin{aligned} stress_{it}^{int} =& STD[STD(TIMEPRESS_{it}) + STD(WPWU_{it}) + STD(EASYSO_{it}) \\ &+ STD(SACCAR_{it}) + STD(EVENING_{it}) + STD(BADSLEEP_{it})]. \end{aligned} \tag{4}$$

We end up with an intrinsic stress index, $stress_{it}^{int}$ for individual i at time t, with mean 0 and variance 1.

[23] The response to this question was reversed, before inclusion into the overall score.

[24] These items represent an operationalization of the overcommitment component in the ERI model (Siegrist et al., 2009).

Table 3 presents the estimation results of the regression models

$$stress_i^{int} = HRP_i\gamma + X_i\beta + u_i \tag{5}$$

and

$$stress_{it}^{int} = HRP_{it}\gamma + X_{it}\beta + \alpha_i + \eta_t + \epsilon_{it}, \tag{6}$$

which differ from equations (2) and (3) only with respect to the dependent variable, i.e., $stress^{ext}$ is replaced by $stress^{int}$. Recall that according to Siegrist (1996) the intrinsic stress index measures an individual's coping pattern with the overall job situation.

[Insert Table 3 about here]

The estimation results of equations (5) and (6) are qualitatively very similar to the previous findings. According to our preferred fixed effects specification in column (5), employer-determined working time, paid overtime, and bad promotion prospects turn out to be positively related to intrinsic stress intensity, while salary adequacy and intrinsic stress level are negatively associated. Moreover, the cross-sectional estimates for the performance appraisal variable also confirm the corresponding estimates in Section 5, i.e., regular performance appraisals are positively associated with a worker's intrinsic stress intensity.

6.2 Splitting the sample by gender

It is possible that perceived extrinsic stress intensity is differently affected by a firm's personnel policy depending on whether the concerned worker is male or female. Specifically, we assume that owing to their higher involvement in household production, female workers may suffer more from policies that go along with longer working hours than male workers. For example, time pressure may be more important when a worker has to leave work at a certain time to meet family or other obligations. In other words, the time constraint (i.e., the allocation of time budget) may be more binding for female workers than for male workers.

In Table 4 we present the pooled OLS and the individual fixed effects estimations resulting from equation (3) separated for male and female workers.

[Insert Table 4 about here]

Columns (1) and (2) display the pooled OLS and fixed effects parameter estimates for male workers, while columns (3) and (4) show the corresponding estimates for female workers. Most results are very similar in the male and the female sample. However, there is one important exception. Apparently, male workers in flexible working time arrangements are less likely to perceive higher extrinsic stress levels than female workers.

According to our preferred fixed effects estimates, the most remarkable result is that employer-determined working time significantly increases extrinsic stress level for female but not for male workers. This leads to the conclusion that the overall positive effect of employer-determined working time on extrinsic stress level found in Section 5 is mainly driven by female workers. Obviously, female workers suffer more from lacking control over working hours than male workers. This may result from a more constrained time budget of female workers in their private lives as female workers are more likely to be forced to coordinate work and family issues than male workers.

The positive effect of employer-determined working time on extrinsic stress level in the sample of female workers is also in line with the findings of Bell et al. (2012) who find a negative effect of overwork on subjective health for women, even if their actual working hours range between 20–35 hours per week. Similar to us, the authors attribute these results to possibly more binding time constraints in the private life of female workers.

6.3 Exploiting exogenous variation

Our econometric approach does not allow for establishing causal effects, because fixed effects estimates do only account for time-constant unobserved heterogeneity but not for time-varying unobserved heterogeneity. For example, reverse causality leads to a potential endogeneity bias that cannot be eliminated by applying a fixed effects estimation strategy. In our case, especially the subjective HRP variables indicating salary adequacy and promotion prospects appear to be prone to reverse causality. Another endogeneity problem that usually cannot be completely ruled out via fixed effects estimations is selectivity. In the present case, for example, (self-)selection of workers into flexible working time arrangements or paid overtime might also depend on unobserved time-varying factors.

