Stress and Work Intensification: What is the Influence of Personnel Policy?*

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Abstract

This paper investigates the determinants of work intensification and work-related stress. Special attention is given to the role of human resource management practices. The goal is to identify a series of practices that creates or mitigates work intensification and stress. Work-related stress can lead to substantial mental health problems. Work-induced (mental) health problems pose an increasing challenge for establishments as they result in immense costs. Therefore the identification of stress causing human resource management practices is of great relevance for firm performance. Using data from the German Socio-Economic Panel Study (SOEP) first results indicate a significant effect of certain practices on work-related strain. For instance, bad promotion prospects and paid overtime are associated with higher work-related strain, while a perceived adequate salary seems to mitigate individual stress levels.

JEL-Classification: I0, I31, J62
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1 Introduction

Work-relations have dramatically changed in most industrialized countries since the 1990ies. Increasing competition and technological change pose high flexibility demands on establishments and employees. The latter are increasingly confronted with rising job demands in both quantitative (multitasking, job enlargement) and qualitative (job enrichment) regards as well as flexible working contracts and time arrangements (Green, 2004). Although this development may bring about advantages from an employee's perspective, work-related stress is on the rise as various official numbers indicate. For instance about 10% of the European working age population with health problems reports to suffer most from mental health problems (Oortwijn et al., 2011). In general, work-related stress can lead to substantial mental health problems such as depression and burnout (e.g. Béjean and Sultan-Taïeb, 2005). The resulting costs (e.g. Scharnhorst, 2012) pose an increasing challenge on establishments as mentally ill employees are less productive and have higher absenteeism rates (e.g. Lerner and Henke, 2008; Rost et al., 2004). Thus, establishments are confronted with the question, to what extent they contribute to their employees' stress. In this paper we investigate, (*i*) which human resource practices increase or mitigate stress levels, and (*ii*) if there are human resource practices that have a stronger effect when combined into a bundle. We regard the identification of such practices and practice bundles as of great relevance for firm performance.

The theoretical framework of this work is given by the Job Demand-Control (JDC) model (Karasek, 1979) and the Effort-Reward Imbalance (ERI) model (Siegrist, 1996). Both models predict that an unfavourable combination of workload and responsibility or reward is detrimental to an individual's health.

In line with these theories we assume that human resource management practices that are associated with a heavy workload and low rewards lead to higher individual stress levels. At the same time we expect to see a stress mitigating effect of human resource practices that increase a worker's perception of job control. Also, we expect that a positive reward situation rather mitigates an individual's stress perception, while the opposite should be true for low rewards.

While a vast body of literature from the fields of medicine, psychology, sociology, and organizational behaviour deals with the effects of working conditions on stress, economists have so far mainly delivered contributions targeting the effects of job satisfaction on stress and health (e.g. Fischer and Sousa-Poza, 2009). Some of these (e.g. Kleibrink, 2014) have paid attention to the underlying drivers concerning job characteristics comparable to human resource practices like for instance working hours. Furthermore, several studies deal with the effects of (undesired long) working hours on health and well-being (e.g. Bell et al., 2012; Kugler et al., 2014; Wooden et al., 2009). For instance, Bell et al. (2012) find evidence of a negative effect of so called 'overwork' (i.e. a positive difference between actual

and desired working hours) on individuals' subjective health (satisfaction with current health). Lastly, only a few studies have analysed particular personnel policy measures and resulting stress/health outcomes. For instance Johnston and Lee (2013) and Boyce and Oswald (2012) focus on the effects of promotions on health, and Nijp et al. (2012) analyse the effect of work time control on stress and well-being.

This paper contributes in a twofold way to the existing literature. First, most related studies focus on single personnel policy measures (e.g. Johnston and Lee, 2013; Boyce and Oswald, 2012), while we focus on an entire bundle of personnel policy measures. Second, most studies dealing with work-related stress are conducted using small data samples (e.g. van der Doef and Maes, 1999 and Häusser et al., 2010 for reviews concerning the JDC model or van Vegchel et al., 2005 for a review on the ERI model). On the contrary, we aim to answer the proposed questions utilizing a large representative household data set. Moreover, the data are collected on the individual level allowing to control for an individual's socio-economic background, which permits a better disentanglement of work-related and private stress triggers.

The remainder of this paper is structured as follows. In Section 2 we briefly summarize the theoretical considerations of this paper. In Section 3 we present the data and our key variables. Section 4 continues with our empirical strategy. In Section 5, we present and discuss our estimation results before Section 6 concludes.

2 Theoretical considerations

The JDC model's (Karasek, 1979) basic implication is that individuals feel overloaded when there is a disproportion between workplace requirements (job demand) and worker autonomy (job control), which results in so called job strain. The posed demands are the job stressors or the work-load, and the job control is the decision latitude an individual has over its activities. The model's postulation is that a relatively low level of control compared to high demands will result in mental strain, 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 by means of developing new behavioural patterns. Van Doef and Maes (1999) distinguish two hypotheses in their review of the JDC model. The more restrictive 'strain' hypotheses according to which high demand results in work-related 'strain' and the more relaxed 'buffer' hypotheses that allows for 'buffering' the negative effects of demand on health by a higher decision latitude. While a large share of the reviewed studies supports the 'strain' hypothesis, evidence is rather mixed for the 'buffer' hypothesis. Of particular interest for our research is that high job-demand is usually associated with a higher probability of burnout and lower job-related psychological well-being.

