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Stressed by Your Job: Does Personnel Policy Matter?*

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Abstact

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. In this paper, the relationship between personnel policy and work-related stress is investigated by considering a series of human resource management practices that relate to a worker's job reward, job demand, or job control situation. The authors use data from the German Socio-Economic Panel (SOEP) and find statistically significant associations between several policies and work-related stress. Most importantly, bad promotion opportunities and low working time control are found to be associated with higher stress levels, while the opposite is true for an adequate salary.

JEL-Classification: I10, J81, M54

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 some advantages from an employee's perspective, work-related stress is also likely on

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the rise. For example, in the European Working Conditions Survey 2010, over 26% of the respondents from the EU27 countries report that they experience stress at work "always or most of the time", and an additional 40% state that they experience it at least "sometimes" (Eurofond, 2010).

Stress at work might involve serious consequences for both employees and employers. First, employees might respond to significant stress in their workplace by choosing or considering the exit option, i.e., they quit their jobs or increasingly think about leaving their current employer to escape from the heavy workload. In fact, stress at work has been identified as a predictor for quitting intentions (Leontaridi / Ward, 2002). As a result, stressed workers might feel less committed to their employer and generate fluctuation costs associated with a declining work morale. Second, work-related stress can lead to substantial physical and mental health problems, such as cardiovascular disease, musculoskeletal disease, back pain, depression, and burnout (e.g., Béjean / Sultan-Taïeb, 2005). The resulting costs constitute an increasing challenge for establishments, as ill employees are less productive and have higher absenteeism rates. For instance, Goetzel et al. (2003) identify back disorders and depressions as illnesses that are associated with stress among the ten most costly employee health problems for U.S. enterprises. Moreover, according to a European Commission report, approximately 9% of the European working-age population with health problems suffer most from mental health problems (Oortwijn et al., 2011). Over 14% of workers with health problems, report that they 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 take sick leave in the previous twelve months and over 20% missed out on more than a month of work (Eurostat, 2010). Therefore, firms are faced with the question about the extent to which 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, 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 most commonly used conceptional frameworks in epidemiology for work-related stress are the Job Demand-Control (JDC) model (Karasek, 1979) and the Effort-Reward Imbalance (ERI)

[1] See, for instance, Kinman / Jones (2005) for a discussion of the term "workplace stress" and the comparison of an academic and lay 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 / Jones, 2005). However, given the orientation of this paper, we adopt the "layman" terminology and refer to the outcome as stress as previously done in economics (e.g., Hamermesh / Lee, 2007; Johnston / 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.

model (Siegrist, 1996). Both frameworks are broadly in line with this 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 manifold way. First, most studies dealing with work-related stress use small data samples stemming from very specific populations. In contrast, we aim to answer the proposed question by utilizing a large representative household data set, the German Socio-Economic Panel (SOEP). Second, most related studies focus on single personnel policy measures as the main explanatory variable (e.g., Johnston/Lee, 2013), while we consider a series of personnel policies that potentially have a mutual influence on work-related stress. We chose this approach, because considering a set of policies rather than a single measure is a far more realistic replication of the scope of choices that an employer confronts when shaping an individual's workplace. As a by-product, by regarding several policies at once, we are likely to reduce a possible omitted variable bias. Specifically, we consider the employees' working time arrangements, the benefit of a computer for private use, paid overtime hours, regular performance appraisals, salary adequacy, and promotion prospects in our analysis. Third, our data allow us to include a rich set of covariates reflecting job and individual characteristics, including important life events, that might also influence a worker's perception of stress. This procedure allows us to obtain more precise parameter estimates and additionally limits the consequences of an omitted variables bias. Finally, we explicitly address other endogeneity issues that may be associated with our personnel policies by applying appropriate regression techniques. Provided that our approach to examine the stress consequences of various personnel policies does not allow us to apply an instrumental variables estimation strategy to obtain causal effects, our chosen estimation strategy is expected to produce meaningful results that can be used to sensitise employers to the problem of stress factors at work.

Our results indicate that bad promotion opportunities, paid overtime 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. The results remain largely robust, when we exploit an exogenous source of variation in 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, and 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 job control combined with high demands will result in mental stress, while high job demands 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., heavy workload) is particularly unfavourable to an individual's health. The model's application, which was initially developed to explain cardiovascular diseases, 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 such as job demands 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. Economists use the expression time pressure to conceptualise stress. Hamermesh / 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 / Lee, 2007, 374).[3]

[2] The word "effort" may be a misleading term in economics, as it is typically associated with an employee's willingness to work, which is a desired behaviour for employers. In Siegrist (1996), however, the term is used to signify a perceived burden triggered by expending a great amount of effort in order to fulfil a job's requirements.

Several studies from occupational medicine have analysed the association between working hours and health-related outcomes. In this context, working time arrangements can be evaluated from two employee perspectives: as job demands (i.e., as a heavy workload that manifests itself in overtime) and as job control (e.g., whereby employees exert autonomy over their working schedule).

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 a psychiatric disorder (e.g., Stansfeld et al., 1999). Bosma et al., (1998) also tested the ERI model and found that an imbalance between efforts and rewards is associated with a significantly higher risk of coronary heart disease. Support for the hypothesis that an unfavourable effort–reward combination is detrimental to individual health is also found in the review of van Vegchel et al. (2005) who consider more than 40 studies which test the ERI model.

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 demand and job control. Van Doef/Maes (1999) find that a large share of the reviewed studies support the hypothesis that high job demands impair 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 consequences of workplace characteristics on stress. As it is not our intention here to draw a complete picture, we conclude this section by summarizing recent findings on the influence of workplace characteristics on stress as well as on related outcomes such as health, well-being, and job satisfaction.