A common solution in these cases is the implementation of an instrumental variables (IV) approach (Antonakis et al., 2010). However, given the objective of our analysis, i.e., testing the impact of several personnel policies on a worker's stress level instead of focusing on one specific policy, it is rather impossible to find suitable instruments for several policies at once. We considered to decompose the analysis by regressing stress intensity on single personnel policies and instrumenting those.[25] However, the considered instruments were either too weak and/or failed to satisfy the exclusion restriction, so we finally abstained from experimenting with an IV estimation approach.

Although we cannot completely account for the sources of time-varying endogeneity, we can at least alleviate these endogeneity issues to some extent by restricting our sample to individuals who did not change jobs between the two observation periods 2006 and 2011. Proceeding in that way, we exploit an exogenous source of variation in our HRP

[25]For instance, we considered union membership and the amount of close friends as instruments for salary adequacy.

measures, because it can be argued that individuals who do not change their jobs over a period of five years are unlikely to cause modifications regarding certain personnel policies on their own. Hence, observed changes in personnel policies must be induced by the employer rather than being a worker's response to stress burden. While the benefit of this approach remains arguable with respect to our subjective explanatory variables (i.e., salary adequacy and promotion prospects), it seems to be a reasonable procedure to address endogeneity issues regarding the variables of paid overtime, flexible working time arrangements and the provision of a computer.[26]

Table 5 presents the results from exploiting exogenous variation for both the extrinsic and the intrinsic stress indices, where the focus is on the estimation of equations (3) and (6).

[Insert Table 5 about here]

We can ascertain that the parameter estimates qualitatively remain quite stable for the majority of our considered HRP variables. Specifically, bad promotion prospects are still found to increase both extrinsic and intrinsic stress intensity, while the reverse is still true for salary adequacy. Moreover, as before employer-determined working time is the only policy of flexible working time that turns out to increase extrinsic and intrinsic stress intensity in the fixed effects specification. However, in the extrinsic stress intensity model the significance of the point estimate drops from the 1%- to the 10%-level. Nevertheless, assuming that selection into working time regimes is induced by the employer rather than being the result of a worker's self-selection via job change, we can confirm our previous conclusion according to which low levels of working time autonomy tend to increase work-related stress.

There are also some interesting differences in the parameter estimates compared to the results discussed in Section 5. First, paid overtime is still a significant driver of intrinsic stress intensity, but this does no longer hold for extrinsic stress intensity. Thus, our previous interpretation that paid overtime is associated with higher extrinsic stress levels should be regarded with some caution. Second, on the contrary to our previous fixed effects estimations, where the provision of a computer for private use does not turn out to be a significant predictor of extrinsic or intrinsic stress intensity, this variable is now weakly significant with a negative sign in the fixed effects model for extrinsic stress

[26]Exploiting exogenous variation in the described way is a quite common approach in the commuting literature. A strand of literature utilizes the approach of focusing on individuals that did not change their jobs or their place of residence in order to analyse the effect of commuting time on work-related outcomes. Here, it is argued that after excluding job and residence changers the observed variation in commuting time/distance must be attributable to plant shifts by the employer and is therefore exogenous for the observed individuals. Recent applications include, for example, Lorenz and Goerke (2015) who utilize this strategy to evaluate the effects of commuting on sickness absence in Germany relying on data from the SOEP or Roberts et al. (2011) who regard the gender specific effects of commuting on psychological health.

intensity and weakly significant with a positive sign in the fixed effects model for intrinsic stress intensity. A possible explanation for these contradicting findings is that, while the provision of a computer for private use can involve higher job demands, it can also go along with higher working time autonomy. However, we should not put too much weight on these results and interpretation, because of the fact that the incidence of providing computers for private use as a fringe benefit in our sample is very low (about 4%), meaning that the estimates may merely result from a lack of variation.