Similarly, the ERI model (Siegrist, 1996) states that an imbalance between the costs and gains 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 distress that is related to cardiovascular diseases the model's application has been extended to behavioural and psychological outcomes (see e.g. van Vegchel et al., 2005 for a review). The ERI model distinguishes between extrinsic (situation-specific) and intrinsic (person-specific) dimensions, called 'effort' and 'overcommitment'. An individual's effort is determined by extrinsic factors like job-demand and obligations, while rewards are transmitted through money, esteem, and status control respectively security/career opportunities. The intrinsic component, overcommitment, depicts how an individual perceives his effort/reward situation thereby influencing health outcomes indirectly. Furthermore, an 'overcommitted' person tends to work too much and therefore suffers from exhaustion.

3 Data, variables and hypotheses

The analysis is conducted using data from the German Socio-Economic Panel (SOEP).[1] The SOEP is an annual longitudinal survey conducted since 1984. Each year covers about 22,000 individuals living in about 12,000 private households. The SOEP questionnaires contain a wide range of individual and job-related characteristics, including variables on health and individual well-being.[2] However, while 'basic' variables like the socio-economic factors or an individual's wage are surveyed every year, a lot 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 2006 and 2011 since a shortened version of the ERI questionnaire consisting of 16 items (Siegrist et al., 2009) is included in these waves. The questionnaire contains three items on effort, seven items on reward, and six items on overcommitment (see Appendix A.2). We use the effort and the overcommitment items to construct our dependent variables, while individual items of the reward questionnaire are included as explanatory variables into the analysis.

Our analysis is restricted to workers aged between 18 and 65 and employed in the private or public sector. Furthermore, self-employed individuals,[3] individuals enrolled in army or civil service and apprentices are excluded from the sample. Additionally, individuals who earn less than 400€ per month (so called 'mini-jobbers') are not taken into account.

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[1]More specifically, we use the SOEPlong v28 dataset.

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

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

3.1 Dependent variables

Our main dependent variable, the effort score, is constructed from the three effort items of the ERI questionnaire. These three items measure the following: (i) time pressure and a heavy work load (TPWL), (ii) frequent interruptions and disturbances (INTERRUPT), and (iii) increasing job demands over the last years (JOBDEM). All effort items are measured in two stages. Firstly, the respondents are asked to confirm or deny whether a certain statement applies to them or not. Secondly, 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 effort score we follow Bloom et al. (2011) by applying a double standardization approach. We first standardize (STD) each 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 effort items as presented in equation 1:

$$ES_{it} = STD[STD(TPWL_{it}) + STD(INTERRUPT_{it}) \\ + STD(JOBDEM_{it})]. \tag{1}$$

ES_{it} is the resulting effort score 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 ES_{it} change of standard deviations of our effort score.

The higher the score value, the more burdened an individual feels. This means that our main dependent variable, the effort score measures the individual's level of stress perception.

Our second dependent variable is the overcommitment score consisting of the six items of the overcommitment questionnaire. 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),[4] (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 the overcommitment items the respondents are asked to what extent they agree to the presented statements

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

on a 1 ('not at all') to 4 ('very heavily') scale. We then proceed as in the case of the effort score, first we standardize the score of each item, and then once again the sum of these six standardized overcommitment items (see equation 2):

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\begin{aligned}
OC_{it} = &STD[STD(TIMEPRESS_{it}) + STD(WPWU_{it}) + STD(EASYSO_{it}) \\
&+ STD(SACCAR_{it}) + STD(EVENING_{it}) + STD(BADSLEEP_{it})].
\end{aligned}
\tag{2}
$$

We end up with an overcommitment score, OC_{it} for individual i at time t, with mean 0 and variance 1. A high score indicates high overcommitment. The overcommitment score measures how burdened an individual feels by his effort/reward situation, i.e. it represents his intrinsic coping pattern.

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 work-place.

We consider the fringe benefit, provision of a computer (or laptop), in our analysis.[5] It is a dummy variable taking on value 1, if an individual receives a computer for personal use from his employer and 0 else. In our opinion the provision of a personal computer (or laptop) for personal use can reinforce tendencies to work on weekends and from home, which goes along with higher job-demands.[6] Therefore we expect the provision of a personal computer to be positively associated with higher stress levels.

Second, we include an individual's working time arrangement in our set of explanatory variables.[7] We construct four dummy variables from the four available categories of working time arrangements in the data. Each dummy variable takes on value 1, if a certain working time regime applies to an individual and 0 else. The four working time

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[5]The SOEP waves 2006, 2008, and 2010 cover a list of possible benefits provided by an employer. In order to use this information in other waves we impute the variable's value into the next year, if the individual holds the same position at the same company as in the previous year. We compare the means of all our dependent variables for individuals who changed jobs in 2006 with those who kept their job in 2006 (as this information is collected in 2007, we cannot conduct such a comparison for 2011 as this is the last year in our sample). The means are slightly lower (at a statistically significant level for the effort score and for the third effort item) for those who stayed in their job, meaning that the rather stressed are over-represented among the job-changers. Given this, we do not expect our approach to cause problems, because if anything it means that our results are biased downwards as some of the higher stressed drop out of our sample.

[6]We also tried to include the benefit cellular phone into our analysis. However, the imprecise definition of this benefit in the questionnaire (i.e. 'Cellular phone for personal use, or reimbursement of telephone costs') did not permit to clearly distinguish reimbursements from our targeted personnel policy.

[7]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.

regimes are: fixed working time (FWT), employer-determined working time (EDWT), self-managed working time (SMWT), and so called 'flextime' within a working hours account (FT) (see Beckmann and Cornelissen, 2014 and Table A.4 in Appendix A.3 for more information and a precise definition). In our further analysis FWT serves as reference category. In line with our theory we assume that individuals facing greater work time autonomy, these are to some extent the 'flextimers' and in particular those having a SMWT regime, also experience a greater level of job control. Therefore, we expect that larger working time autonomy mitigates individuals' perceived stress levels.