In regard to the impact of individual personnel policies on well-being, there are studies analysing the effects of promotions on stress (Johnston/Lee, 2013), on health (Boyce/Oswald, 2012), and on job satisfaction (Kosteas, 2011). Johnston/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 employees' perceived job control increases following a promotion, the increased job stress seems to be

[3] In respect to different worker population surveys, this seems to be a very reasonable approach. For instance, "working under time and performance pressure" is the work-related burden that was reported most frequently (about 40%) 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 that they work to tight deadlines "at least a quarter of the time" (Eurofond, 2010).

the predominant outcome. Boyce/Oswald (2012) evaluate the effect of promotions on health in a longitudinal setting and contest previous findings that identify a positive association between job control and health by stating that actually there is a selection of healthy people into a promotion, while individuals often experience a substantial deterioration in their health after a promotion.

In a European comparison of the effect of working conditions on various mental health indicators, Cottini/Lucifora (2013) find a statistically significant association between high job demands and stress. Furthermore, they find support for the hypothesis that job demands have a negative causal effect on mental health using an instrumental variables (IV) regression, where they instrument job demands by exploiting the variation in workplace regulations over industries, countries, and time. In contrast to our study, Cottini and Lucifora (2013) do not consider particular personnel policies, but group their explanatory variables by job demands and hazards that cover, for instance, psychological stressors such as 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/Sousa-Poza, 2009; Gupta/Kristensen, 2008). In this context, Kleibrink (2014) identifies working hours as an important channel through which job satisfaction affects health. 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 cause of death in the United States. In this context, it should be noted that Goh et al. (2015) regard ten different workplace practices that could affect employee health. However, the comparability of their results to our study is limited, as they include lay-offs and health insurance provision.

None of the above-mentioned studies has explicitly investigated the effects that a series of personnel policies have 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 stress level.

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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/Caroli (2014) for a survey on the relationship between working hours and health.

3. Data and Variables

For our analysis, we use data from the German Socio-Economic Panel (SOEP).[6] The SOEP is an annual longitudinal household survey that has been 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 large amount of additional information 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 questions related to job stress 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. In contrast to this approach, we limit our concept of stress solely to the perceived burdens that are attributable to the individual's effort. However, we include selected reward items as proxies for personnel policies in our set of explanatory variables (see Section 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 the 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 are not captured in certain survey years, but are reported in others. 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 about 4,800 observations.

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6 Socio-Economic Panel (SOEP), data for years 1984 – 2013, version 30, SOEP, 2015, doi:10.5684/soep.v30.

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

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 such as 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 policies.

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 providing the most suitable basis for our research question.

3.1 Dependent Variables

We measure a worker's stress intensity using two variables that combine various dimensions of extrinsic and intrinsic stress perception. Our first dependent variable, the extrinsic stress index, is constructed from three items that cover 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 three items are measured in two stages. In the first stage, the respondents are asked to confirm or deny whether a certain statement applies to them or not. Thereafter, those who stated "yes" in the first stage have to indicate on a 4-point scale ranging from 1 ("not at all") to 4 ("very heavily"), to what extent they feel burdened by the issue the particular item covers. Following Richter et al. (2013), the two variables are then combined into a single five-point ordinally scaled variable. Those who responded "no" to the first answer are assigned a 1, and those who responded "yes" in the first stage, and were consequently asked in the second stage, how heavily the item burdens them, are assigned one of the four values ranging from 2 to 5; i.e., a 2 for "not at all" and a 5 for "very heavily". Therefore, the higher the score, the more burdened an individual feels by the particular item.

Our second dependent variable is the intrinsic stress index. The intrinsic stress index consists of six items measuring an individual's intrinsic pattern of coping 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),[12] (*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).[13] For all these items, the respondents are asked to what extent they agree to the presented statements using a 4-point scale ranging from 1 ("not at all") to 4 ("very heavily").[14]

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11 These items represent a shortened operationalization of the effort component in the ERI model (Siegrist et al., 2009). All items' translations into English are as in Richter et al. (2013, p. 12).

12 The response to this question was reversed, before inclusion in the overall score.

13 All items' translations into English are as in Richter et al. (2013, 12).

Instead of estimating the effects of personnel policy on each of these items separately, we prefer to follow Siegrist (1996) who constructed aggregate variables. Also Richter et al. (2013) suggest combining the information of single items by summarising these items' scores into a single variable. We extend this approach by standardising the individual items as well as their sum. This so-called double standardization approach is frequently used in the empirical literature. Recent examples are Bresnahan et al. (2002) and Bloom et al. (2011). 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 potential problems associated with different distributions on the items' responses. For example, regarding extrinsic stress perception, more individuals may respond that they feel heavily burdened by time pressure than by frequent interruptions. We then standardize the sum of the standardized items. The double standardization approach for the extrinsic stress index can therefore be summarized as

$$stress_{it}^{ext} = STD[STD(TPWL_{it}) + STD(INTERRUPT_{it}) + STD(JOBDEM_{it})]. \quad (1)$$

Analogously, the double standardization approach for the intrinsic stress index yields

$$stress_{it}^{int} = STD[STD(TIMEPRESS_{it}) + STD(WPWU_{it}) + STD(EASYSO_{it}) + STD(SACCAR_{it}) + STD(EVENING_{it}) + STD(BADSLEEP_{it})]. \quad (2)$$

The term $stress_{it}^{ext}$ ($stress_{it}^{int}$) is the resulting extrinsic (intrinsic) stress index for individual i at time t. It is again a standardized variable with mean 0 and variance 1. The double standardization approach facilitates a convenient interpretation of the parameter estimates. A one-unit change in an independent variable translates into a change in stress intensity that can be expressed in standard deviations of the respective stress index. Thus, given that the explanatory variables are equally scaled, it applies that the higher the estimated coefficient of a certain human resource management practice, 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 manage-

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

ment practices in an individual's workplace. We group the selected explanatory variables by the expected channel of their effect on stress, i.e., job demands, job control, and job rewards.

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 indicates a company-induced motive. The variable measures how many paid overtime hours an individual worked in the month before the survey.[15] We assume that paid overtime is positively associated with higher stress levels, because it reflects higher job demands.

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 predetermined 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 was not collected in either 2006 or in 2005. 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.[16] The working time regimes to be considered are: fixed working time (FWT), employer-determined working time (EDWT), self-managed working time (SMWT), and flexitime within a working hours account (FT).[17] 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 employees' average actual and contractual working hours for the different types of working time arrangement.