7 Conclusion

The objective of this study was to investigate the associations between various personnel policies and work-related stress. Our empirical results can be summarized as follows: First, after accounting for time-constant unobserved individual characteristics we find that salary adequacy turns out to reduce both extrinsic and intrinsic stress intensity, while bad promotion prospects, employer-determined working time, and paid overtime contribute to increase these stress indicators. In contrast to this finding, policies of flexible working time that involve some working time autonomy (i.e., self-managed working time and flextime) are found to be unrelated to higher stress levels. Second, after splitting the sample with respect to gender, we find that the positive effect of employer-determined working time on extrinsic stress intensity can only be observed in the sub-sample of female workers but not in the sub-sample of male workers, suggesting that female workers are more likely to be time-constrained owing to the obligation to coordinate work and family issues. Finally, after exploiting a source of exogenous variation with regard to the considered personnel policies to alleviate potential time-varying endogeneity issues, the previous results remain stable except for paid overtime whose estimated coefficients fail to be significant in the extrinsic stress index model (but not in the intrinsic stress index model).

The results for paid overtime and the flexible working time policies are consistent with Karasek's Job Demand-Control (JDC) model, according to which high job demands (longer working hours) combined with low job control (low working time autonomy in the form of employer-determined working time as well as employer-induced overtime) are likely to increase stress at work and subsequently, to endanger an individual's health. Therefore, the general conclusion is that long working hours are likely to have detrimental consequences for worker health in absence of control over scheduling individual working time (Bassanini and Caroli, 2014). Consequently, despite the fact that workers in self-managed working time and flextime arrangements also work, on average, more hours than their counterparts with fixed working time, they are not found to suffer from higher stress levels, which can be attributed to higher time sovereignty mitigating the stress-enhancing consequences of longer working hours.

Furthermore, it is obvious to relate our results for bad promotion prospects and salary

adequacy to Siegrist's Effort-Reward Imbalance (ERI) model. According to this model, a good reward situation mitigates perceived stress intensity, while the opposite is true for unfavourable reward situations. Our empirical results for salary adequacy and bad promotion prospects insistently confirm this view.

Finally, we should not forget that according to the results of a cross-sectional analysis workers who are subject to regular performance appraisals, experience significantly higher perceived stress levels. This association indicates that performance appraisals increase a worker's job demands. Although the estimated effect at the cross-sectional level is relatively strong, one should be careful with regard to a more detailed interpretation, because owing to lacking data availability we can only estimate the performance appraisal effect based on conditional correlations without any endogeneity correction.

A potential limitation of this study is that the estimated effects of personnel policies on a worker's stress level cannot be interpreted in a causal manner. However, we should have been able to limit potential endogeneity concerns to a large extent by applying fixed effects models and by restricting the analysis to a sub-sample that allows us to exploit some of the exogenous variation of the considered personnel policies. Nevertheless, our empirical results have to be interpreted somewhat cautiously and in a merely associative manner.

Furthermore, one might be concerned about the utilization of subjective dependent (perceived stress levels) and explanatory variables (promotion prospects, salary adequacy representing the perceived individual reward situation). A possible problem with such an approach is that the relation between dependent and explanatory variables may be driven by person-specific unobserved factors such as certain personality traits. In accordance with Bell et al. (2012) who regress self-assessed health on subjective measures of overwork, we argue that the estimation of individual fixed effects models should sufficiently take this issue into account.

Despite the necessity to interpret our estimation results carefully, we can derive some management implications that employers should consider in their own interest to save costs caused by increased stress intensities. First, employers should pay attention to adequate salaries, because adequate salaries contribute to an improved effort–reward (im)balance. Second, for the same reason employers can be advised to offer good promotion prospects. Finally, employers should reduce the amount of flexible working hours, when flexibility is determined by the employer. Instead, employers should consider granting their employees more job control, for example, via flextime or self-managed working time arrangements. Even if job demands are high, policies of increasing job control can help to mitigate the consequences of rising stress at work.