In order to include a measure in our analysis that captures long working hours, but is not 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. We assume that paid overtime is positively associated with higher stress levels, because it reflects higher job demands.

We continue to enrich our set of human resource practices by a rather subjective measure. Namely, an individual's response to the question whether his promotion opportunities are bad. We extract this variable from the ERI questionnaire. We use the first stage response to this question, i.e. our measure is a dummy variable taking on value 1, if an individual states that his promotion opportunities 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 again draw on the ERI questionnaire and extract the first stage of the individual's response to the item of whether he considers his salary as adequate. For those who confirm this statement the dummy variable takes on value 1, and is 0 for those who do not consider their salary as adequate. We expect that an adequate salary mitigates an individual's perceived stress level as it reflect a high job reward situation.

Finally, we consider in our cross sectional specifications 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 is 0, if this is not the case. We assume that facing performance appraisals might increase the perceived job pressure, i.e. 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.

3.3 Descriptive analysis

Table 1 presents the mean of real working hours per week[8] depicted by the four working time arrangements. This table also contains information on the share of individuals in each arrangement in our sample.

[Insert Table 1 about here]

Individuals with FWT arrangements constitute the largest share of our sample (40.5%). This group has also the lowest mean of real working hours, which lies below 38 hours per week. Both individuals with a flextime working time account and the ones with employer determined working time constitute roughly 20% of our sample and work about 40 hours per week. However, in line with our theory we would assume the first group, the 'flex-timers' to have a larger work time autonomy, which would support a lower stress level. Finally, individuals with SMWT are the remaining 13% of our sample and have with a figure of almost 44 hours a distinctively higher number of real working hours per week. Despite this higher average work load we assume that SMWT enhances an individual's perception of job-control and therefore expect to see lower stress levels for these individuals in our analysis.

In Figure 1 we present means of our major dependent variable, the effort score, depicted by the categories of our six selected human resource practices. Recall that the higher the effort score mean level, the higher the perceived stress level for the respective group.

[Insert Figure 1 about here]

Those receiving a pc (or laptop) exhibit on average a higher mean effort score (Figure 1a) than those who do not receive such a fringe benefit. The mean score is on average also higher for individuals believing that their promotion prospects are bad (Figure 1d), and for individuals subject to regular performance appraisals (Figure 1f). On the contrary, those who believe their salary to be adequate have a lower effort score mean (Figure 1e) than those who do not consider their salary as adequate. Individuals, who had paid overtime in the month before the survey, exhibit a higher effort score mean than those who did not (Figure 1c).[9] Finally, Figure 1b shows the depiction of the effort score mean by working time arrangements. Individuals who work on a fixed working hours account and those with employer determined working hours exhibit the lowest effort score means, while those with self-managed and flextime arrangements have means visibly above zero.

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[8]Apart from the contractual working hours per week the SOEP also contains a question on the actual worked hours per week.

[9]Please 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.

Notably, the mean for individuals having SMWT arrangements is lower than the one for the 'flextimers'. This would be the first support for our hypothesis that despite higher working hours worker's autonomy supports lower stress level perceptions.

4   Empirical strategy

The aim of this analysis is to identify personnel policy measures that are associated with a worker's perceived stress level. In order to account for unobserved heterogeneity our main specification presented in equation 3 is a fixed effects model. It accounts for individual-specific time-invariant effects. The aim of this specification is to measure the effect of a company's human resource practices on the individual's perceived stress level. Vector HRP_{it} contains a set of practices that individual i faces at time t.

$$stress_{it} = \beta_0 + X_{it}\beta + HRP_{it}\gamma + \alpha_i + u_{it}. \tag{3}$$

In equation 3 $stress_{it}$ represents our two different specifications of individual i's perceived stress, i.e. the effort and overcommitment score, at time t (see Section 3.1 for a description). α_i is the individual-specific time-invariant effect and u_{it} denotes an idiosyncratic error term with zero mean and finite variance.

Since an individual's perceived stress level may also depend on various factors that are not related to the specific human resource practices he faces in his work-place, we also include a large set of control variables in our analysis that are denoted by vector X. We consider individual characteristics such as age, age squared, years of schooling, gender, nationality, cohabiting status, the existence of children in the household, an individual's self-reported health status, and satisfaction with health and household income, as well as the number of hours devoted to leisure-time activities.[10] Furthermore, we enrich our set of control variables with job characteristics and variables from an individual's employment history that may affect his stress perception. These variables include the individual's monthly gross wage set in logarithms, the type of employment contract (fixed-term vs. unlimited), if the individual is employed in full-time, the tenure with the respective company, and if the individual has ever experienced part-time or full-time employment, and unemployment. The job-specific variables also include a dummy for whether the individual holds a management position. Also, we include a dummy for the size of the company the individual is employed at as well as the company's industry sector affiliation.

As Kleibrink (2014) shows that working more hours than desired has a negative effect on mental health we include the difference between the average real working hours (wh_{real})

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[10]The time-invariant variables age, age squared, gender, years of schooling, and nationality are only considered when estimates are conducted by means of OLS, but excluded from the fixed effects regressions.

and the working hours an individual would desire ($wh_{desired}$) per week as a measure for 'overwork' in our set of control variables. We also include how satisfied an individual is with his job and whether he considers his job-security as poor. It seems of particular necessity to include the latter variable into our analysis, as in line with the JDC model job-control is often referred to as the feeling of job security and, for instance, Reichert and Tauchmann (2011) and Kleibrink (2014) show that low job security has an adverse effect on (mental) health.