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

16 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.

17 See Beckmann et al. (2015) and Table 2 in Section 3.3 for more information and a precise definition.

Table 1

Actual and Contractual Working Hours per Week by Working Time Arrangements

Working time arrangement	Working hours per week				
		Actual 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.

We can see that the difference between actual 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 about 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 higher job control. Therefore, we expect that EDWT (i.e., high job demand combined with low job control) is associated with higher stress levels, while in particular SMWT (i.e., high job demand combined with high job control) is expected to mitigate the stress-enhancing effect of longer working hours.

Job Reward

We continue to enrich our set of human resource management practices by introducing measures of positive and negative job rewards. At first, we consider the fringe benefit provision of a computer (PC or laptop) for private use, termed "PC benefit", in our analysis.[18] This dummy variable takes the value 1 if an individual receives a computer for private use from his employer, and 0 otherwise. In our opinion, the impact of the provision of a computer for private

[18] 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.

use on an employee's stress level is ambiguous. On the one hand, the provision of a computer for private use allows the employee to work more autonomously, thereby increasing perceived job control. On the other hand, the provision of a computer for private use can reinforce tendencies to work at weekends or after closing time, which contributes to higher job demands. In line with our argumentation on the higher job control associated with certain flexible working time arrangements, we expect the beneficial component of endowing a worker with a computer for private use to outweigh the demand component.

Furthermore, we consider an individual's response regarding the promotion opportunities in his company. Our measure is a dummy variable indicating whether an individual states that the promotion prospects in his company are bad. We assume that bad promotion prospects contribute to 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 to be 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

Table 2 presents the descriptive statistics for our dependent and main explanatory variables. We see that only 4% of our sample receive a computer for private use from their employer. Almost half of the respondents (48%) consider their salary to be adequate. In this light, it is striking that 67% consider the promotion prospects in their company as bad. Both items have rather high within-variations of 0.2. The average amount of paid overtime hours per week is only 0.53, which might induce one to expect a rather negligible effect of this variable on stress. However, it should be noted that almost 90% of the employees in the sample did not report paid overtime, so that the maximum number of hours per week (almost 23) seems to be a closer approximate value than 0 for those affected. Approximately 40% of the employees report that they are subject to regular performance appraisals. Finally, we see that the largest share of employees work under a FWT regime (42%), whereas just about 10% have a SMWT regime. Flexitimers constitute about 27% of our sample, and those under EDWT account for roughly 21%.

Figures 1 and 2 present descriptive statistics of our dependent variables, the stress indices, depicted by the categories of the selected human resource management practices for our full sample. Recall that the higher the stress index, the higher the perceived stress level for the respective group.

Individuals receiving a computer for private use exhibit median stress indices above zero, while those who do not receive such a fringe benefit have a median below zero (Figures 1a and 2a). Figures 1e and 2e show that those who believe