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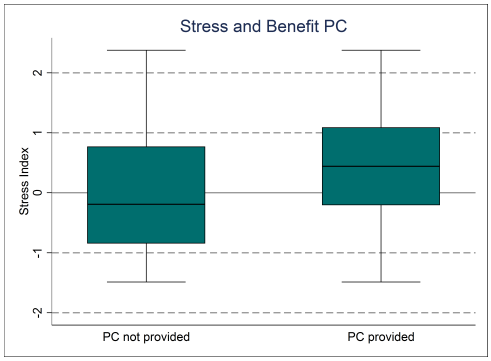
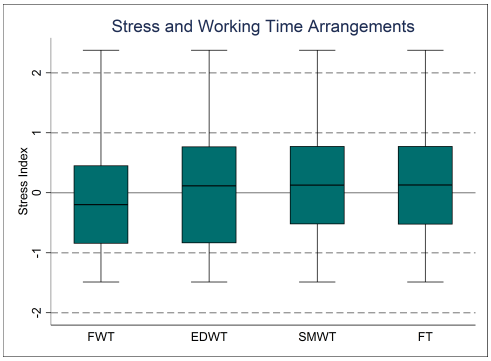
Tables and figures

Figure 1: Extrinsic stress index and human resource practices

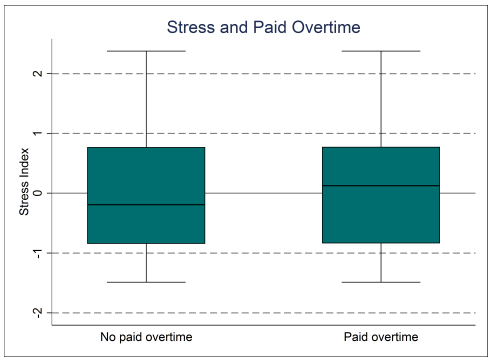
(a)



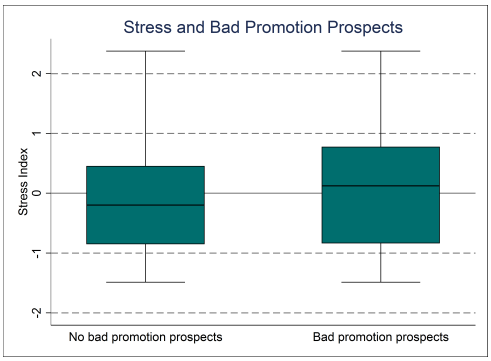
(b)



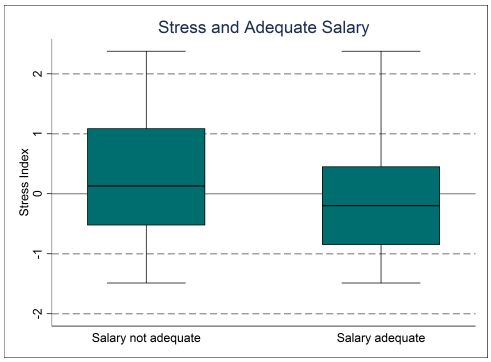
(c)



(d)



(e)



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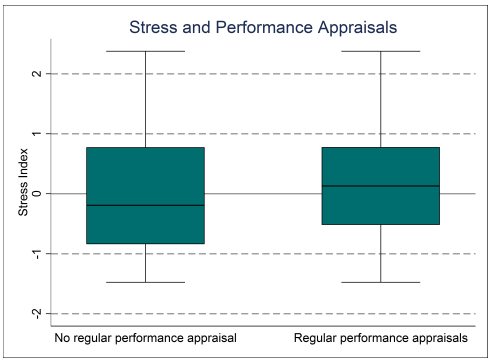

Notes: The above figure depicts the extrinsic stress index by categories of the main explanatory variables. These are: (1a) benefit PC, (1b) working time arrangements, (1c) paid overtime last month (discrete variable summarized into two categories, 0 and >0, hours rescaled to weekly level), (1d) bad promotion prospects, (1e) salary adequate, and (1f) performance appraisals.
All figures are box plots with the median being marked bold. The upper box range is the 75^{th} percentile (x^{75}), and the lower range is the 25^{th} percentile (x^{25}). The upper whisker bound is located at $x^{75} + 1.5 \times (75^{th} - 25^{th})$ and the lower whisker bound is located at $x^{25} - 1.5 \times (75^{th} - 25^{th})$.
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.