We also include an individual's locus of control[11] as we assume that individuals with an internal locus of control are better able to cope with job strain (see e.g. Rodríguez et al., 2001). Drawing on Caliendo et al.'s (2010) factor analysis, we group the items of the locus of control questionnaire in an internal and external index as well as an overall index.

Finally, we include time and regional dummies into the set of our control variables. Table A.4 in Appendix A.3 provides the definitions and descriptive statistics of the complete set of variables used in this study.

5   Results

First we present a simple OLS regression without control variables in order to show an unconditional correlation between the selected personnel policies and our dependent variables. We then proceed with a conditional pooled OLS regression that accounts for socio-economic, job-related and personality specific factors that may have an impact on an individual's perceived stress level. Since an important human resource practice, performance appraisals, is surveyed in 2011, but not in our second analysis year, 2006, we additionally conduct a cross sectional analysis for 2011 that includes this variable. The respective tables are presented in Appendix A.1. Finally, we apply a fixed effects approach in order to control for individual-specific time-invariant effects.

[Insert Table 2 about here]

Table 2 presents our main results, the relationship between the effort score, constructed from three items of the ERI questionnaire, and various human resource practices. Column (1) presents results from the unconditional pooled OLS estimation. As expected, the coefficients of all considered human resource practices, but the one of adequate salary,

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[11]The basic idea of this concept is that individuals with an internal locus of control perceive behavioural outcomes as results of their own actions, while individuals with an external locus of control rather see behavioural outcomes as results of chance or luck (Rotter, 1966). As locus of control is only surveyed in the SOEP waves 2005 and 2010 we apply a similar strategy as in Beckmann and Cornelissen (2014) replacing the missing values by imputing the 2005 observations for 2006 and the 2010 observations for 2011. As personality traits are considered stable over short periods of time (see Heineck and Anger, 2010, for a discussion on this topic), we do not expect to encounter problems due to this approach.

exhibit a positive sign, meaning that they are positively correlating with higher perceived stress levels.

In Column (2) we run a pooled OLS regression with covariates. As in the previous specification the coefficients of all explanatory variables, but the one of adequate salary have a positive sign. Although the coefficients drop in magnitude compared to Column (1), they are all statistically significant at least at the 10% level. The benefit of a computer provided by ones employer is associated with a slightly higher perceived stress level, and so are all working time arrangements as compared to a fixed working time schedule. Furthermore, bad prospects of receiving a promotion and paid overtime seem to increase perceived stress levels.

The coefficient of the dummy variable 'bad promotion prospects' is statistically significant at the 1% level and is quite large in size (0.177), meaning that if an individual considers his promotion prospects as bad, he will on average have an approximately 18% higher standardized effort score, which is 1/5 of a standard deviation in this case. This supports the theoretical assumption, that lower perceived reward goes along with higher stress perception.

Finally, Column (3) presents the results from the fixed effects model, our preferred specification. Here the coefficients of two variables, 'benefit pc', and SMWT change sign and become negative. While the coefficient of SMWT is not statistically significant, 'benefit pc' is statistically significant at the 10% level. A possible explanation for this at first seemingly counter intuitive result is that the provision of a computer for private use supports a free time allocation and therefore permits to better deal with time pressure. This is supported by the estimated coefficients of the working time arrangement. EDWT exhibits a weakly statistically significant positive coefficient, meaning that compared to fixed working time employer determined working time goes along with a higher perceived stress level. Meanwhile flextime within a working hours account does not have a statistically significant coefficient, meaning that it is not associated with more stress than fixed working hours. The same is true for SMWT, i.e. self-managed working time. This is an interesting result as individuals under the SMWT arrangements have on average longer weekly working hours (see Table 1). This finding supports the job control hypothesis, i.e. a higher perception of job control, in this context through working time autonomy, mitigates the pressure of higher job demands.

As described in Section 3 we choose paid overtime as the relevant measure for long working hours as this comes closest to our idea of overtime that is induced by the employer. The coefficient of the variable 'paid overtime' is rather small, yet statistically significant at the 1% level. When interpreting the coefficient's size one should keep in mind that this variable is measured in hours per month. So the coefficient of 0.0039 means that one extra hour of paid overtime per month goes along with a ca. 0.4% increase of perceived stress level. In our sample the average number of paid overtime hours per month is 2.37 (see

Table A.4 in Appendix A.3), which means that the score is on average increasing by 1%. Given this, one should consider that this variable has a large share of respondents with a value of 0, as most respondents do not have any paid overtime hours (compare footnote 9 in Section 3.3). This means that those who do have paid overtime hours actually conduct much more than the average of 2.37 hours per month. Thus, we interpret this estimation coefficient as support for the hypothesis that high job demands are unfavourable for perceived stress levels.

Finally, the dummy variable 'salary adequate' exhibits a large and negative coefficient that is statistically significant at the 1% level meaning that the perception of an adequate salary mitigates ones stress level. This again supports the general hypothesis of the ERI model that rewards mitigate individuals' stress perception.

Table A.1 in Appendix A.1 presents our supporting evidence. Here we regress the overcommitment score, i.e. the intrinsic stress component, on our human resource practices. The general results are in line with the previous findings. The statistical significance level of 'bad promotion prospects' is now lower, which makes insofar sense as the overcommitment score pictures an individual's 'overcommitting' reaction to his effort/reward imbalance. Naturally, an individual with bad promotion prospects will not exhibit tendencies to 'overcommit' himself to his job.