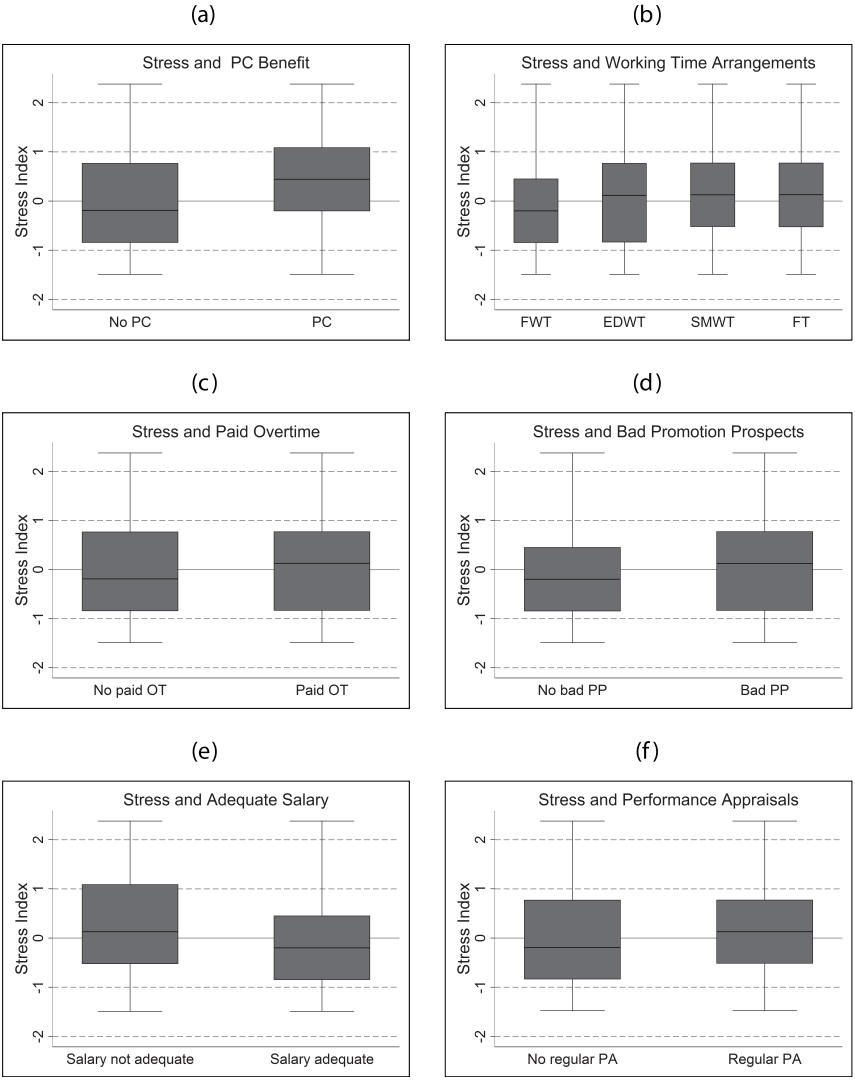
Table 2

Definition and Descriptive Statistics of Main Variables

Variable	Definition	N	Mean	Std	Std-within	Min-Max
Dependent variables						
Extrinsic stress index	Standardized index of three extrinsic stress items (see Section 3.1)	9562	0.00	1.00	0.36	–1.49 – 2.38
Intrinsic stress index	Standardized index of six intrinsic stress items (see Section 3.1)	9541	0.00	1.00	0.33	–2.02 – 2.87
Explanatory variables						
PC benefit	Dummy variable indicating whether employee receives a computer (PC or laptop) for private use	9562	0.04	0.19	0.07	0 – 1
Fixed working time (FWT)	Dummy variable indicating whether employee has fixed working times (reference category)	9562	0.42	0.49	0.17	0 – 1
Employer-determined working time (EDWT)	Dummy variable indicating whether employee faces flexible working hours determined by the employer	9562	0.21	0.41	0.15	0 – 1
Self-managed working time (SMWT)	Dummy variable indicating whether employee has extensive decision-making authority in terms of scheduling individual working hours	9562	0.10	0.30	0.11	0 – 1
Flextime within a working-hours account (FT)	Dummy variable indicating whether employee is allowed to vary daily working hours, where daily attendance is restricted to a defined time interval (working hours account)	9562	0.27	0.44	0.14	0 – 1
Adequate salary	Dummy variable indicating whether employee considers his salary adequate given his efforts and achievements	9562	0.48	0.50	0.20	0 – 1
Performance appraisals	Dummy variable indicating whether employee's performance is regularly assessed by a superior	4343	0.40	0.49	–	0 – 1
Paid overtime	Number of paid overtime hours last month	9562	0.53	1.94	0.76	0 – 22.85
Bad promotion prospects	Dummy variable indicating whether employee perceives promotion prospects in his company as bad	9562	0.67	0.47	0.20	0 – 1

Notes: N is the number of observations. Std is the standard deviation. Std-within is the within standard deviation. No Std-within reported for performance appraisals, since this variable is only available in 2011.

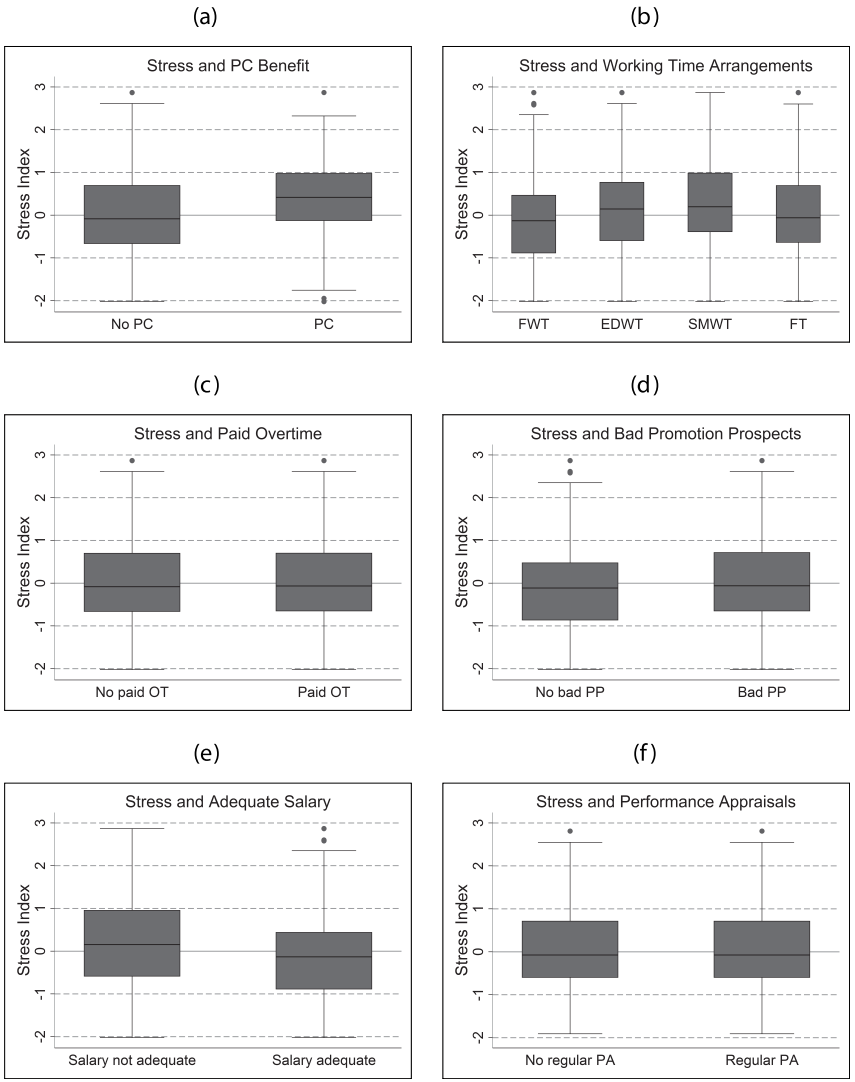
Source: German Socio-Economic Panel (SOEP), waves 2006 and 2011, own calculations.



Notes: The above figure depicts the extrinsic stress index by categories of the main explanatory variables. These are: (1a) PC benefit, (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 (PP), (1e) adequate salary, and (1f) performance appraisals (PA). 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.

Figure 1: Extrinsic Stress Index and Personnel Policies



Notes: The above figure depicts the intrinsic stress index by categories of the main explanatory variables. These are: (2a) PC benefit, (2b) working time arrangements, (2c) paid overtime last month (discrete variable summarized into two categories, 0 and >0, hours rescaled to weekly level), (2d) bad promotion prospects (PP), (2e) adequate salary, and (2f) performance appraisals (PA). 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.