Table 1: Effective and contractual working hours per week by working time arrangements

Working time arrangement		**Working hours per week**			
		Effective hours		Contractual hours	
	Share in %	Mean	Std	Mean	Std
Fixed working time (FWT)	42.22	37.88	9.51	35.09	7.98
Employer-determined working time (EDWT)	20.78	39.29	10.42	34.55	8.16
Self-managed working time (SMWT)	10.10	44.29	12.02	36.20	7.87
Flextime within a working hours account (FT)	26.90	40.51	7.80	36.62	5.94

Notes: Std is the standard deviation. Share in % indicates the sample share of the individuals having the particular working time arrangement.
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.

Table 2: Personnel policy and the extrinsic stress score

Dependent variable	**Extrinsic stress index**				
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) FE
Benefit PC	0.232***	0.228***	0.102	0.072	-0.152
	(0.068)	(0.068)	(0.070)	(0.050)	(0.093)
EDWT	0.155***	0.157***	0.123***	0.111***	0.133***
	(0.039)	(0.039)	(0.038)	(0.026)	(0.051)
SMWT	0.284***	0.286***	0.130***	0.154***	-0.039
	(0.050)	(0.050)	(0.051)	(0.036)	(0.073)
FT	0.316***	0.317***	0.163***	0.170***	0.057
	(0.037)	(0.037)	(0.038)	(0.026)	(0.066)
Paid overtime	0.021***	0.021***	0.015*	0.016***	0.019**
	(0.008)	(0.008)	(0.008)	(0.005)	(0.009)
Salary adequate	-0.466***	-0.467***	-0.456***	-0.421***	-0.172***
	(0.030)	(0.030)	(0.030)	(0.020)	(0.039)
Bad promotion prospects	0.232***	0.231***	0.241***	0.218***	0.219***
	(0.031)	(0.031)	(0.030)	(0.020)	(0.037)
Performance appraisals	0.209***	0.208***	0.113***		
	(0.030)	(0.030)	(0.033)		
Life events	NO	YES	YES	YES	YES
Controls	NO	NO	YES	YES	YES
Observations	4,343	4,343	4,343	9,562	4,800
Adj. R^2 / R-within	0.111	0.111	0.188	0.160	0.063

Notes: */**/*** denotes statistical significance at the 10/5/1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) - (4)) and robust standard errors clustered at the individual-level (column (5), 2,400 individuals). The *extrinsic stress index* is defined in equation 1 in Section 3.1. The specification in column (2) controls for birth of a child, separation or divorce from partner or spouse, and death of a close relative. The specifications in columns (3)-(5) contain a set of covariates: age†, age squared†, years of schooling†, gender†, nationality†, marital status, children in the household under 16, birth of a child, separation or divorce from partner or spouse, death of a close relative, self-reported health status, number of hours devoted to leisure-time activities, log monthly gross wage, weekly contracted working hours, type of employment contract (fixed-term vs. permanent), tenure with the company, years unemployed, years in part-time employment, management position, public employee, job changed between observations, company size, 8 industry dummies, time (2011)‡ and regional (East Germany) dummies. The time-invariant variables, marked with a †, are not included in specifications in column (5). The time dummy for 2011, marked with a ‡ is not included in the cross-sectional specification in column (3). The descriptive statistics for all covariates can be found in Table A.1 in Appendix A.1.
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.

Table 3: Personnel policy and the intrinsic stress score

Dependent variable	**Intrinsic stress index**				
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) FE
Benefit PC	0.374***	0.376***	0.294***	0.211***	0.129
	(0.068)	(0.068)	(0.067)	(0.050)	(0.101)
EDWT	0.239***	0.242***	0.176***	0.176***	0.116**
	(0.039)	(0.039)	(0.038)	(0.026)	(0.047)
SMWT	0.398***	0.398***	0.262***	0.240***	0.072
	(0.052)	(0.052)	(0.052)	(0.037)	(0.070)
FT	0.146***	0.148***	0.043	0.039	0.002
	(0.037)	(0.037)	(0.038)	(0.026)	(0.060)
Paid overtime	0.017**	0.018**	0.020***	0.017***	0.026***
	(0.007)	(0.007)	(0.008)	(0.006)	(0.010)
Salary adequate	-0.380***	-0.382***	-0.325***	-0.300***	-0.127***
	(0.030)	(0.030)	(0.030)	(0.021)	(0.036)
Bad promotion prospects	0.137***	0.139***	0.112***	0.072***	0.124***
	(0.031)	(0.031)	(0.030)	(0.021)	(0.036)
Performance appraisals	0.084***	0.083***	0.070**		
	(0.031)	(0.031)	(0.032)		
Life events	NO	YES	YES	YES	YES
Controls	NO	NO	YES	YES	YES
Observations	4,321	4,321	4,321	9,541	4,788
Adj. R^2 / R-within	0.075	0.075	0.162	0.149	0.057