Finally, regarding our supporting cross sectional analysis in Column (2) in Table A.2 in Appendix A.1, we can generally confirm the previous findings. We attribute some of the resulting differences to the fact that this estimation was conducted by means of OLS. The coefficient of 'benefit pc' is now not statistically significant any more, while the one of FT is, meaning that compared to a fixed working time account a flextime arrangement is associated with a higher perceived stress level. This could be explained by the fact that individuals employed in flextime have on average longer working hours than those with a fixed working time arrangement, but at the same time do not have a similar level of job autonomy compared with SMWT (see Table 1 in Section 3.2). As expected, the coefficient of the dummy variable 'performance appraisals' is positive and statistically significant at the 1% level supporting the assumption that 'performance appraisals' go along with higher stress levels.

6 Conclusion

The presented paper is work in progress. Therefore the aim of this Section is to quickly summarize our first results before proceeding with the future research agenda of this project.

First evidence supports our hypothesis in regard to job control, i.e. that higher job control is associated with lower perceived stress levels. Our estimation results for individuals hav-

ing self-managed working times indicate that their stress levels are not higher than those of individuals working under fixed working time arrangements although the self-managers work longer hours on average. Furthermore, a good reward situation, for instance through a perceived adequate salary, mitigates perceived stress, while the opposite is true for unfavourable reward situations like bad promotion prospects.

Evidence is mixed regarding explanatory variables that target job demands, while a high amount of employer induced overtime is associated with higher stress levels, this seems not to be the case for benefits like the provision of a computer for personal use that were a priori assumed to interfere with an individual's private life. A possible explanation for this is, that while the provision of a personal computer can mean more work load, it also can go along with a higher autonomy of working time allocation. Finally, in a cross sectional sub-analysis we saw that individuals subject to performance appraisals experience higher perceived stress levels. This association is an indication that performance appraisals are a form of stronger job demands.

So while we were able to present first evidence on our first research question, which human resource practices increase or mitigate (perceived) stress levels, further research is necessary to answer the second research question, whether effects of certain human resource practices become stronger when combined into bundles. Therefore, the first step in our further research on this project will be to implement interactions between certain human resource practices.

Second, there is the goal to find another job-stress related measure that is surveyed in more SOEP waves than 2006 and 2011. This would permit to expand the current methodological tool set. For instance, to implement anticipation and adaptation effects of human resource practices on perceived stress as in Johnston and Lee (2013).

Finally, there is the possibility to instrument certain human resource practices, in order to give an indication towards possible causal effects of these practices on perceived stress levels.

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Figures and Tables

Figure 1: Effort Score and Human Resource Practices

(a)

(b)

(c)

(d)

(e)

(f)
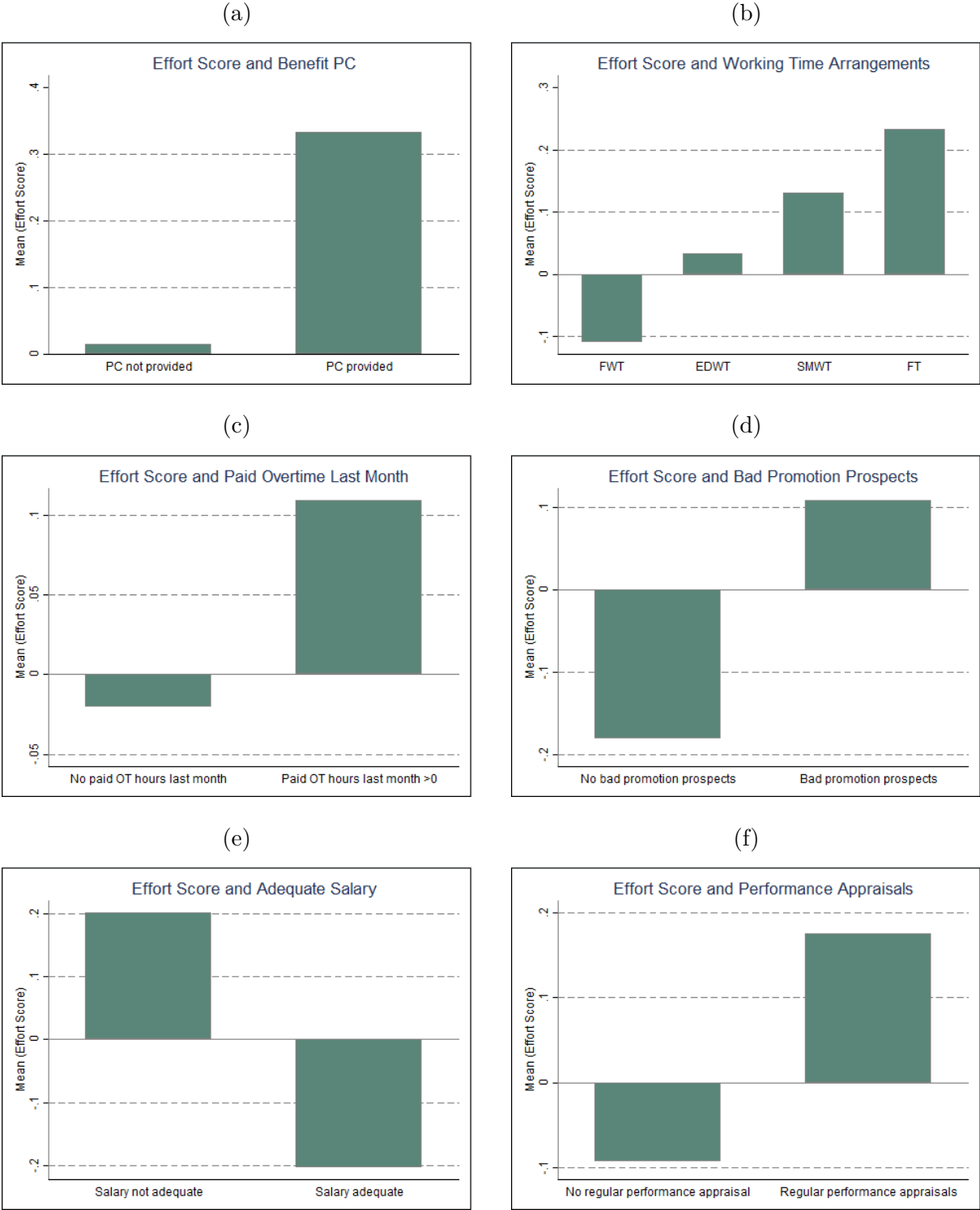
Notes: The above figure depicts the mean value of our main dependent variable, the effort score, by categories of our main explanatory variables. These are: (1a) benefit pc, (1b) working time arrangements, (1c) paid overtime last month (discrete variable summarized into two categories, 0 and >0), (1d) bad promotion prospects, (1e) salary adequate, and (1f) performance appraisals.