Figure 2: Intrinsic Stress Index and Personnel Policies

their salary to be adequate have lower (median below zero) stress indices than those who do not consider their salary as adequate (median above zero). The depiction of the stress indices by working time arrangements (Figures 1b and 2b) shows that FWT workers exhibit the lowest median stress indices, while the medians for the EDWT and the SMWT workers are visibly above zero, and the median for the FT workers is above (below) zero for the extrinsic (intrinsic) index. Moreover, the median extrinsic stress indices are higher for individuals who believe that their promotion prospects are bad (Figure 1d), for individuals subject to regular performance appraisals (Figure 1f), and for individuals who performed paid overtime work in the month before the survey (Figure 1c).[19] For these three policies, the picture is not as distinct in the case of the intrinsic stress index.[20] 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 management 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 and intrinsic stress indices introduced in Section 3.1 on all personnel policies 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

$$stress_i^j = HRMP_i\gamma + X_i\beta + u_i. \tag{3}$$

Here, j alternatively represents *ext* and *int*, so that both dependent variables $stress^{ext}$ and $stress^{int}$ are expressed by $stress^j$. Furthermore, $HRMP_i$ is a vector of human resource management 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 management practices. Therefore, X includes individual characteristics such as age, years of schooling, gender, nationality, marital status, the existence

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

[20] Note that the presented box plots picture median and not mean values. We also compared the means of the stress indices assigned to the different groups of personnel policy items and saw a statistically significant difference for both stress indices with the exception of paid overtime (not reported here).

of children in the household, private life events that happened in the year of the observation (birth of a child, a separation or divorce from partner or spouse, and the death of a close relative), 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 with the respective company, and the number of years that an individual has been unemployed and has been employed in 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. In addition, we add dummies for the size of the company that employs the individual 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 A1 in the Appendix provides the definitions and descriptive statistics of the complete set of control variables used in this study.

Although we employ a rich set of control variables, estimation of equation (3) is likely to suffer from omitted variable 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.,

$$stress^{j}_{it} = HRMP_{it}\gamma + X_{it}\beta + \alpha_i + \eta_t + \varepsilon_{it}. \tag{4}$$

Equation (4) contains observations from two panel waves $t = 2006$ and $t = 2011$.[21] Recall that the performance appraisals variable is no longer included in the *HRMP*-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 us to mitigate issues associated with potential self-selection into jobs according to individual stress preferences. Equation (4) is estimated using both the pooled OLS (thereby ignoring α_i) and the within estimator.

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

5. Results

The estimation results of our regression analyses on the effects of personnel policy on extrinsic and intrinsic stress intensity are displayed in Tables 3 and 4. Columns (1) and (2) of Table 3 display the estimation results according to equation (3). Column (1) contains the results for the variables in *HRMP* without control variables, while column (2) displays the results for the *HRMP*-variables conditioned on the complete set of control variables X. In the unconditioned model, all *HRMP*-measures are highly significant and mostly exhibit the anticipated sign, i.e., an adequate salary contributes to decreasing extrinsic stress intensity, while all other measures tend to increase extrinsic stress levels. Interestingly, this also holds for PC benefit, which we assumed would have a negative sign. Compared to column (1), the coefficients for the *HRMP* vari-

Table 3

Personnel Policy and the Extrinsic Stress Index

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

Notes: */**/*** denotes statistical significance at the 10%, 5%, and 1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1)–(3)) and robust standard errors clustered at the individual-level (column (4), 2,400 individuals). The *extrinsic stress index* is defined in equation (1) in Section 3.1. The specifications in columns (2)–(4) contain a set of covariates introduced in Section 4.

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

ables in column (2) are typically somewhat smaller, except the coefficients for the variables on salary adequacy and bad promotion prospects. Nevertheless, only the coefficient for the PC benefit variable becomes insignificant, thereby indicating that providing a computer for private use is an ambivalent management practice in terms of stress perception. Apart from the paid overtime variable, which is only significant at the 10% level in the complete model, all other *HRMP*-measures, i.e., EDWT, FT, SMWT, 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 (3) and (4) refer to equation (4). They do not include the coefficients for the performance appraisal variable, as mentioned earlier in Section 4. In addition, note that the pooled OLS estimates in column (3) are based on the unbalanced full sample which includes individuals whose responses are only observed in one of the two periods, while the fixed effects estimates in column (4) 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 (2), the parameter estimates from the fixed effects model 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 FT and the SMWT variables are no longer statistically significant, meaning that workers in these regimes are unlikely to suffer more strongly from extrinsic stress. However, we still observe a highly significant positive association between EDWT and extrinsic stress intensity. Similarly, accounting for individual fixed effects does not affect the significance of the remaining *HRMP*-variables, i.e., paid overtime, salary adequacy, and bad promotion prospects.[22] As a consequence, we can conclude so far that EDWT, paid overtime, and bad promotion prospects are found to be positively associated with extrinsic stress intensity, while salary adequacy apparently mitigates extrinsic stress intensity.[23]

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[22] In order to test our assumption that stress levels may be prone to unobserved individual time-invariant effects, we run auxiliary regressions of the stress indices on all personnel policies, 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 auxiliary regressions 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.

[23] We also conducted separate regression analyses for each of the items entering the extrinsic stress index, i.e., time pressure due to a heavy workload, frequent interruptions and disturbances, and increasing job demands over the past few 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 are found

Besides statistical significance it is important to know whether the estimated coefficients are economically significant or not. Since our dependent variables are standardized, all changes in the explanatory variables have to be interpreted in terms of changes in standard deviations. Hence, we can state, for example, that a change from FWT to EDWT is associated with an increase in extrinsic stress perception of about 0.13 standard deviations (or 13% of standard deviation 1). Analogously, extrinsic stress intensity of workers with bad promotion prospects increases by approximately 0.22 standard deviations relative to workers with good promotion prospects, while salary adequacy tends to decrease extrinsic stress intensity by about 0.17 standard deviations.[24] This indicates that the effect of these binary personnel policies on extrinsic stress intensity is not only statistically but also economically significant. Regarding the relative importance of the effects on extrinsic stress intensity, we can state that bad promotion prospects are found to be slightly more stressful than EDWT, while the stress-reducing effect of an adequate salary lies in between (in absolute terms).