Notes: */**/*** denotes statistical significance at the 10/5/1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) - (4)) and robust standard errors clustered at the individual-level (column (5), 2,394 individuals). The *instrinsic stress index* is defined in equation 4 in Section 6.1. The specification in column (2) controls for birth of a child, separation or divorce from partner or spouse, and death of a close relative. The specifications in columns (3)-(5) contain a set of covariates: age†, age squared†, years of schooling†, gender†, nationality†, marital status, children in the household under 16, birth of a child, separation or divorce from partner or spouse, death of a close relative, self-reported health status, number of hours devoted to leisure-time activities, log monthly gross wage, weekly contracted working hours, type of employment contract (fixed-term vs. permanent), tenure with the company, years unemployed, years in part-time employment, management position, public employee, job changed between observations, company size, 8 industry dummies, time (2011)‡ and regional (East Germany) dummies. The time-invariant variables, marked with a †, are not included in specifications in column (5). The time dummy for 2011, marked with a ‡ is not included in the cross-sectional specification in column (3). The descriptive statistics for all covariates can be found in Table A.1 in Appendix A.1.

Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.

Table 4: Personnel policy and the extrinsic stress score by gender

Dependent variable	**Extrinsic stress index**			
	male sample		female sample	
	(1) OLS	(2) FE	(3) OLS	(4) FE
Benefit PC	-0.020	-0.120	-0.024	-0.188
	(0.086)	(0.115)	(0.142)	(0.149)
EDWT	0.008	0.078	0.169***	0.188**
	(0.052)	(0.067)	(0.053)	(0.076)
SMWT	0.099	-0.124	0.194**	0.098
	(0.068)	(0.092)	(0.093)	(0.115)
FT	0.183***	0.033	0.160***	0.090
	(0.049)	(0.084)	(0.054)	(0.099)
Paid overtime	0.010	0.021*	0.016	0.024*
	(0.008)	(0.011)	(0.014)	(0.014)
Salary adequate	-0.410***	-0.133**	-0.452***	-0.200***
	(0.039)	(0.054)	(0.042)	(0.057)
Bad promotion prospects	0.188***	0.184***	0.246***	0.233***
	(0.039)	(0.049)	(0.044)	(0.055)
Life events	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Observations	2,640	2,640	2,160	2,160
Adj. R^2 / R-within	0.159	0.067	0.191	0.094

Notes: */**/*** denotes statistical significance at the 10/5/1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) and (2)) and robust standard errors clustered at the individual-level (columns (2) and (4), 1,320 and 1,080 individuals). The *extrinsic stress index* is defined in equation 1 in Section 3.1. All specifications contain a set of covariates: age†, age squared†, years of schooling†, gender†, nationality†, marital status, children in the household under 16, birth of a child, separation or divorce from partner or spouse, death of a close relative, self-reported health status, number of hours devoted to leisure-time activities, log monthly gross wage, weekly contracted working hours, type of employment contract (fixed-term vs. permanent), tenure with the company, years unemployed, years in part-time employment, management position, public employee, job changed between observations, company size, 8 industry dummies, time (2011) and regional (East Germany) dummies. The time-invariant variables, marked with a †, are not included in specifications in columns (2) and (4). The descriptive statistics for all covariates can be found in Table A.1 in Appendix A.1.
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.