Table 1: Real working hours per week by working time arrangements

Working time arrangement	Real working hours per week		
	Share in %	Mean	Std
Fixed working time (FTW)	40.50	37.73	11.12
Employer-determined working time (EDWT)	21.72	39.23	11.55
Self-managed working time (SMWT)	13.25	43.69	14.34
Flextime within a working hours account (FTWT)	24.53	40.51	8.17

Notes: Std is the standard deviation. Share in % indicates the sample share of the individuals having the particular working time arrangement.

Table 2: Effort and Personnel Policy

Dependent variable	Effort Score		
	(1) OLS	(2) OLS	(3) FE
Benefit PC	0.268***	0.0769*	-0.157*
	(0.0453)	(0.0459)	(0.0881)
EDWT	0.121***	0.0889***	0.0868*
	(0.0252)	(0.0261)	(0.0490)
SMWT	0.289***	0.0856***	-0.0216
	(0.0315)	(0.0330)	(0.0698)
FT	0.346***	0.164***	0.0397
	(0.0240)	(0.0260)	(0.0635)
Bad promotion prospects	0.208***	0.159***	0.177***
	(0.0196)	(0.0201)	(0.0355)
Paid overtime	0.00543***	0.00217*	0.00394**
	(0.00113)	(0.00117)	(0.00196)
Salary adequate	-0.395***	-0.328***	-0.139***
	(0.0191)	(0.0203)	(0.0375)
Controls	NO	YES	YES
Observations	11,565	9,776	9,926
Adj. R^2 / R-within	0.080	0.210	0.098

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors clustered at the individual level are reported in parentheses. The *effort score* is defined in equation 1 in Section 3.1. The specifications in column (2) and (3) contain a set of covariates, specified in table A.4 in Appendix A.3.

A Appendix

A.1 Supporting evidence

Table A.1: Overcommitment and Personnel Policy

Dependent variable	Overcommitment Score		
	(1) OLS	(2) OLS	(3) FE
Benefit PC	0.300***	0.175***	0.0569
	(0.0465)	(0.0447)	(0.0891)
EDWT	0.224***	0.166***	0.0904**
	(0.0253)	(0.0258)	(0.0449)
SMWT	0.356***	0.186***	0.0131
	(0.0318)	(0.0330)	(0.0647)
FT	0.151***	0.0481*	-0.0153
	(0.0241)	(0.0258)	(0.0557)
Bad promotion prospects	0.0893***	-0.00752	0.0614*
	(0.0199)	(0.0202)	(0.0339)
Paid overtime	0.00348***	0.00275**	0.00563***
	(0.00114)	(0.00125)	(0.00199)
Salary adequate	-0.331***	-0.210***	-0.118***
	(0.0191)	(0.0202)	(0.0344)
Controls	NO	YES	YES
Observations	11,539	9,749	9,897
Adj. R^2 / R-within	0.054	0.207	0.096

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors clustered at the individual level are reported in parentheses. The *overcommitment score* is defined equation in 2 in Section 3.1. The specifications in columns (2)-(3) contain a set of covariates, specified in table A.4 in Appendix A.3.

Table A.2: Effort and Personnel Policy (Cross Section)

Dependent variable	Effort Score	
	(1) OLS	(2) OLS
Benefit PC	0.261***	0.0968
	(0.0608)	(0.0631)
EDWT	0.143***	0.0866**
	(0.0357)	(0.0365)
SMWT	0.241***	0.0686
	(0.0433)	(0.0449)
FT	0.315***	0.156***
	(0.0340)	(0.0360)
Performance appraisals	0.205***	0.0982***
	(0.0279)	(0.0302)
Bad promotion prospects	0.222***	0.172***
	(0.0279)	(0.0287)
Paid overtime	0.00493***	0.00152
	(0.00165)	(0.00162)
Salary adequate	-0.436***	-0.355***
	(0.0272)	(0.0291)
Controls	NO	YES
Observations	5,177	4,428
Adj. R^2	0.103	0.245

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. The *effort score* is defined in equation 1 in Section 3.1. The specification in column (2) contains a set of covariates, specified in table A.4 in Appendix A.3.