At first glance, the statistically significant coefficient of the variable paid overtime appears to be rather small, indicating that an increase in paid overtime of one hour per week is associated with higher extrinsic stress intensity of only 0.02 standard deviations. Given that the average number of paid overtime hours in our sample is 0.53 (see Table 2 in Section 3.3), this seems to be a negligible

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to be insignificant in each of the separate regressions. The results of these separate regressions are available from the authors upon request.

[24] To illustrate this interpretation assume the following example. An increase of 0.2 standard deviations complies with a standard normally distributed variable jumping from –0.1 to +0.1 (i.e., symmetrically around the mean value), which is equivalent to changing from the 46th percentile to the 54th percentile. This means that without the firm's adoption of a certain human resource management practice, 46% of the workers are less stressed than the reference worker, while confronting the reference worker with that practice increases this share to 54%. Alternatively, assume that stress intensity is still standard normally distributed and one is interested in the stress effect for the mean worker of this distribution. In this case, an effect of 0.2 standard deviations means that confronting the mean worker with a certain personnel policy increases the share of workers who perceive less stress at work than the mean worker from 50% to approximately 58%. Another illustration can be found in Hübler (2005, 84–85) who shows that in a two-variables OLS model the standardized regression coefficient (BETA coefficient) equals the correlation coefficient between the dependent and the regressor variable. Hence, in an OLS model with a standardized dependent variable (in our case $stress^{ext}$) and a dummy regressor variable (in our case, e.g., EDWT) one has to multiply the parameter estimate of the dummy regressor variable with its standard deviation to obtain the correlation coefficient between the standardized dependent variable and the dummy regressor variable. This correlation coefficient provides an easy interpretation for the strength of the association between both variables. However, Hübler (2005, 141–142) also shows that in the multiple case this interpretation can only be maintained if the dummy variable is uncorrelated with the other regressor variables. Otherwise, the interpretation of the two-variables case is at least approximately valid, but approximate validity decreases in the correlation between the dummy and the other regressor variables.

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 work much more than this average (i.e., for our balanced panel, this is over 4 hours overtime per week), thus resulting in an appreciable effect for those, who work overtime.

The estimation results for the intrinsic stress index displayed in Table 4 are qualitatively very similar to the findings for the extrinsic stress index. According to our preferred fixed effects specification in column (4), EDWT, paid overtime, and bad promotion prospects are found to be positively related to intrinsic stress intensity, while salary adequacy and intrinsic stress level are negatively associated. Compared with their counterparts from the extrinsic stress intensity model, the parameter estimates for EDWT, bad promotion prospects, and salary

Table 4

Personnel Policy and the Intrinsic Stress Index

Dependent variable	**Intrinsic stress index**			
	(1) OLS	(2) OLS	(3) OLS	(4) FE
PC benefit	0.374***	0.294***	0.211***	0.129
	(0.068)	(0.067)	(0.050)	(0.101)
EDWT	0.239***	0.176***	0.176***	0.116**
	(0.039)	(0.038)	(0.026)	(0.047)
SMWT	0.398***	0.262***	0.240***	0.072
	(0.052)	(0.052)	(0.037)	(0.070)
FT	0.146***	0.043	0.039	0.002
	(0.037)	(0.038)	(0.026)	(0.060)
Paid overtime	0.017**	0.020***	0.017***	0.026***
	(0.007)	(0.008)	(0.006)	(0.010)
Adequate salary	–0.380***	–0.325***	–0.300***	–0.127***
	(0.030)	(0.030)	(0.021)	(0.036)
Bad promotion prospects	0.137***	0.112***	0.072***	0.124***
	(0.031)	(0.030)	(0.021)	(0.036)
Performance appraisals	0.084***	0.070**		
	(0.031)	(0.032)		
Controls	NO	YES	YES	YES
Observations	4,321	4,321	9,541	4,788
Adj. R^2 / R^2-within	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)–(3)) and robust standard errors clustered at the individual-level (column (4), 2,394 individuals). The *intrinsic stress index* is defined in equation (2) in Section 3.1. The specifications in columns (2)–(4) contain a set of covariates introduced in Section 4.

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

adequacy are slightly smaller (in absolute terms) in the intrinsic stress intensity model, while the reverse is true for paid overtime.

Finally, the cross-sectional estimates for the performance appraisal variable also confirm the corresponding estimates obtained for the extrinsic stress level; i.e., regular performance appraisals are positively associated with a worker's intrinsic stress intensity. In the extrinsic (intrinsic) stress model, the economic magnitude of the performance appraisal effect is approximately (slightly below) 0.1 standard deviations, which is somewhat smaller than the corresponding stress effects associated with the remaining binary personnel policies. However, given that these estimates merely reflect conditional correlations at the cross-section, we should not overemphasize this finding.

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 are not necessarily stress-enhancing. In fact, this finding suggests that the lack of working time autonomy is a potential source of increased stress at work. It therefore supports Karasek's JDC hypothesis, according to which high job demands (here: longer actual 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; i.e., because overtime is paid by the employer, it is therefore presumed to be induced by the employer. The positive stress effect can be interpreted to be in accordance with the JDC hypothesis. Moreover, it is in line with the literature which asserts that longer working hours are detrimental to an individual's health (see e.g. Bell et al., 2012; Robone et al., 2011).[25]

Finally, the positive stress effect for individuals who evaluate their promotion prospects as being bad supports the theoretical assumption of the ERI model which asserts that low evaluations of perceived rewards are associated with high levels of perceived stress. 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 and intrinsic stress intensity.

[25] We also added interaction terms of the paid overtime variable with the working time arrangement dummies to equation (4) but obtained no significant effect. This indicates that there is no mutual reinforcing impact of the considered *HRMP* practices on extrinsic and intrinsic 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 two steps. First, we estimate equation (4) separated for male and female workers. We proceed in this way, because we believe that there may be a systematic difference in work-related outcomes according to gender. For example, today women still provide the larger share of household production and may therefore suffer disadvantages owing to time-consuming personnel policies such as paid overtime. Moreover, in order to improve coordination between work and family issues, female workers may be more likely to be involved in certain flexible working time arrangements than male workers. Second, we exploit an exogenous source of variation in our *HRMP* measures by focusing on individuals who have not changed jobs across the two observation periods of 2006 and 2011. We thereby address a potential limitation of the empirical approach that we applied 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 Splitting the Sample by Gender

It is possible that perceived 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 involve longer working hours than male workers. For example, time pressure may be more important when a worker has to leave work at an appointed 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 Tables 5 and 6, we present the pooled OLS and the individual fixed effects estimations resulting from equation (4), separated for male and female workers.