Table 5: Personnel policy and job stayers sample

Dependent variable	**Extrinsic stress index**		**Intrinsic stress index**	
	(1) OLS	(2) FE	(3) OLS	(4) FE
Benefit PC	-0.091	-0.204*	0.276***	0.212*
	(0.087)	(0.115)	(0.082)	(0.121)
EDWT	0.109***	0.103*	0.174***	0.115**
	(0.041)	(0.054)	(0.041)	(0.051)
SMWT	0.140**	-0.070	0.224***	0.076
	(0.060)	(0.081)	(0.061)	(0.075)
FT	0.197***	0.092	0.032	0.047
	(0.039)	(0.073)	(0.039)	(0.067)
Paid overtime	0.010	0.005	0.029***	0.025**
	(0.008)	(0.010)	(0.009)	(0.011)
Salary adequate	-0.441***	-0.147***	-0.328***	-0.113***
	(0.031)	(0.043)	(0.032)	(0.039)
Bad promotion prospects	0.197***	0.241***	0.063*	0.128***
	(0.032)	(0.040)	(0.033)	(0.039)
Life events	YES	YES	YES	YES
Controls	YES	YES	YES	YES
Observations	4,016	4,016	4,014	4,014
Adj. R^2 / R-within	0.169	0.056	0.158	0.052

Notes: */**/*** denotes statistical significance at the 10/5/1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) and (2)) and robust standard errors clustered at the individual-level (columns (2) and (4), 2,008 and 2,007 individuals). The *stress indices* are defined in equations 1 and 4 in Sections 3.1 and 6.1. All specifications contain a set of covariates: age†, age squared†, years of schooling†, gender†, nationality†, marital status, children in the household under 16, birth of a child, separation or divorce from partner or spouse, death of a close relative, self-reported health status, number of hours devoted to leisure-time activities, log monthly gross wage, weekly contracted working hours, type of employment contract (fixed-term vs. permanent), tenure with the company, years unemployed, years in part-time employment, management position, public employee, job changed between observations, company size, 8 industry dummies, time (2011) and regional (East Germany) dummies. The time-invariant variables, marked with a †, are not included in specifications in columns (2) and (4). The descriptive statistics for all covariates can be found in Table A.1 in Appendix A.1.
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.

A Appendix

A.1 Summary statistics

Table A.1: Definition and descriptive statistics of the variables

Variable	Definition	N	Mean	Std	Min-Max
Dependent variables					
Extrinsic stress index	Standardized index of three extrinsic stress items (see Section 3.1)	9562	0.00	1.00	-1.49 - 2.38
Intrinsic stress index	Standardized index of six intrinsic stress items (see Section 6.1)	9541	0.00	1.00	-2.02 - 2.87
Main explanatory variables					
Benefit PC	Dummy variable indicating whether or not respondent receives a computer/laptop for personal use	9562	0.04	0.19	0 - 1
Fixed working time (FWT)	Dummy variable indicating whether or not an employee has fixed working times (serves as reference category in the analysis)	9562	0.42	0.49	0 - 1
Employer-determined working time (EDWT)	Dummy variable indicating whether or not an employee faces flexible working hours determined by the employer (reference category: FWT)	9562	0.21	0.41	0 - 1
Self-managed working time (SMWT)	Dummy variable indicating whether or not an employee has extensive decision-making authority in terms of scheduling individual working hours (reference category: FWT)	9562	0.1	0.3	0 - 1
Flextime within a working hours account (FT)	Dummy variable indicating whether or not an employee is allowed to vary daily working hours, where daily attendance is restricted to a defined time interval (working hours account) (reference category: FWT)	9562	0.27	0.44	0 - 1
Salary adequate	Dummy variable indicating whether or not respondent considers his salary adequate given his efforts and achievements	9562	0.48	0.5	0 - 1
Performance appraisals	Dummy variable indicating whether or not respondent's performance is regularly assessed by a superior	4343	0.4	0.49	0 - 1
Overtime paid	Number of paid overtime hours last month	9562	0.53	1.94	0 - 22.85
Bad promotion prospects	Dummy variable indicating whether respondent perceives promotion prospects in his company as bad	9562	0.67	0.47	0 - 1