Table A.3: Overcommitment and Personnel Policy (Cross Section)

Dependent variable	Overcommitment Score	
	(1) OLS	(2) OLS
Benefit PC	0.347***	0.260***
	(0.0599)	(0.0594)
EDWT	0.238***	0.154***
	(0.0353)	(0.0362)
SMWT	0.359***	0.221***
	(0.0439)	(0.0453)
FT	0.144***	0.0423
	(0.0339)	(0.0360)
Performance appraisals	0.0845***	0.0539*
	(0.0280)	(0.0296)
Bad promotion prospects	0.119***	0.0387
	(0.0278)	(0.0285)
Paid overtime	0.00400***	0.00305*
	(0.00149)	(0.00164)
Salary adequate	-0.368***	-0.226***
	(0.0274)	(0.0290)
Controls	NO	YES
Observations	5,152	4,407
Adj. R^2	0.071	0.224

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are reported in parentheses. The *overcommitment score* is defined in equation 2 in Section 3.1. The specification in column (2) contains a set of covariates, specified in table A.4 in Appendix A.3.

A.2 The Effort-Reward Imbalance (ERI) questionnaire in the SOEP

In the following is the shortened ERI questionnaire implemented in the SOEP (version 2011).[12] The original German wording of the questions/statements in brackets.

Please indicate whether each point applies to you and, if so, how much of a burden it is for you. (Bitte geben Sie an, ob der jeweilige Punkt bei Ihnen zutrifft und, falls ja, wie stark Sie das belastet.)

Note, items marked with **(reversed coding)** mean that the first stage question is asked in a reversed way, i.e., '... and, if not, how much of a burden it is for you.'

Effort

1. I have constant time pressure due to a heavy workload. (Aufgrund des hohen Arbeitsaufkommens besteht häufig großer Zeitdruck.)

2. I have many interruptions and disturbances while performing my job. (Bei meiner Arbeit werde ich häufig unterbrochen und gestört.)

3. Over the past few years, my job has become more and more demanding. (Im Laufe der letzten beiden Jahre ist meine Arbeit immer mehr geworden.)

Reward

1. I receive the respect I deserve from my superior. (Ich erhalte von meinen Vorgesetzten die Anerkennung, die ich verdiene.) **(reversed coding)**

2. My job promotion prospects are poor. (Die Aufstiegschancen in meinem Betrieb sind schlecht.)

3. I have experienced or I expect to experience an undesirable change in my work situation. (Ich erfahre - oder erwarte - eine Verschlechterung meiner Arbeitssituation.)

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[12]The original questionnaires and their translations into English can be retrieved online:

- Version 2006, GER: http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.44391.de/personen_2006.pdf, Q42, Q43a,b

- Version 2006, EN: http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.44392.de/personen_en_2006.pdf Q42, Q43a,b

- Version 2011, GER: http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.394133.de/soepfrabo_personen_2011.pdf, Q58-60

- Version 2011, EN: http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.394180.de/soepfrabo_personen_2011_en.pdf, Q58-60.

4. My job security is poor. (Mein eigener Arbeitsplatz ist gefährdet.)

5. Considering all my efforts and achievements, I receive the respect and prestige I deserve at work. (Wenn ich an all die erbrachten Leistungen und Anstrengungen denke, halte ich die erfahrene Anerkennung für angemessen.) **(reversed coding)**

6. Considering all my efforts and achievements, my job promotion prospects are adequate. (Wenn ich an all die erbrachten Leistungen und Anstrengungen denke, halte ich meine persönlichen Chancen des beruflichen Fortkommens für angemessen.) **(reversed coding)**

7. Considering all my efforts and achievements, my salary / income is adequate. (Wenn ich an all die erbrachten Leistungen denke, halte ich mein Gehalt / meinen Lohn für angemessen.) **(reversed coding)**

Scale for Effort and Reward items:

- First stage: **1** ('Yes'/'Ja') - **2** ('No'/'Nein')

- Second stage: **1** ('not at all'/'gar nicht') - **4** ('very heavily'/'sehr stark')

Please indicate to what degree you agree with the following statements (Bitte geben Sie an, in welchem Masse Sie den folgenden Aussagen zustimmen):

Overcommitment

1. At work, I easily get into time pressure. (Beim Arbeiten komme ich leicht in Zeitdruck.)

2. I often am already thinking about work-related problems when I wake up. (Es passiert mir oft, dass ich schon beim Aufwachen an Arbeitsprobleme denke.)

3. When I get home, it is easy to switch off from thinking about work. (Wenn ich nach Hause komme, fällt mir das Abschalten von der Arbeit sehr leicht.)

4. Those closest to me say I sacrifice too much for my career. (Diejenigen, die mir am nächsten stehen sagen, dass ich mich für meinen Beruf zu sehr aufopfere.)

5. Work seldom lets go of me; it stays in my head all evening. (Die Arbeit lässt mich selten los, das geht mir abends im Kopf rum.)

6. If I put off something that needs to be done that day, I can't sleep at night. (Wenn ich etwas verschiebe, was ich eigentlich heute tun müsste, kann ich nachts nicht schlafen.)