In both tables, 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 similar in the male and the female sample. However, there is one important exception that holds for both the extrinsic and the intrinsic stress index model. Apparently, male workers in certain flexible working time arrangements are less likely to perceive higher extrinsic and intrinsic stress levels than female workers. According to our preferred fixed effects estimates, the most remarkable result is that employer-determined working time significantly increases both the extrinsic and intrinsic stress levels for female but not for male workers. This leads to the conclusion that the overall positive effect of employer-determined working

Table 5

Personnel Policy and the Extrinsic Stress Index by Gender

Dependent variable	**Extrinsic stress index**			
	male sample		female sample	
	(1) OLS	(2) FE	(3) OLS	(4) FE
PC benefit	–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)
Adequate salary	–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)
Controls	YES	YES	YES	YES
Observations	2,640	2,640	2,160	2,160
Adj. R^2/R^2-within	0.159	0.067	0.191	0.094

Notes: */**/*** denotes statistical significance at the 10%, 5%, and 1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) and (3)) 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 introduced in Section 4.

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

time on extrinsic and intrinsic stress intensity 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 the fact that female workers are more time-constrained in their private lives, as they 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 and intrinsic stress perception in the sample of female workers is also in line with the findings of Bell et al. (2012), who find that overwork has a negative effect on subjective health for women, even if their actual working hours range between 20 and 35 hours per week. Similar to us, the authors attribute these results to the possibility that female workers' private lives have more binding time constraints.

Table 6

Personnel Policy and the Intrinsic Stress Index by Gender

Dependent variable	**Intrinsic stress index**			
	male sample		female sample	
	(1) OLS	(2) FE	(3) OLS	(4) FE
PC benefit	0.179**	0.037	0.429***	0.355**
	(0.079)	(0.127)	(0.147)	(0.157)
EDWT	0.091*	0.056	0.206***	0.182***
	(0.052)	(0.064)	(0.053)	(0.070)
SMWT	0.244***	0.106	0.178*	0.063
	(0.068)	(0.094)	(0.096)	(0.101)
FT	0.070	0.065	–0.011	–0.055
	(0.048)	(0.082)	(0.056)	(0.089)
Paid Overtime	0.018**	0.024**	0.043**	0.037**
	(0.008)	(0.012)	(0.020)	(0.018)
Adequate salary	–0.283***	–0.112**	–0.358***	–0.119**
	(0.039)	(0.050)	(0.044)	(0.053)
Bad promotion prospects	0.070*	0.088*	0.075	0.162***
	(0.039)	(0.049)	(0.047)	(0.054)
Controls	YES	YES	YES	YES
Observations	2,636	2,636	2,152	2,152
Adj. R^2 / R^2-within	0.156	0.063	0.159	0.085

Notes: */**/*** denotes statistical significance at the 10%, 5%, and 1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) and (3)) and robust standard errors clustered at the individual-level (columns (2) and (4), 1,318 and 1,076 individuals). The *intrinsic stress index* is defined in equation (2) in Section 3.1. All specifications contain a set of covariates introduced in Section 4.

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

Table 6, which contains the estimation results for the intrinsic stress index specification, reveals another interesting difference in the samples for male and female workers. The fixed effects estimates displayed in columns (2) and (4) indicate that the company's provision of a computer for private use tends to increase the intrinsic stress levels of female workers only. In Section 3.2, we discussed that endowing workers with a computer for private use may affect a worker's perceived stress ambiguously, depending on whether the reward component of the PC benefit dominates the demand component, or vice versa. The positive effect of the variable PC benefit on the intrinsic stress intensity of female workers indicates that female workers, unlike their male counterparts, perceive the PC benefit, as an instrument that primarily increases workload and pressure rather than improving job autonomy. Therefore, this result also questions the suitability of the provision of a computer for private use as a means to improve a worker's work-life balance.

6.2 Exploiting Exogenous Variation

Our econometric approach does not allow for establishing causal effects, because fixed effects estimates only account for time-constant unobserved heterogeneity, but do not account 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 *HRMP* 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 to implement an instrumental variables (IV) approach (Antonakis et al., 2010). However, given that the objective of our analysis is to test the impact of several personnel policies on a worker's stress level instead of focusing on one particular policy, it is almost impossible to find suitable instruments for several policies at once. We therefore considered decomposing the analysis by regressing stress intensity on single personnel policies and instrumenting them.[26] 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 across the two observation periods from 2006 to 2011. Proceeding in this way, we exploit an exogenous source of variation in our *HRMP* 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 instigated by the employer rather than by a worker in response to his 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 for private use.[27]

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

[27] Exploiting exogenous variation in the described way is a quite common approach in the literature on commuting. A strand of this literature utilizes the approach of focusing on a sample of individuals who 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 changes, the observed variation in commut-

Table 7 presents the results from exploiting exogenous variation for both the extrinsic and the intrinsic stress indices, where the focus is on the estimation of equation (4).

Table 7

Personnel Policy and Stress Indices in the Job Stayers Sample

Dependent variable	**Extrinsic stress index**	**Intrinsic stress index**		
	(1) OLS	(2) FE	(3) OLS	(4) FE
PC benefit	–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)
Adequate salary	–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)
Controls	YES	YES	YES	YES
Observations	4,016	4,016	4,014	4,014
Adj. R^2 / R^2-within	0.169	0.056	0.158	0.052

Notes: * / ** / *** denotes statistical significance at the 10%, 5%, and 1% level. The values in parentheses represent heteroskedasticity-robust standard errors (columns (1) and (3)) 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 (2) in Section 3.1. All specifications contain a set of covariates introduced in Section 4.