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... Table A.1 continued

Variable	Definition	N	Mean	Std	Min-Max
Control variables					
Male	Dummy variable indicating whether or not an employee is male	9562	0.53	0.5	0 - 1
Age	Age of respondent	9562	44.99	9.7	20 - 65
Age squared	Age of respondent squared and divided by 100	9562	21.18	8.58	4 - 42.25
Foreign nationality	Dummy variable indicating whether or not an employee is of non-German nationality	9562	0.05	0.22	0 - 1
Schooling	Years of schooling	9562	12.75	2.67	7 - 18
Marital status	Dummy variable indicating whether or not individual has a settled living partner	9562	0.79	0.41	0 - 1
Children aged under 16	Dummy variable indicating whether an individual has one or more children aged under 16 who currently live in the household	9562	0.34	0.47	0 - 1
Monthly gross wage	Gross wage of the respondent in the month before the survey (logarithm)	9562	7.79	0.56	5.99 - 10.13
Fixed-term contract	Dummy variable indicating whether or not an employee has a fixed-term contract	9562	0.04	0.19	0 - 1
Job tenure	Years of an employee's job tenure	9562	14.04	9.91	1.2 - 49.8
Part-time experience	Years of an employee's experience in a part-time job	9562	3.19	5.85	0 - 39.20
Unemployment experience	Years of a worker's unemployment experience	9562	0.47	1.25	0 - 24
Contractual working hours	Weekly working hours as according to employment contract	9562	35.5	7.56	1 - 72
Management	Dummy variable indicating whether employee holds a management position	9562	0.2	0.4	0 - 1
Public service	Dummy variable indicating whether employee is a public servant	9562	0.14	0.35	0 - 1
Job changed	Dummy variable indicating whether employee works in the same company in both waves	9562	0.3	0.46	0 - 1
Firm size 1-19	Dummy variable indicating whether respondent works in a firm with 1 to 19 employees (serves as reference category in the analysis)	9562	0.18	0.39	0 - 1
Firm size 20-199	Dummy variable indicating whether respondent works in a firm with 20 to 199 employees (reference category: <20)	9562	0.31	0.46	0 - 1
Firm size 200-1999	Dummy variable indicating whether respondent works in a firm with 200 to 1999 employees (reference category: <20)	9562	0.25	0.43	0 - 1
Firm size $\geq$ 2000	Dummy variable indicating whether respondent works in a firm with equal or more than 2000 employees (reference category: <20)	9562	0.26	0.44	0 - 1

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... Table A.1 continued

Variable	Definition	N	Mean	Std	Min-Max
Hobbies and other leisure activities	Number of hours devoted to hobbies and other leisure activities on a typical working day	9562	1.67	1.27	0 - 13
Current health: very good	Dummy variable indicating whether or not an employee assesses her current health status as very good (serves as reference category in the analysis)	9562	0.07	0.26	0 - 1
Current health: good	Dummy variable indicating whether or not an employee assesses her current health status as good (reference category: very good)	9562	0.47	0.5	0 - 1
Current health: satisfactory	Dummy variable indicating whether or not an employee assesses her current health status as satisfactory (reference category: very good)	9562	0.34	0.47	0 - 1
Current health: poor	Dummy variable indicating whether or not an employee assesses her current health status as poor (reference category: very good)	9562	0.1	0.31	0 - 1
Current health: bad	Dummy variable indicating whether or not an employee assesses her current health status as bad (reference category: very good)	9562	0.02	0.12	0 - 1
Separation from partner or divorce	Dummy variable indicating whether respondent has been divorced or separated from partner in the survey year	9562	0.03	0.16	0 - 1
Child born	Dummy variable indicating whether respondent became a parent in the survey year	9562	0.02	0.13	0 - 1
Death in family	Death of a close family member in the year of the survey	9562	0.03	0.17	0 - 1
East Germany	Dummy variable indicating whether respondent lives in East Germany	9562	0.24	0.43	0 - 1
Time dummies	Two dummies for the survey years 2006 and 2011				
Sector dummies	9 dummy variables for the industry a respondent is employed in				

Notes: N is the number of observations. Std is the standard deviation.
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.