Scale for Overcommitment items:

- **1** ('not at all'/'gar nicht') - **4** ('very heavily'/'sehr stark')

A.3 Summary Statistics

Table A.4: Definition and descriptive statistics of the variables

Variable	Definition	N	Mean	Std	Min-Max
Dependent variables					
Effort Score	Standardized score of three effort items of the ERI questionnaire (Appendix A.2)	18160	0	1	-1 - 2
Overcommitment Score	Standardized score of six overcommitment items of the ERI questionnaire (see Appendix A.2)	18227	0	1	-2 - 3
Main explanatory variables					
Benefit PC	Dummy variable, 1 if individual receives a computer/laptop for personal use	15101	0.04	0.2	0 - 1
Employer-determined working time (EDWT)	Dummy variable, 1 if individual faces flexible working hours determined by employer (reference group: fixed working time)	13838	0.22	0.41	0 - 1
Self-managed working time (SMWT)	Dummy variable, 1 if individual has extensive decision-making authority in terms of scheduling individual working hours (reference group: fixed working time)	13838	0.13	0.34	0 - 1
Flextime within a working hours account (FT)	Dummy variable, 1 if individual is allowed to vary daily working hours, where daily attendance is restricted to a defined time interval (working hours account) (reference group: fixed working time)	13838	0.24	0.43	0 - 1
Salary adequate	Dummy variable, 1 if individual considers his salary adequate given his efforts and achievements (reference group: not adequate; item 7 (reward) of the ERI questionnaire, Appendix A.2)	18297	0.49	0.5	0 - 1
Performance appraisals	Dummy variable, 1 if individual's performance is regularly assessed by a superior	7063	0.38	0.49	0 - 1
Overtime paid	Number of paid overtime hours last month	17684	2.37	8.68	0 - 99
Bad promotion prospects	Dummy variable, 1 if individual perceives his promotion prospects as bad (item 2 (reward) of the ERI questionnaire, Appendix A.2)	18073	0.64	0.48	0 - 1
Control variables					
Male	Dummy variable, 1 if individual is male	18616	0.52	0.5	0 - 1
Age	Age of individual	18616	43.8	10.72	18 - 65
Age squared	Age of individual squared and divided by 100	18616	20.33	9.24	3 - 42
Foreign nationality	Dummy variable, 1 if individual is of non-German nationality	18616	0.06	0.23	0 - 1

Continued on next page...

Variable	Definition	N	Mean	Std	Min-Max
Schooling	Years of schooling	18134	12.78	2.72	7 - 18
Living with partner	Dummy variable, 1 if individual has a settled living partner	18615	0.77	0.42	0 - 1
Children aged under 16	Dummy variable, 1 if individual has one or more children aged under 16 who currently ive in the household	18616	0.34	0.47	0 - 1
Ln (monthly gross wage)	Natural logarithm of gross wage in the month before the survey	18616	7.7	0.65	6 - 12
Management	Dummy variable, 1 if individual holds a management position	18372	0.2	0.4	0 - 1
Fixed-term contract	Dummy variable, 1 if individual has a fixed-term contract	17630	0.09	0.28	0 - 1
Full-time employed	Dummy variable, 1 if individual is employed full-time	18466	0.75	0.43	0 - 1
Job tenure	Years of individual's job tenure	18444	12.22	10.36	0 - 50
Full-time experience	Years of individual's experience in a full-time job	18403	17.01	11.58	0 - 49
Part-time experience	Years of individual's experience in a part-time job	18403	3.07	5.71	0 - 46
Unemployment experience	Years of individual's unemployment experience	18403	0.52	1.41	0 - 24
Overwork	Difference between actual and desired working hours per week	18022	3.89	8.16	-55 - 75
Firm size 20-199	Dummy variable, 1 if individual works in a firm with 20 to 199 individuals (reference group: Firm size <20)	17735	0.3	0.46	0 - 1
Firm size 200-1999	Dummy variable, 1 if individual works in a firm with 200 to 1999 individuals (reference group: Firm size <20)	17735	0.23	0.42	0 - 1
Firm size ≥ 2000	Dummy variable, 1 if individual works in a firm with equal or more than 2000 employees (reference group: Firm size <20)	17735	0.25	0.43	0 - 1
Poor job security	Dummy variable, 1 if individual perceives job security as poor (item 4 (reward) of the ERI of the questionnaire, Appendix A.2)	18263	0.15	0.36	0 - 1
Satisfaction with work	Ordinal variable ranging from 0 to 10 that indicates the degree of Satisfaction with the respondent's work (0: completely unsatisfied, 10: completely satisfied)	17355	7	1.99	0 - 10
Satisfaction with household income	Ordinal variable ranging from 0 to 10 that indicates the degree of Satisfaction with the respondent's household income (0: completely unsatisfied, 10: completely satisfied)	17482	6.61	2.09	0 - 10

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	18160	1.67	1.34	0 - 15
Satisfaction with health	Ordinal variable ranging from 0 to 10 that indicates the degree of Satisfaction with the respondent's health (0: completely unsatisfied, 10: completely satisfied)	17603	6.94	1.98	0 - 10
Current health: good	Dummy variable, 1 if individual assesses her current health status as good (reference group: very good)	18601	0.47	0.5	0 - 1
Current health: satisfactory	Dummy variable, 1 if individual assesses her current health status as satisfactory (reference group: very good)	18601	0.32	0.47	0 - 1
Current health: poor	Dummy variable, 1 if individual assesses her current health status as poor (reference group: very good)	18601	0.1	0.3	0 - 1
Current health: bad	Dummy variable, 1 if individual assesses her current health status as bad (reference group: very good)	18601	0.01	0.12	0 - 1
Locus of Control	Standardized index measuring an individual's locus of control (a higher score means a more internal locus of control, i.e. individual believes in a self-determined life)	13435	0.01	0.99	-4 - 3
Eastern Germany	Dummy variable, 1 if individual lives in Eastern Germany (reference category: Western Germany)	18616	0.22	0.42	0 - 1
Time dummies	Two dummies for the survey years 2006 and 2011				
Sector dummies	Twelve industry dummies				

Notes: N is the number of observations. Std is the standard deviation.