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

We can ascertain that the parameter estimates remain quite stable qualitatively for the majority of our considered *HRMP* variables. Specifically, bad promotion prospects are still found to increase both extrinsic and intrinsic stress

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ing time / distance must be attributable to the employer's plant relocations and is therefore exogenous for the observed individuals. Recent applications include, for example, Lorenz / 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, while the reverse is still true for salary adequacy. The magnitudes of the estimated coefficients are quite similar to the results obtained from the conventional fixed effects models, which also holds for the parameter estimates of the remaining personnel policies. Moreover, as before, employer-determined working time is the only policy of flexible working time that is found 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%-level 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 no longer holds 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, contrary to our previous fixed effects estimations, where the provision of a computer for private use is not found 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 intensity and weakly significant with a positive sign in the fixed effects model for intrinsic stress intensity. A possible explanation for these contradictory findings is that, while the provision of a computer for private use can involve higher job demands, it can also be associated with higher working time autonomy. However, we should not put too much weight on these results and their interpretation owing to the fact that, in our sample, the incidence of providing computers for private use as a fringe benefit is very low (about 4%), meaning that these 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 reduces both extrinsic and intrinsic stress intensity, while bad promotion prospects, EDWT, and paid overtime contribute to increasing these stress indicators. Moreover, policies of flexible working time that involve some working time autonomy (i.e., self-managed working time and flexitime) 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 and in-

trinsic stress intensity can only be observed in the sub-sample of female workers, but not in the sub-sample of male workers, thus suggesting that female workers are more likely to be time-constrained owing to their obligation to coordinate work and family issues. Finally, after exploiting a source of exogenous variation with regard to the considered personnel policies in order 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 where workers do not have control over scheduling their individual working time (Bassanini / Caroli, 2014). Consequently, despite the fact that workers in self-managed working time and flexitime 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 their greater time sovereignty mitigating the stress-enhancing consequences of their 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 an unfavourable reward situation will exacerbate it. Our empirical results for salary adequacy and bad promotion prospects consistently 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 cautious when analysing this effect at a more detailed level, 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 additionally restricting the analysis to a sub-sample that allows us to exploit some of the exogenous varia-

tion 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 and 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 when devising personnel strategies in order to save costs caused by increased work-related stress. 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 are advised to offer good promotion prospects. Finally, employers should reduce the amount of flexible working hours if the flexibility is a policy determined by the employer. Instead, employers should consider granting their employees more job control; for example, via flexitime or self-managed working time arrangements. Even if job demands are high, policies aimed at increasing job control counteract the adverse consequences of rising stress at work.

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Appendix

Table A.1

Definition and Descriptive Statistics of the Control Variables

Variable	Definition	Mean	Std	Min-Max
Male	Dummy variable indicating whether respondent is male	0.53	0.5	0 – 1
Age	Age of respondent	44.99	9.7	20 – 65
Age squared	Age of respondent squared and divided by 100	21.18	8.58	4 – 42.25
Foreign nationality	Dummy variable indicating whether respondent is of non-German nationality	0.05	0.22	0 – 1
Schooling	Years of schooling	12.75	2.67	7 – 18
Marital status	Dummy variable indicating whether respondent has a settled living partner	0.79	0.41	0 – 1
Children aged under 16	Dummy variable indicating whether respondent has one or more children aged under 16 who currently live in the household	0.34	0.47	0 – 1
Monthly gross wage	Gross wage of respondent in the month before the survey (logarithm)	7.79	0.56	5.99 – 10.13
Fixed-term contract	Dummy variable indicating whether an employee has a fixed-term contract	0.04	0.19	0 – 1
Job tenure	Years of job tenure	14.04	9.91	1.2 – 49.8
Part-time experience	Years of experience in a part-time job	3.19	5.85	0 – 39.20
Unemployment experience	Years of unemployment experience	0.47	1.25	0 – 24
Contractual working hours	Weekly working hours as according to employment contract	35.5	7.56	1 – 72
Management	Dummy variable indicating whether employee holds a management position	0.2	0.4	0 – 1
Public service	Dummy variable indicating whether employee is a public servant	0.14	0.35	0 – 1
Job changed	Dummy variable indicating whether employee works in the same company in both waves	0.3	0.46	0 – 1
Firm size 1 – 19	Dummy variable indicating whether employee works in a firm with 1 to 19 employees (serves as reference category in the analysis)	0.18	0.39	0 – 1

Firm size 20 – 199	Dummy variable indicating whether employee works in a firm with 20 to 199 employees	0.31	0.46	0 – 1
Firm size 200 – 1999	Dummy variable indicating whether employee works in a firm with 200 to 1999 employees	0.25	0.43	0 – 1
Firm size ≥ 2000	Dummy variable indicating whether employee works in a firm with equal or more than 2000 employees	0.26	0.44	0 – 1
Hobbies and other leisure activities	Number of hours devoted to hobbies and other leisure activities on a typical working day	1.67	1.27	0 – 13
Current health: very good	Dummy variable indicating whether respondent assesses his current health status as very good (serves as reference category in the analysis)	0.07	0.26	0 – 1
Current health: good	Dummy variable indicating whether respondent assesses his current health status as good	0.47	0.5	0 – 1
Current health: satisfactory	Dummy variable indicating whether respondent assesses his current health status as satisfactory	0.34	0.47	0 – 1
Current health: poor	Dummy variable indicating whether respondent assesses his current health status as poor	0.1	0.31	0 – 1
Current health: bad	Dummy variable indicating whether respondent assesses his current health status as bad	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	0.03	0.16	0 – 1
Child born	Dummy variable indicating whether respondent became a parent in the survey year	0.02	0.13	0 – 1
Death in family	Dummy variable indicating whether a close family member of the respondent died in the year of the survey	0.03	0.17	0 – 1
East Germany	Dummy variable indicating whether respondent lives in East Germany	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: The number of observations is 9,562. Std is the standard deviation.

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